Environmental Assessment Report

Initial Environmental Examination
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July 2015

Proposed Grants and Administration of Grants for Additional Financing
Kingdom of Tonga: Outer Island Renewable Energy Project
(Power Distribution Network Upgrade Work in Vava'u Island)

Prepared by Tonga Power Ltd. and the Ministry of Finance and National Planning for the Asian Development Bank

CURRENCY EQUIVALENTS
(as of 5 June 2015)

Currency units – euro (€)/Australian dollar (AU$)/ pa'anga (TOP)

€1.00	=	$1.24
$1.00	=	€0.89
AU$1.00	=	$0.77
$1.00	=	AU$1.30
TOP1.00	=	$0.51
$1.00	=	TOP1.98

LIST OF ABBREVIATIONS

ADB	-	Asian Development Bank
CFC	-	Chlorofluorocarbons
DG	-	Diesel Generator
EA	-	Executing Agency
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Plan
EPC	-	Engineering, Procurement and Construction
GoT	-	Government of Tonga
GDP	-	Gross Domestic Product
GFP	-	Grievance Focal Points
GHG	-	Green House Gases
GRC	-	Grievance Redress Committee
GFP	-	Grievance Focal Point
IA	-	Implementing Agency
IEC	-	Island Electricity Committee
IEE	-	Initial Environmental Examination
IUCN	-	International Union for Conservation of Nature
MFNP	-	Ministry of Finance and National Planning
MEIDECC	-	Ministry of Energy, Information, Disaster Management, Climate Change and Communications
PCBs	-	polychlorinated biphenyl
PMC	-	Project Management Consultant
PPTA	-	Project Preparatory Technical Assistance
REA	-	Rapid Environmental Assessment
SHS	-	Solar Home System
SPS	-	Safeguard Policy Statement
TA	-	Technical Assistance
TERM	-	Tonga Energy Road Map
TFP	-	Tonga Forestry Products
TPL	-	Tonga Power Limited
T&D	-	Transmission & Distribution

NOTES

(i) The fiscal year (FY) of the Government of Tonga ends on 31 December. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2012 ends on 31 December 2015.

(ii) In this report, "$" refers to US dollars

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A. EXECUTIVE SUMMARY

1. The proposed additional financing for the Outer Island Energy Efficiency Project (the Project) will assist Tonga Power Ltd. (TPL) and the government of the Kingdom of Tonga (the government) efforts to minimize power distribution losses and reducing the fuel consumption of the existing diesel power plants. This will potentially avoid about 128 tons of CO_2 per annum for the project as a whole and 104 tons of CO_2 per annum for Vava'u alone.

2. The scope of the Project includes upgrading of existing power distribution grids on the outer islands of (i) Vava'u; and (ii) 'Eua. The proposed Project will replace grid assets (cable, poles, distribution transformers and switchgear).

3. This is the Initial Environmental Examination (IEE) prepared for the refurbishment work on Vava'u Island proposed under the Project. The interventions proposed under the Project are located on the entire island of Vava'u. Based on Tongan government law and ADB's environmental safeguard policy, the proposed Project is categorized as an environmental Category 'B' project considering the most sensitive component. This IEE meets the requirements of the Tonga's Environmental Impact Assessment (EIA) Act 2003 and complies with ADB's Safeguard Policy Statement (SPS) 2009. The scope of this IEE is limited to the sites of proposed interventions.

4. This IEE was initially prepared during the project preparation work in the month of January 2013 and reviewed again in May 2015. The project is currently in preparation stage, and although there are no major changes in the project design or location of components anticipated, this IEE (including the environmental management plan [EMP]) will be updated during detailed design in line with the SPS.

5. The proposed Project will capitalize on the results to be achieved under the proposed Outer Islands Renewable Energy Project (ongoing project)[1], the scope of which is to implement solar power connected to existing power distribution networks in the outer islands of Tonga including Vava'u. To maximize the distribution of newly installed solar electricity under the ongoing project, this Project will upgrade the existing power distribution grid on the island. It will minimize power distribution losses and therefore reduce the fuel consumption at the existing diesel power plants. The added value of the proposed project is to demonstrate that combining deployment of renewable power generation and power distribution loss reduction is an appropriate strategy to optimize existing energy matrixes and reduce their carbon output. Additional electricity will contribute to power security, create sustainable livelihoods and reduce environmental pressure.

6. The proposed Project will replace existing grid equipment i.e. cable, poles, distribution transformers and switchgears, therefore the Project will not encroach on any land outside the existing grid system which is owned by government. The existing grid system is mainly located on flat to undulating terrain and land use is mostly mixed of rural residential and open areas with thin rural plantations. There are no sensitive areas on and around these existing grid systems. Some of the distribution lines pass through vegetation cover, however density is very low. There is no physical infrastructure or archaeological/ religiously important sites in and around the existing grid systems. Table 1 presents the summary of existing features and proposed interventions on the targeted island.

Table 1: Summary of Existing Features and Proposed Interventions

Parameter	Targeted Island – Vava'u
Island Group	Vava'u
Total Geographical Area (sq.km.)	121.0

[1] ADB. 2013. *Report and Recommendation of the President to the Board of Directors: Proposed Grant and Administration of Grant for to the Kingdom of Tonga for the Outer Island Renewable Energy Project*. Manila.

Parameter	Targeted Island – Vava'u
Number of Households	2,828
Population[2]	14,936
Geographical Location	Vava'u is the second largest Island located to the north of Tongatapu.
Land Use	Mixed (residential and open)
Terrain	Plain to undulating
Existing Grid	Overhead HV and LV (6.6 kV and 240V) distribution system managed by TPL
Proposed Interventions	Replacement of cable, poles, distribution transformers, and switchgears;
Location of proposed sites for interventions	Vava'u main Island
Ownership of proposed land	Government
Land requirement	No additional land requirement

7. The replacement of the existing grid assets will not have any significant long term adverse environmental impacts; in fact the Project will create long-term environmental benefits by reducing CO_2 emissions in the order of 128 tons per year. The main environmental impacts are short-term and will be created during the installation stage. The main environmental impacts will be during removal of existing cables and poles and installation of new poles and cables. Short term impacts from management and disposal of discarded material i.e. old cables, poles and transformers are anticipated. However, these impacts will be minimized as the discarded material will be recycled and reused within the TPL system. 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 bucket trucks, cranes etc. However these will be short-term (approximately 2-3 days in each location to change out assets). Impacts associated with the replacement of cables, poles and transformers are mostly related to change in local topography and visual impacts. However, these impacts will not be significant as the cables and poles already exist and they will be duly replaced at existing locations. Operational impact includes management of used equipment i.e. transformers, batteries etc. It is proposed that handling and recycling/disposal of used transformers, etc. will be the responsibility of TPL. Similarly after decommissioning of the grid system, cables, transformers, and switchgears, will be dismantled and handled by TPL. All these impacts are manageable by implementing mitigation measures proposed in the environmental management plan. Although emission of halogenated gases such as SF_6 from switchgears and transformers are very minor, it will be checked and controlled by well installed SF_6 equipment with routine checking of all such equipment.

8. Local communities and stakeholders were involved in the process of preparing the IEE through on-site discussions and with 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. The IEE 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 and expanded during project implementation to ensure that stakeholders are fully engaged in the Project 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.

9. 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 (CO_2) through reducing distribution losses and reducing dependence on existing diesel generator (DG) sets which use imported fossil fuels. 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. Due to the limited and manageable nature of

[2] Tonga National Population and Housing Census, 2011, Statistics Department Tonga

impacts, this IEE is adequate to comply with the EIA Act of Tonga and ADB's SPS and therefore further environmental analysis of the Project is not required. Requisite compliance measures (updating and implementation of EMP and monitoring plan) will be included in the project and bid/tender documents.

B. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

10. Environmental assessment of the proposed project has been carried out in compliance with ADB's SPS and the government's legislation and requirements.

1. The Government Environmental Laws and Regulations

11. Some of the important laws relevant to the Project focusing on environmental assessment are summarized in Table 2.

Table 2: Summary of Relevant Environmental Laws and Regulations of Tonga

Environmental Legislation	Year Passed	Objective
Environmental Impact Assessment (EIA) Act 2003	2003	To provide for the application of environmental impact assessment to the planning of development in Tonga.
Environmental Impact Assessment (EIA) Regulations 2010	2010	To regulate major development projects and the applications of notification consistent with the EIA Act 2003.
Waste Management Act 2005	2005	To manage and oversee the function of the Waste Management Board.
Parks and Reserves Act 1976	1976 (amended in 1979 & 1988)	To provide for the establishment of Parks and Reserves Authority and for the establishment, preservation and administration of Parks and Reserves.
Biosafety Act 2009	2009	To regulate living modified organisms and the applications of modern biotechnology consistent with Tonga's obligations and rights under the Convention on Biological Diversity and the Cartegena Protocol.
Ozone Layer Protection Act 2010	2010	To regulate the use of ozone depleting substances and to implement the provisions of the Convention for the Protection of the Ozone Layer and the Protocol on substances that deplete the ozone layer and for related purposes.
Hazardous Wastes and Chemicals Act 2010	2010	To provide for the regulation and proper management of hazardous wastes and chemicals in accordance with accepted international practices and the International Conventions applying to the use, transboundary movement and disposal of hazardous substances and for related purposes.
Renewable Energy Act 2008	2008 (amended in 2010)	To regulate the use of renewable energy in the Kingdom and related matters.
Environment Management Act 2010	2010	To establish the Ministry of Environment & Climate Change to ensure the protection and proper management of the environment and the promotion of sustainable development.

Source: Ministry of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communications (MEIDECC), Government of Tonga

2. Environmental Assessment Process in Tonga

12. Under the Tongan regulatory framework (the EIA Act 2003 and the EIA Regulations 2010), all development activities must be referred to the Minister of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communications. With this notification, the proponent must complete a Determination of Category of Assessment 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 Secretariat and the Minister determine whether the proposed development is a minor or major project, and advises the proponent within 30 days. If it is a major project, the proponent then submits a full Environmental Impact Assessment for review by the Secretariat. The Secretariat makes recommendations to the Environmental Assessment Committee. The Minister receives an assessment report and issues the approval (with or without conditions), a request for further information, or a rejection.

13. Under the EIA Act, a Schedule lists the projects considered as major projects. Electricity Generating Stations is listed as one of the major projects however; electricity distribution and energy efficiency projects such as this project have not been stated in this Schedule. However, this IEE provides the information required for the Ministry of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communications to undertake its assessment process as required under the regulations as any Major Project.

3. ADB's Environmental Safeguard Requirements

14. This environmental assessment is carried out in compliance with safeguard 1 of ADB's SPS so as to ensure that potential adverse environmental impacts are identified, avoided where possible and managed or addressed.

15. As per the SPS the objective of Environmental Safeguards is to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process. 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.

16. Based on the Government's EIA Act and ADB's SPS, the interventions proposed in the Project is categorized as category 'B' project based on the most sensitive component. Project categorization was carried out using the Rapid Environmental Assessment (REA) Checklist (Appendix 3). Accordingly this IEE is prepared to meet the requirements of the government as well as ADB's SPS requirements.

4. Institutions

17. The principal national agency charged with environmental protection is the Ministry of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communications (MEIDECC). The role of MEIDECC is to protect the environment and promote sustainable development. The environmental assessment for development projects is also approved by MEIDECC. It is also the agency required to respond to any complaints from the public about environmental issues.

5. Extent of IEE Study

18. The interventions proposed under the Project are located on Vava'u Island. This is the Initial Environmental Examination (IEE) prepared for the refurbishment work in Vava'u Island proposed under the Project. The scope of this IEE is limited to the existing electricity distribution grid system on this Island only. The purpose of this IEE is to assess potential environmental, health, safety and social impacts of the proposed interventions.

19. This IEE is prepared during the project preparation work in the month January 2013. The project is currently at preparation stage, and although there are no major changes in the project design and location of components anticipated, this IEE will be updated during detailed engineering design in compliance with the ADB's SPS 2009.

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

C. DESCRIPTION OF THE PROJECT

1. Project Background

21. Like other Pacific islands countries, Tonga 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. The proposed Outer Island Energy Efficiency Project (the Project) will capitalize on the results to be achieved under the ADB's Outer Island Renewable Energy Development Project, the scope of which is to implement solar power connected to existing power distribution networks in the outer islands of Tonga. To maximize the distribution of the newly installed solar electricity the Government has requested ADB's assistance to upgrade the existing power distribution grids. The proposed project will replace grid assets (cable, poles, distribution transformers and switchgear) on Vava'u Island. It will minimize power distribution losses and reduce the fuel consumption of the existing diesel power plants, thus avoiding about 104 tons of CO_2 per year[3] on Vava'u.

22. A project preparatory technical assistance (PPTA) has been provided to the government to help develop the Project in the outer islands of (i) 'Uiha, Nomuka, Ha'ano and Ha'afeva; (ii) Vava'u; and (iii) 'Eua. It includes project due diligence for each project site including technical feasibility, social and environmental safeguards, and a gender action plan. This report presents the findings of the environmental assessment study carried out for interventions proposed under the Project on the targeted island of Vava'u.

23. The scope of the Project include:

- Replacement of distribution grid assets such as cable, poles, distribution transformers, switchgears etc. on Vava'u Island.

2. Location of Project

24. All the physical components included in the Project are located in Vava'u in Tonga. The Vava'u Islands is the second largest island group among the Kingdom's four major groups located in the northern part of the country and covering a total land area of 121 sq. km. As per 2011 census, the total population of Vava'u is 14,936 with 2,828 households. The main islands of the Vava'u group originated from raised coral. They have a characteristic terraced silhouette and appear to be 3-tiered. Vava'u, the largest island in the group, has a maximum elevation of 213 m. The soils of the group are developed largely on a substantial mantle of volcanic ash, up to 9 m thick, overlaying the coral limestone.

[3] Baseline; the gross generation on Vava'u is 5,000,000 kWh per annum, and 1,150,000 for 'Eua. These total 6,150,000 kWh combined. 3% savings on each island equates to 150,000kWh for Vava'u and 34,500kWh for 'Eua. These total 184,500 kWh per annum for both islands. This in turn equate to 24 tons of CO2 savings per annum for 'Eua and 104 tons of CO2 savings for Vava'u. These total 128 tons of CO2 per annum for the project as a whole.

25. Figure 1 shows the location map of the project facilities. Features of the existing grid system are provided in Appendix 1.

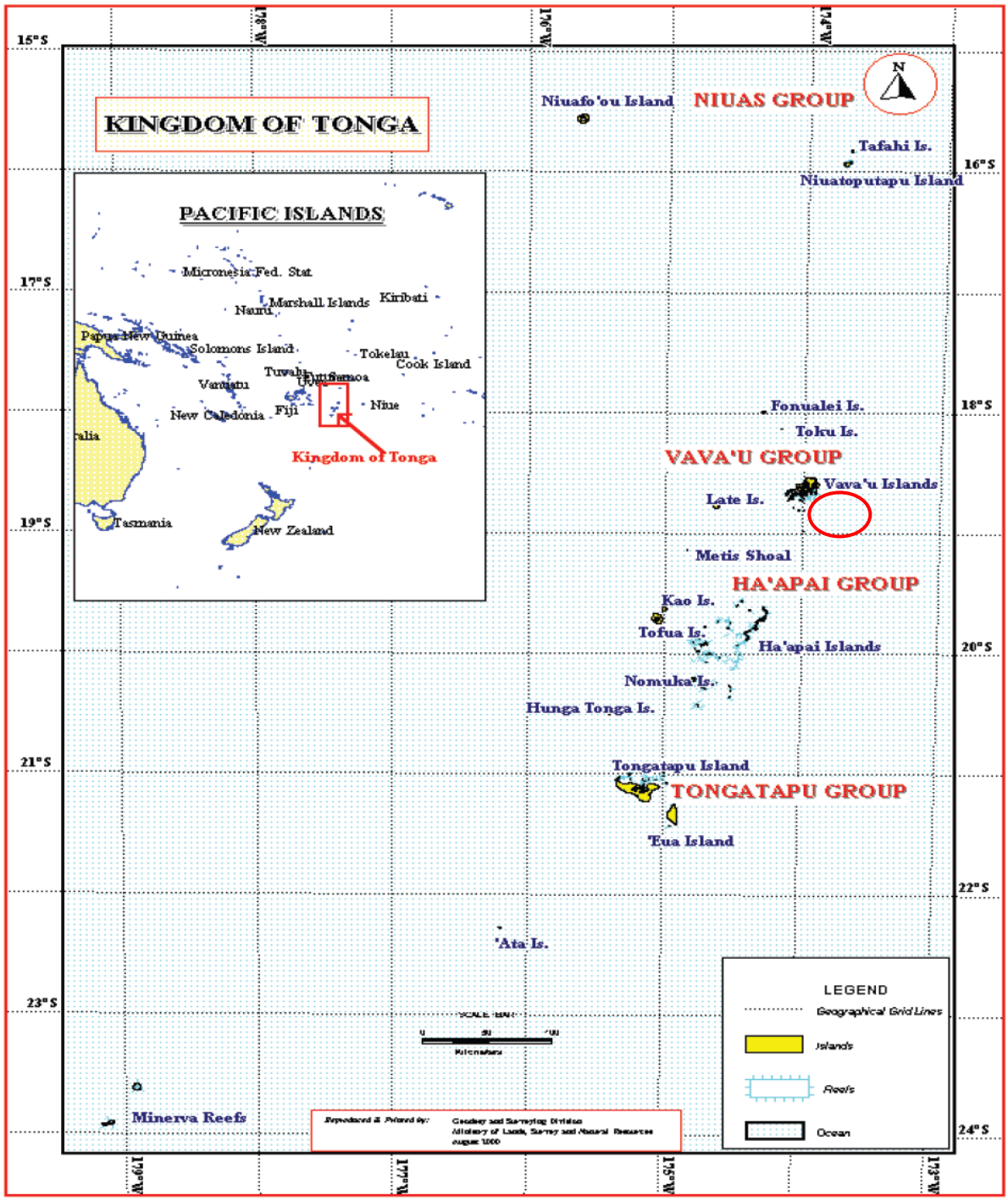

Figure 1: Locations of Project Areas on Country (Tonga) Map[4]

[4] Source: http://www.lib.utexas.edu/maps/islands_oceans_poles/tonga_pol_1989.pdf

3. Project Components and Activities

26. As part of the Project, existing distribution grid assets will be replaced with new and efficient grid assets on Vava'u Island. The technical specifications and quantities of equipment will be determined during the detailed engineering design.

27. The existing grid system in Vava'u Island consists of overhead cables/ open conductors, poles (mostly wooden), distribution transformers and switchgears. On the main islands of Tonga, the distribution system is operated and managed by Tonga Power Limited (TPL). The existing grid assets are mostly located on government land and follows the development pattern of the Island i.e. mostly along existing roads. Land use is a mixed type dominated by residential/built up areas followed by open land. Under this Project existing equipment will be replaced so there will not be any additional land requirements.

28. Table 3 below summarizes grid details and summary of existing features and proposed interventions on the targeted island.

Table 3: Summary of Existing Features and Proposed Interventions

Parameter	Targeted Island – Vava'u
Island Group	Vava'u
Number of Households	2,828
Existing Grid	(6.6 kV and 240V) distribution system managed by TPL
Proposed Interventions	Replacement of cable, poles, distribution transformers, and switchgears;
Sites of proposed interventions	Vava'u main Island

29. The main activities under the Project are summarized below:

- Replacement of existing inefficient cables[5] (6.6kV, 240V.)
- Replacement of existing inefficient overhead (open) conductors (11kV, 6.6kV, 240V.)
- Replacement of wooden/concrete poles
- Replacement of inefficient transformers
- Replacement of inefficient switchgears

4. Local Infrastructure Required

30. The local infrastructures required for the Project are the roads, wharf, existing/planned generation units and the pre-existing distribution grids.

31. The roads and wharf will be needed to transport necessary material and equipment during installation. It is estimated that a maximum of 5 trucks will be moving daily for a maximum 3-4 days during peak construction time. The enhanced grid system will be connected to the existing/new generation units which will feed energy to it.

5. Implementation Arrangement and Schedule

32. Existing and newly established institutions will support the project implementation. The government through its Ministry of Finance and National Planning (MFNP) will be the executing agency (EA) of the Project. The implementing agency (IA) will be TPL. TPL has key hands-on

[5] The technical specifications and quantities of equipments to be replaced under the project will be determined during the detailed engineering design.

expertise and will nominate counterpart staff with adequate capacity in engineering and power system planning, finance, environment, and social areas. An international team comprising a power distribution specialist, field engineer, safeguards specialist, and financial expert will be established as the Project Management Consultant (PMC) to support the EA and IA. TPL will also carry out the operations and maintenance (O&M) of the network. During project implementation a project steering committee chaired by the MFNP will supervise project implementation.

33. It is envisaged that the Project will be implemented between November 2015 and November 2016. The tendering process should begin in September 2015 and expected to be completed in October 2015.[6] According to this time line, bid evaluation and contract should be awarded in November 2015. Installation work is expected to start in November 2015.

6. Project Benefits and Justification

34. The successful implementation of the Project will improve power distribution network efficiency by reducing line losses from the current ~13% to a target figure of ~10%. As a result the network system should supply approximately 150 MWh[7]/year more electricity to customers on the Vava'u network.

35. The added value of the proposed project is to demonstrate that combining deployment of renewable power generation and power distribution loss reduction is an appropriate strategy to optimize existing energy matrixes and reduce their carbon output. Additional electricity will contribute to power security, create sustainable livelihoods and reduce environmental pressure by avoiding emission of about 104 tons of CO_2 per year for Vava'u alone. 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).

D. DESCRIPTION OF THE ENVIRONMENT

1. Physical Resources

1.1 Physiography, Land use and Demography

36. The Kingdom of Tonga (Tonga) is a group of small islands located in the Central South Pacific. It lies between 15º and 23º30' South and 173º and 177º West. Tonga has a combined land and sea area of 720,000 km². It is an archipelago of 172 named islands covering an area of 747 km^2 of which 36 islands (covering an area of 649 km^2) are inhabited. Tonga had a total population of 103,036 (2011 census) compared to 101,991 at the census of 2006, an increase of 1,045 people over the 5 years.

37. Tonga consists of four clusters of islands extended over a north-south axis: Tongatapu (260 km^2); 'Eua (87 km^2) in the south; Ha'apai (109 km^2) in the centre; Vava'u (121 km^2) in the north; Niuafo'ou and Niuatoputapu (72 km^2) in the far north. Tonga's archipelago is situated at the subduction zone of the Indian-Australian and the Pacific tectonic plates and within the Ring of Fire where intense seismic activities occur.

38. Within Tonga there is a western line of islands of volcanic origin, steep topography and generally high elevations, and an eastern line of generally low-lying limestone and mixed geology islands. Amongst the western group are Tofua (507 m), Kao (1030 m), Late (519 m), Niuafo'ou (260 m), Niuatoputapu (106 m) and Tafahi (548 m). The eastern group where the majority of the population lives consists of Tongatapu (65 m), 'Eua (312 m) and most of the islands of the Ha'apai and Vava'u groups.

[6] Advance contracting will be undertaken in conformity with ADB's Procurement Guidelines.
[7] Baseline: 5,000,000 kWh gross generation in 2014. A 3% reduction in line losses equates to ~150,000 kWh per annum.

39. Vava'u Island is the second largest island group among the Kingdom's four major groups covering a total land area of 121 sq. km. As per 2011 census, total population of Vava'u is 14,936 and 2,828 households. The land use around the existing grid network is mostly residential followed by open land with flat to undulating topography.

40. Table 4 present the physiographical features of the islands that form the Project area.

Table 4: Physiographical Features of the Proposed Sites

Parameter	Targeted Island - Vava'u
Island Group	Vava'u
Total Geographical Area (sq.km.)	121.0
Number of Households	2,828
Population[8]	14,936
Geographical Location	Vava'u is the second largest Island located to the north of Tongatapu.
Land Use	Mixed (residential and open)
Terrain	Plain to undulating
Existing Grid	Overhead Ha and LV (6.6 kV and 240V) distribution system managed by TPL
Proposed Interventions	Replacement of cable, poles, distribution transformers, and switchgears;
Location of proposed sites for interventions	Vava'u main Island
Ownership of proposed land	Government
Land requirement	No additional land requirement

1.2 Meteorology and Climate

41. The climate of Tonga is tropical. It lies within the south-east trade wind zone of the South Pacific. Wind speed over its surrounding oceans averages around 12 knots. Strong winds are not common except during tropical cyclone passages in summer (November- April) and gales from eastward migrating high-pressure systems during winter (May-October). Rainfall is moderate, with high relative humidity. Tonga's annual rainfall is defined by two seasons, a Wet and Dry season.

42. Temperature variations throughout the country show an increase in daily and seasonal variations with increasing latitude. Mean annual temperatures vary from 27^0C at Niuafo'ou and Niuatoputapu to 24^0C on Tongatapu. Diurnal and seasonal variations can reach as high as 6^0C throughout the island group. During the Hot Wet Season (November-April), the average temperature ranges from 27-29^0C whereas at Dry Cool Season (May-October), the average temperature ranges from 20-24^0C.

43. Tonga has seen an increasing trend in the occurrences of tropical cyclones. There is also evidence that the intensity of cyclones has increased since the 1980's in Tonga. Since the 1960's many cyclones have severely affected Tonga. To name but a few; Cyclone Flora in March, 1961 affected Vava'u and Ha'apai groups, Cyclone Isaac in March, 1982 affected Ha'apai and Tongatapu and Cyclone Waka in December, 2001 affected the northern group of Niua, Cyclone Tam in 2006, Cyclone Renee in 2010 severely affected Tongatapu, Vava'u and Ha'apai groups. A a combination of Cyclone Cyril swiftly followed a week later by Cyclone Jasmine heavily impacted Tongatapu in February 2012 and recent Cyclone Ian caused catastrophic damage to the Ha'apai Island group in January 2014. All of these cyclone events caused severe damages to crops and

[8] Tonga National Population and Housing Census, 2011, Statistics Department Tonga

food supply, infrastructure, tourist resorts, the environment, buildings and disrupted essential services and the wellbeing of the people of affected communities for a prolonged period of time.

44. Vava'u has a semi-tropical climate with mean monthly maximum and minimum temperatures of 28.3^0C and 22^0C respectively. Average annual rainfall is 2222 mm, and prolonged droughts occur, on average, every 7 years. In most years, a dry spell of 1–2 months can be expected in the period June–September. This is more marked in eastern areas where rainfall tends to be lower. Because of higher and more even rainfall distribution, Vava'u posses greater agricultural potential and flexibility than Tongatapu.

45. A climate risk profile for Tonga[9] 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 Tonga indicate that sea level is likely to have increased by 36 centimeters and the frequency of severe short sea level rise resulting from storm surges (2.2 meters above mean sea level) will increase from a one in 580-year event to a one in 5-year event by 2050. In this context, the project will provide grid assets with additional resilience to climate change through compact and preassembled systems resistant to marine environments.

1.3 Geology, Soils and Mineral Resources

46. The soils of Tonga are derived from a mixture of volcanic ash and coral. Because island groups are isolated from each other, and are physically and economically different, the country is described in four parts. Most of the islands of Tonga have a soil layer overlying coral limestone. While soils vary from island to island, they are mainly derived from volcanic ash (andesitic tephra) deposited by a series of volcanic eruptions from emergent volcanoes such as Tofua and Kao and from submarine volcanoes to the west. Other soils include coral and lagoon sands and mud.

47. The main islands of the Vava'u group originated from raised coral. They have a characteristic terraced silhouette and appear to be 3-tiered. Vava'u, the largest island, has a maximum elevation of 213 m. The soils of the group are developed largely on a substantial mantle of volcanic ash, up to 9 m thick, overlaying the coral limestone. It is mainly on steeper sites and recently accumulating beach areas that coral based soils are found. The south of the Vava'u group is generally composed of high volcanic and elevated limestone islands with reef communities or fringing reefs.

1.4 Water Resources

48. The freshwater resources of Tonga consist of groundwater in the form of freshwater lenses. Freshwater lenses form on top of seawater in many of the islands due to the difference in density of the two fluids. The interface, or boundary, between the two fluids forms a transition zone. Within the transition zone the water salinity increases from that of freshwater to that of seawater over a number of metres. Surface water resources are only evident on some of the high volcanic and mixed geology islands in the form of springs and lakes. Crater lakes exist on the islands of Niuafo'ou and Tofua. It is reported that the former lake has been used in dry periods as a source of potable water.

49. Rainwater harvesting systems are a complementary freshwater resource, and an essential source of potable water on many of the islands. On the Vava'u group they are the only source of freshwater. On most parts of the main islands of the Vava'u group the depth from the surface to water table is higher being in the order of 5 to 8 m in many places and up to 15 meters and more in elevated parts of the islands.

[9] Climate Profile of Tonga prepared by ADB in 2008

2. Ecological Resources

2.1 Flora and Fauna

50. Tonga's flora and fauna is limited in diversity. There is a wide variety of vegetation types throughout the islands of Tonga. Indigenous vegetation includes a variety of rootcrops, fruit trees such as mangoes, tava, and a variety of citrus, and native vegetables and grasses. In the settled areas of the four Island Groups, much of the native vegetation has been cleared for coconut plantations, home gardens, villages, and commercial crops. A significant percentage of the country is now under coconut and Panicum grassland.

51. The major marine ecosystems in Tonga are: algal and seagrass beds; fringing and lagoon reefs; rocky coasts; beaches; open lagoons; marine lakes; marine caves and a submarine trench. The reefs and lagoons are the prime fishery for subsistence supplies. The natural vegetation pattern shows secondary fallow vegetation in all island groups. All islands have a cover of coconuts, and a few other trees.

52. Knowledge of Tonga's terrestrial fauna is limited with most past research and investigations concentrated on agricultural-related fauna. Tonga's Stocktaking report (2004) reviewed the terrestrial fauna in terms of vertebrates and invertebrates. Invertebrates are mostly agricultural pests widely found throughout the Pacific and tropical environments and include beetles, moths, flies and worms whose prominence relate more to their destructive impact on agriculture as opposed to being biologically rare and unique.

53. Of vertebrates, other than the domesticated ones of low conservation significance, birds have the highest diversity. Watling reported 74 species (Watling, 2001) 51 of which are resident breeding species, 22 native land birds, 23 sea bird species, and 6 introduced. The remaining 23 species are migrants or vagrants of which are 6 shore birds, 13 seabirds and 3 land and wetland species (ibid.). Endemism is low with only one (Hengahenga or Tonga whistler; Pachycephala jacquinoti) species, while the Niuafo'ou megapode (Megapodius pritchardii) is known to also exist in Vanuatu. The megapode is listed by the IUCN as an endangered species.

54. Other fauna species are hepterofauna of which some 20 species are reported, two species of fruit bats (Pteropus tonganus and P samoensus), rodents and cats.

2.2 Forests and Protected Areas

55. Tonga's protected area network consists of national parks, terrestrial and marine parks and reserve protected areas. Under the Parks and Reserves Act of 1976, five marine parks have been designated on Tongatapu. The parks cover 250 hectares of coral reef, which is 10% of Tonga's total coral system. None of the other island groups have marine parks although surveys have been conducted with this intention in mind. Table 5 presents the overview of the protected area system in Tonga and corresponding IUCN category. The IUCN categorization system is provided in Appendix 3.

Table 5: Overview of Protected Area System in Tonga

PA category/type	No.	Surface area, (ha)	Corresponding IUCN category	Management authority
Marine Protected Areas, protected seascape/ marine reserves	8	1,003,729	IV-VI	MLNR
Managed resource terrestrial protected areas	6	2,100	II, V,VI	Forestry & MLNR
Managed resource protected areas/special management areas (SMA) – community based.	6	9256.5	VI	Fisheries

Strict Nature Reserve (SMAs – community based)	6	1,104.5	IA	Fisheries

Source: Data provided by the Ministry of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communications

3. Socio-economic Conditions

3.1 Demography

56. The population of Tonga is 106,036 distributed over 36 of its 172 islands. Since 2006 the average annual population growth has been 0.2%, and is not expected to increase. There is steady migration (urban drift) to the capital of Nuku'alofa, with a population growth of 0.8%. The official poverty line in Tonga has been established at $2586 per person per year in 2009. According to the Bureau of Statistics, 22% of people in Tonga are viewed as living below the poverty line. Table 6 presents the demographic details of the targeted island i.e. Vava'u.

Table 6: Island-wise Detail of Demographic Features

Parameter	Targeted Island -Vava'u
Island Group	Vava'u
Total Geographical Area (sq.km.)	121.0
Number of Households	2,828
Population	14,936

57. In the consultation process, households were asked to comment on level of power supply and fairness of pricing for a range of utility services including electricity. Most of the people in the main islands agreed that the level of electricity supply they are getting from the existing system is satisfactory as there are not many blackouts reported by the public. However in the outer islands of Ha'apai where the existing supply is managed by Island electricity committees, the level of power supply is not enough to meet the requirements of households as they are getting interrupted power supply.

3.2 *Economic Development*

58. The economy of Tonga is largely based on agriculture and fisheries. Subsistence agriculture plays an important role for many families. In addition, remittances sent from relatives working abroad play a significant part in the Tongan economy as a whole, and in the economy of individual households. The global financial crisis in recent times has impacted on this economic flow, increasing the level of hardship experienced by many families in Tonga. The agriculture sector is the main contributor, in terms of GDP, to the economy of Tonga from 2000–2009. This is closely followed by public administration and services. If we aggregate the data to the sectoral level then the services sector is revealed to be the highest contributor to GDP. This indicates a gradual diversification from the agricultural sector to the services sector. During consultations it is reported that about 15-20% of monthly income goes to electricity consumption. Life in Tonga revolves around strong values of family and the Church, and has a well developed historic and contemporary national identity.

3.3 Historical and Cultural Values

59. The proposed project location and the surrounding areas are for mainly residential and open land use, and have no important historical or cultural sites. There are no records of archeological findings in the project areas.

E. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

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

1.1 Physical Environment

60. The proposed works will be carried out within the existing grid network therefore there will not be any need for new sites. The existing grid assets which are to be replaced are installed on government land, therefore proposed project facilities do not encroach any of the environmentally sensitive areas. Also there are no sites of any archaeological importance in and around the project facilities. Therefore impacts associated with project siting on the physical environment are negligible.

61. The equipment to be procured and installed by the Project (switchgears and transformers) will comply with international standards for noise as well as escape of polluting materials such as SF_6. The Project will use compact and preassembled systems to minimize impacts. Therefore no adverse impacts due to Project design are anticipated. To ensure that all the environmental mitigation measures are implemented, the EMP will be included in the bidding documents.

62. The climate risk profile for Tonga 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 Tonga indicate that sea level is likely to have increased by 36 centimeters and the frequency of severe short sea level rise resulting from storm surge (2.2 meters 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 equipment and assets with additional resilience to climate change through compact and preassembled systems resistant to marine environments.

1.2 Biological Environment

63. There will not be any requirement for cutting of trees and vegetation for project activities. Although Tonga has a large protected area network, none of these areas are located in the impact area of sites proposed for interventions (grid assets replacement) under the Project. Therefore there will not be any impacts on fauna.

1.3 Social Environment

64. The impacts on the social-economic environment will be mostly positive. However, during detailed engineering design, if any adverse impacts on socio-economic aspects of the communities are identified, appropriate mitigation measures would be implemented. The impacts of land acquisition and relocation due to project are not anticipated.

2. Impacts and Mitigation Measures Due to Installation Activities

2.1 Physical Environment

65. Impacts on topography due to installation of grid assets will be insignificant. The distribution lines and poles will be replaced on existing locations at equal numbers. Therefore in the installation phase there will be no impact on soil quality of the area.

66. Visual impacts are anticipated due to the replacement of poles, cables, transformers and handling, storage and transportation of discarded and new materials and also from the movement of equipment and machineries. This will be minimized by the selection of suitable storage areas for materials or discarded with minimum visibility from residences and roads with screening where necessary.

67. Impacts on water resources are not anticipated as there will not be any wastewater generation from project activities. In case of wastewater generated during construction, it will be managed by constructing temporary collection tanks.

68. The Project will involve only minor civil works such as digging of trenches for poles. Mechanical and electrical works will take place at various locations within a large project site. Clearing of vegetation and trimming of tress may be required during the installation work. This will be undertaken in coordination with forestry officials. There will not be any significant change in the drainage pattern. The transportation of construction materials and project equipment will require about 5 truck trips per day during the working period of 8 hours. It will mean there is more traffic, particularly heavy traffic, on the road than usual. Since most of the work will be undertaken along existing roads, temporary disruption to local traffic in anticipated. Necessary traffic diversion arrangements will be made during installation phase. Traffic levels will return to normal after the installation work on particular roads is completed. Considering the nature and scope of construction works and the ecological insensitivity of the Project site, it is certain that only minor and manageable environmental disturbances will be created during installation, with minimum impacts on nearby communities and the natural environment. Environmental disturbances during installation 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.

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

- Selection of installation techniques and machinery seeking to minimize ground disturbance and noise vibrations.
- Proper maintenance and operation of construction equipment.
- Existing roads and tracks used for construction and maintenance access to the line / site wherever possible to minimize increase in airborne dust particles.
- Discarded material disposed of at designated places.
- Fuel and other hazardous materials securely stored above high flood level.
- Construction activities only undertaken during the day and local communities informed of the construction schedule.
- Safe handling and disposal of phased out equipment.
- Contractor to arrange for health and safety training sessions.
- Implementation of effective environmental monitoring and reporting systems using checklists of all contractual environmental requirements.
- Appropriate contract clauses to ensure satisfactory implementation of contractual environmental mitigation measures.

2.2 Biological Environment

70. The project does not require cutting of trees or clearing of large areas of vegetation. During installation work, clearing of small land areas for the footing of the poles and trimming of trees near the conductors may be required. However impacts on the environment due to these activities will be insignificant. In case clearing of vegetation and trimming of trees is required, it will be undertaken in coordination with local offices of the Lands and Surveys Department, and Forestry Department. No impacts on fauna are anticipated due to contractual activities. The following mitigation measures will be implemented by the contractor -

- Marking of trees to be removed (if any) prior to being trimmed and strict control on clearing activities to ensure minimal clearance.
- Contractor to ensure that there is no illegal felling of trees by the project workers.
- Planting of trees (if necessary) in coordination with local forest authorities.

3.3 Social Environment

71. The installation work will require not more than 20 workers, who will reside outside the Project sites. No groundwater will be tapped at the Project site as these sites have low groundwater potential. Domestic wastewater generated by the construction workers would not be more than 10 cubic meters 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.

72. 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 wastes will be sorted out by the contractors for recycling. The residual wastes will be properly handled by the relevant municipal units for waste disposal. Discarded material will be handled and disposed of by TPL.

73. 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 time 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 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.

74. Since there are no cultural resources near the project sites, there will be no impacts on physical cultural resources through the implementation of project components.

3. Impacts and Mitigation Measures from Operation

2.1 Unlike power generation projects, the operation of the distribution system will have negligible environmental impact during operation. There will be no waste products, no requirements for cooling, no moving parts, no noise, and no impact on flora and fauna. Only impact envisaged is the escape of polluting substances from switchgears and transformers.

3.1 Physical Environment

75. After installation, the project impacts will diminish. The traffic to and from the existing villages will reduce to present levels. The distribution assets contribution to noise in the vicinity will be undetectable and definitely insignificant compared to that of the adjacent diesel generators.

76. The possible impact could be during maintenance of lines and replacement of poles. However these impacts will be very insignificant.

77. All the Tongan islands are vulnerable to tropical cyclones. To mitigate these impacts, the footing of poles and fixing of cables system will be designed to withstand powerful cyclone winds, which will limit the probability of power supply interruption as well as reducing any potential hazard of poles and cables being lifted up and blown onto adjacent properties.

78. Some switchgear that will be installed may contain SF_6. Typically losses of the SF_6 gas are very minor in the operational phase but it is noted that all halogenated gases can potentially accrue “greenhouse gas effects” if they are released in significant quantities. However well installed SF_6 equipment should not leak significant amounts of gas and leakage will be checked routinely from all such equipment. Six monthly reports should be made in case there is a need for

SF_6 to be topped up. The maintenance of the equipment should be geared to achieve a gradual reduction in SF_6 usage (leakage) which can therefore be monitored to slowly eradicate any such impacts. If SF_6 leakage becomes excessive the respective plant will be overhauled to reduce and eradicate leakage.

79. If there is a suspicion that there has been a leak of sulphur hexafluoride or by products at any location, the immediate surrounding locations should be evacuated, the controlling engineer must be informed, pending investigation by an authorized person. Thus atmospheric environmental impacts from SF_6 can be mitigated and are not expected to be significant.

80. The Project will use transformers of forced-oil and forced-air-cool designs, which do not use polychlorinated biphenyl (PCB). Therefore, there will be no PCB disposal problem.

3.2 Biological Environment

81. No significant impacts anticipated on biological environment due to operation of the distribution grid. Since cables will be used instead of bare conductors, impacts on fauna species such as birds, bats etc. due to accidents with live lines are not anticipated.

3.3 Social Environment

82. Only about 10-15 staff will operate Project facilities. Domestic wastes generated by this small number of people could be readily handled by conventional practices.

83. Contractors' emergency response plan including occupational health and safety plan approved by a supervision consultant will be adopted to handle emergency situations during the operation period. Workers will be trained to deal with all emergency situations.

4. Impacts and Mitigation due to Decommissioning

84. The Project's assets are expected to have an economic life of 15-30 years. The suppliers will accept the decommissioned assets particularly transformers and switchgears for recycling. Dismantling of the transformers and switchgears will be handled by suppliers that offer the best price for used switchgears and transformers in the future. To control these possible impacts, it is proposed that the disposal of the switchgears and transformers will be handled by suppliers and TPL.

5. Cumulative Impacts

85. The grid assets under the Project will be replaced at existing grid. This will not result in any disruption to any new development in the area.

86. Impacts due to logging of forests for wooden poles may result in adverse impacts on the environment. However, the Project will procure wooden poles only from government authorized suppliers such as Tonga Timber Limited.

87. Presently, there is no future development or expansion plan either of the existing grid network or any other infrastructure by government. Therefore, there will be no cumulative environmental effects of replacement of grid assets on the existing grid in the targeted island.

F. ANALYSIS OF ALTERNATIVES

88. With and without project alternatives were analyzed and it is found that Vava'u Island and Tonga would continue to pay a heavy price for diesel import and losses incurred due to inefficient distribution systems which will affect the overall economic development of the country and the

outer Islands. Implementation of the Project will bring positive economic, social and environmental benefits. Economic benefits will be from the efficient distribution of electricity and 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 DG sets by reducing diesel transport, storage, spills and emissions; and reduction in noise levels from DG sets being currently operated at existing power station. In addition, as part of capacity building of local technicians in implementation and operation of the distribution grid system, as well as solar and other energy efficient systems, future projects will benefit from the increased local capacity in the installation and operation of grid assets.

89. Alternative sites have not been selected as the objective of the project is to upgrade the existing grid network. The Project's technical team is reviewing the technical aspects of the existing distribution system and assets to be replaced. The best and efficient assets that would meet desired technical requirements will be selected.

G. CONSULTATIONS AND INFORMATION DISCLOSURE

1. Stakeholder / Community Consultations

90. As part of environmental assessment, stakeholders and community consultations were carried out during field visits. The details of such consultations carried out during reconnaissance field visits are presented in Table 7 and Table 8. Also, in total 10 officials from various agencies, i.e., the Tonga Energy Road Map Implementing Unit, the Tonga Power Limited, Office of the Governor of targeted island, town officers, the Department of Environment, Department of Lands and Surveys etc., were consulted during the fact finding visits. The consultations included both discussions with stakeholders and discussions with village/district level authorities.

91. Consultations 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.

Table 7: List of Stakeholders / Communities Consulted during Field Visits

Sl. No.	Name	Designation and Organization	Remark
NUKU'ALOFA			
Meetings and Site Visits (22-23 January 2013)			
1.	Nicholas Fonua	Manager, Strategic Planning Division, Tonga Power Limited, Nuku'alofa	
2.	Harry Asdett	Environmental Engineering Officer, Strategic Planning Division, Tonga Power Limited, Nuku'alofa	
3.	Warrick Vea	Land Registration Officer, Ministry of Lands, Environment, Climate Change and Natural Resource, Government of Tonga, Nuku'alofa	
4.	Charles Sullivan	Energy Coordinator, TERM	
5.	David King	Environmental Engineering Officer, Ministry of Lands, Environment, Climate Change and Natural Resource, Government of Tonga, Nuku'alofa	
6.	Lesieli Tuvai	Ecologist, Ministry of Ministry of Lands, Environment, Climate Change and Natural Resource, Government of Tonga, Nuku'alofa	
VAVA'U ISLAND (Governor's Office, Vava'u) – 17 Jan 2013			
7.	Masina Talakai	Governor Representative, Vava'u Island	

Sl. No.	Name	Designation and Organization	Remark
8.	'Atieli Tupou	Tonga Power Limited, Vava'u Island	
9.	Halaovava Kivalu	Tonga Power Limited, Vava'u Island	
10.	Uini Veikoso	Regional Office, Ministry of Lands, Environment, Climate Change and Natural Resources, Vava'u Island	

Table 8: Summary of Stakeholder/ Community Consultation Undertaken During Site Visits

Date / Venue / No. of participants	Issues discussed / remarks[10]
17 January 2013/ Governor Office, Vava'u / Governor;s representative, TPL, Department of Lands and Enviornment (08 participants)	Information about the project and its scope, issues and concerns related to electricity supply, status of existing grid assets, presence of environmental sensitive areas on the Island. Governor representative ensured to extend his full support to the project and he appreciated the project as it will ensure uninterrupted supply of electricity to the households and will also improve economic conditions of the villages. It is informed by the Manager of TPL (Vava'u) that some of the poles and transformers are inefficient and need immediate replacement.
22 January 2013/ Ministry of Lands. Surveys, and Natural Resources /03	Status of land along the road where existing electricity poles are installed. Need for any approval from the Lands Department for install new poles along the road. Officers informed that as per there is a provision of keeping additional land along the roads for public utilities such as electricity poles, telephone line, water supply lines, sewer lines etc. All the existing poles are installed on this land owned by the Government. Detailed procedure for the land acquisition / leasing was collected from the officer.
22 January 2013/ Environment Department of the Ministry of Lands, Environment, Climate Change and Natural Resources/04	Scope of proposed project, national policy and regulatory framework as well as requirements for permits and EIA approval for grid rehabilitation project were discussed with officials from MLECCNR. Officials informed that as such there is no specific requirement stipulated in the existing Act for grid rehabilitation, but project proponent has to submit Form1 to the Ministry for its information and to examine whether project classify for Major Activity.
22 January 2013/ Tonga Power Limited and Tonga Energy Road Map Implementing Agency/04	Institutional arrangement of Tonga Power Limited, Scope of proposed project, national policy and regulatory framework as well as requirements for permits and EIA approval for grid rehabilitation project were discussed with officials from TPL. Details of existing grid assets in targeted details, cases of previous similar projects. Existing practices for management of discarded material / waste generated from replacement of existing assets, likely environmental impacts and its mitigation measures.

92. Local communities and community leaders are well aware and fully support the proposed Project, as the efficient distribution of electricity will bring benefits to the Island in terms of improved and sustainable electricity supply, improve the overall economy situation by saving in the cost of imported diesel and provide employment opportunities. Appendix 1 shows the photographic record of the consultations undertaken during preparation of the IEE.

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

2. Information Disclosure

93. 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 New Public Communications Policy (PCP) 2011. The EA through the IA will ensure that meaningful public consultations, particularly with project affected persons, if any, are undertaken. A consultation plan will be prepared and agreed by EA during the detailed design stage.

H. GRIEVANCE REDRESS MECHANISM

1. Grievance Redress Mechanism

94. In order to receive and facilitate the resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance, a Grievance Redress Mechanism (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 implementation 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 Tonga's judicial or administrative remedies. The EA through the IA will appropriately inform the affected people about the mechanism before commencement of any civil works.

2. Grievance Focal Points, Complaints Reporting, Recording and Monitoring

95. The process for solving environmental complaints that may arise in the Project is the Grievance Redress Mechanism, which will be established at project level, the process is described below:

96. Environment complaints will be received through the Grievance Focal Point (GFP); these will be designated personnel from within the community who will be responsible for receiving the environmental complaints. The Contractor will record the complaint in the onsite Environmental Complaints Register (ECR) in the presence of the GFP. The GFP will discuss the complaint with the Contractor and have it resolved.

97. If the Contractor does not resolve the complaint within one week, then the GFP will bring the complaint to the attention of the PMC Safeguard Specialist. The PMC Safeguard Specialist will then be responsible for coordinating with the Contractor in solving the issue.

98. If the Complaint is not resolved within 2 weeks the GFP will present the complaint to the Grievance Redress Committee (GRC). The GRC will be comprised of designated officials from the following organizations: Contractor's Environment Specialist, PMC Safeguard Specialist, GFP, Island Level representative, and a representative from IA.

99. The GRC will have to resolve the complaint within a period of 2 weeks and the resolved complaint will have to be communicated back to the community. The Contractor will then record the complaint as resolved and closed in the Environmental Complaints Register. In parallel to the ECR placed with the Contractor, each GFP will maintain a record of the complaints received and will follow up on their rapid resolution.

100. EA through IA will also keep track of the status of all complaints through the Monthly Environmental Monitoring Report submitted by the Contractor to the PMC, and will ensure that they are resolved in a timely manner. Figure 2 shows that Grievance Redress Mechanism.

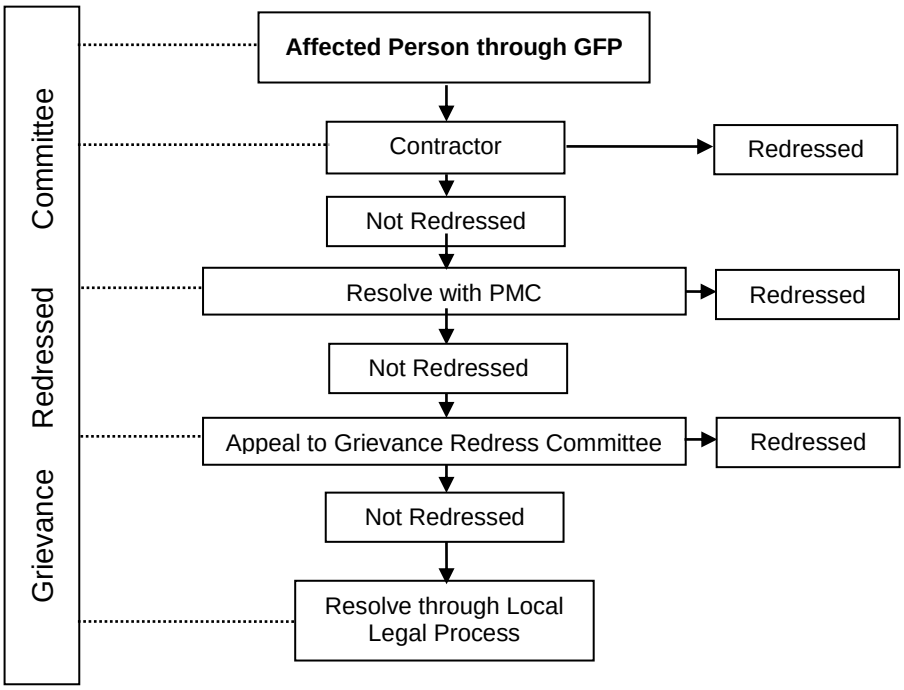

Figure 2: Grievance Redress Mechanism

I. ENVIRONMENTAL MANAGEMENT PLAN

1. Mitigation Measures

101. The likely adverse effects of replacement of grid assets during the installation stage are handling and storage of discarded materials, visual impacts, increased traffic, ground disturbance and health and safety of workers. The environmental effects during operation are mostly due to potential escape of polluting substances from switchgears and transformers. Discarded material will be handled and stored at designated places and will be recycled and reused to the possible extent. Equipment which cannot be recycled by the TPL grid will be sent to authorized waste disposal agencies in New Zealand for final treatment and disposal.

102. If increased traffic causes an issue with local residents, a scheduled time for shipments to and from the wharf can be created. A suitable traffic diversion/ management plan will be prepared and communicated to communities prior to start of work in that particular area. 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 grid assets with additional resilience to climate change through compact and preassembled systems resistant to marine environments.

103. The escape of any polluting substances from switchgears and transformers will be monitored. 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 in Table 9. The EMP will be updated following detailed engineering design.

2. Monitoring and Reporting

104. 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 the project implementation agency. In consultation with the executing agency and ADB, the implementing agency will establish a system for reporting on safeguards performance monitoring, issues resolution, and corrective action plans for the project.

105. The EMP will be part of the overall project monitoring and supervision, and will be implemented by the project management consultant (PMC) with oversight from the implementing agency. Progress on the preparation and implementation of the EMP will be included in the periodic project progress reports. Specific monitoring activities defined in the IEE and EMP will be carried out by the engineering, procurement and construction (EPC) contractor, supervised by the PMC and monitored by the implementing agency. The executing agency will submit semi-annual environmental monitoring reports on EMP implementation for ADB's review.

106. 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 agency with the support from PMC is required to implement safeguard measures and relevant safeguard plans, as provided in the Project agreement.

107. Table 10 provides the environmental monitoring plan outlining parameters and the frequency of monitoring.

Table 9: 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 to avoid encroachment of ecological sensitive areas including protected areas and areas of historical and cultural importance.	Project Cost	EA, IA through PMC	Detailed design
Project design	Negligence of environmental mitigation measures	Ensure that EMP is included in the bidding documents	Project cost	EA, IA through PMC	Tendering process
Climate Change	Risk of climate change	Provided switchgears and transformers with resilience to climate change through compact and preassembled systems resistant to marine environments.	Project cost	EA, IA through PMC	Detailed design
Equipment specifications and design parameters	Release of toxic chemicals and gases in receptors (air, water, land)	PCBs should not be used in transformers and other project facilities or equipment. Processes, equipment and systems not to use chlorofluorocarbons (CFCs), including $SF_{6,}$ halon, and their use, if any, in existing equipment, processes and systems will be (i) professionally handled, routinely monitored and well maintained; and (ii) eventually phased out to be disposed of in a manner consistent with the requirements of Government of Tonga.	Project Cost	EA, IA through PMC	Detailed design Tendering process
B. Installation					
Dismantling of existing grid assets i.e. poles, cables, switchgears and transformers	Topography and visual impacts	Careful handling, transportation and storage of discarded material.	To be included in EPC Contractor cost.	EPC Contractor & PMC	During civil work construction
	Leakage, Spillage and/or	Professional handling, bunding storage,	To be	EPC Contractor &	During civil work

Project activity /stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation schedule
	contamination of soil and waterways from PCBs in old transformers and capacitors.	transportation and disposal at the Tapuhia landfill on Tongatapu Island.	included in EPC Contractor cost.	PMC	construction
Installation of Grid Assets and movement of vehicles	Topography and visual impacts	Selection of suitable storage areas for materials or plant with minimum visibility from residences and roads with screening where necessary.	To be included in EPC Contractor cost.	EPC Contractor & PMC	During civil work construction
Construction debris and wastewater	Pollution of water bodies due to disposal of waste material into water bodies.	Provision of adequate drainage system including controlled collection and preliminary treatment of wastewater.	To be included in EPC Contractor cost.	EPC Contractor & PMC	During civil work construction
Movement and operation of construction equipments	Noise generated from operation and movement of trucks and cranes	- Construction techniques and machinery selection seeking to minimize ground disturbance. - Machines noise level not more than 85 dB(A) at avg. 8 hr	To be included in EPC Contractor cost.	EPC Contractor (preparation and implementation) PMC (approval)	During land clearing and civil work construction
	Visual impacts from storage and haulage of construction material	Selection of suitable storage areas for materials or plant with minimum visibility from residences and roads with screening where necessary.	To be included in EPC Contractor cost.	EPC Contractor (preparation and implementation) PMC (approval)	During land clearing and civil work construction
Transportation of equipments and construction material.	Dust and particulate emission from movement of construction vehicles transporting equipments and construction material.	- Truck wheels cleaning - Road cleaning and watering	To be included in EPC Contractor cost.	EPC Contractor	During land clearing and civil work construction
Clearing / trimming of tree branches and vegetative cover	Loss of vegetative covers	- Trimming of only those trees which are necessary. - Prohibiting illegal feeling of trees by construction workers for domestic uses.	To be included in EPC Contractor	EPC Contractor	During land clearing and civil work construction

Project activity /stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation schedule
			cost.		
Occupational Health and Safety	Impacts on workers health due to working with trucks and piling cranes, Building construction, high voltage work	- Provide Safety Manual - Provide Safety Plan - Supervision and Inspection - Protection gears	To be included in EPC Contractor cost.	EPC Contractor (preparation and implementation) PMC (approval)	During land clearing and civil work construction
C. Operation and Maintenance					
Location of poles, cables and transformers	Exposure to safety related risks	Setback of dwelling to overhead line routes designed in accordance with permitted level of power frequency and the regulation of supervision at sites	To be included in EPC Contractor O&M cost.	EPC Contractor	During operation and maintenance
Equipment specifications and design parameters	Release of chemicals and gases in receptors (air, water, land)	Processes, equipment and systems using cholofluorocarbons (CFCs), including SF_6, halon, should be phased out and to be disposed of in a manner consistent with the requirements of the Government.	To be included in EPC Contractor O&M cost.	EPC Contractor	During operation and maintenance
Natural Disasters	Damage from hurricanes and cyclones.	Design of pole footings and cable 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 EPC Contractor O&M cost.	EPC Contractor	During operation and maintenance
Health and Safety	Health hazards in the event of accidents (cyclones, hurricanes) and emergency	Emergency Response Plan Health and Safety Plan	O&M Cost	EPC Contractor	Emergency during operation and maintenance
Disposal and management of transformers and switchgears	Impacts from used transformers (oil) and switchgears	Adequate storage and handling system.	O&M Cost	EPC Contractor	During operation and maintenance
D. Decommissioning					
Dismantling of cables, poles,	Impacts from disposal of discarded assets.	Contract agreements with transformer and switchgear suppliers for dismantling	Maintenance cost	EA	Post operation

Project activity /stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation schedule
transformers and switchgears		and disposal after use.			

Table 10: 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 least once during installation period.	- Project site - Front main road	2000*1 =2000	EPC Contractor & PMC
Air	Emission of dust and particulate matter	At least once during installation period.	- Project site - Front main road	3000*1=3000	EPC Contractor & PMC
Physical Works Progress	As specified in contractors' plan	Project site Monthly	Project Site	Project Cost	EPC Contractor & PMC
Occupational Health and Safety	As specified in project OHS plan prepared by Contractor	Project site Weekly	Project Site	Project Cost	EPC Contractor & PMC
Operation Stage					
Occupational Health and Safety	As specified in project OHS plan prepared by Contractor	Project site Weekly	Project Site	Project Cost	EPC Contractor & PMC
Released of Chemicals and CFC Gases	Emission of CFC gases / oil spillage from transformers	Biannual	Project Site	Project Cost	EPC Contractor & PMC

3. Implementation Arrangement

108. The main institutions that will be involved in environmental management activities are the Ministry of Finance and National Planning (MFNP) as the executing agency (EA) of the Project, Tonga Power Limited (TPL) as Implementing Agency (IA), the project management consultant (PMC), the EPC contractor, and line agencies including the Energy Division of MEIDECC.

109. The EA has overall responsibility for all aspects of the Project. The IA with the support of the PMC will be responsible for day to day management of technical aspects of the Project. The PMC will be responsible to update the EMP following the detailed design phase and will also be responsible for approving the contractors' management plan, emergency plan, and occupational health and safety plan as well as to ensure on-ground implementation of the environmental management plan. The PMC will also provide training to IA's staff on managing the environmental issued associated with project. The EA will ensure the environmental management and monitoring budgets are available and utilized as necessary for timely implementation of the EMP. The cost of capacity building is included in the capacity building component of the Project.

110. The Contractor will be required to have one staff with experience in environmental management. This person will be responsible for preparing and monitoring plans such as the emergency preparedness plan; occupational health and safety plan, and the day to day implementation of the EMP.

4. Environmental Management Budget and Resources

111. 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 environmental management including implementation and monitoring is US$ 5,000 as detailed in Table 09 and Table 10.

J. CONCLUSION AND RECOMMENDATION

112. The environmental impacts associated with proposed grid rehabilitation activities have been assessed and described in the previous sections of this document. The findings establish that the project site is not located in a sensitive ecosystem, and have no historical and cultural value. The nature of the project site coupled with the efficient supply of power mainly generated through solar, 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 location during installation and operation, and they will be minimized through implementation of the EMP. The EMP will be updated in case of any change in project design following the detailed engineering design stage. It is recommended that the Project be considered environmentally feasible, and that this IEE 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.

113. It is concluded that the Project has no further environmental issues to follow up, and the adequate measures listed in IEE and EMP, when implemented, will fully comply with ADB's SPS 2009 and Government requirements.

APPENDIX 1: PHOTOGRAPHS (FIELD AND CONSULTATIONS)

A. Photographs (Site Conditions)

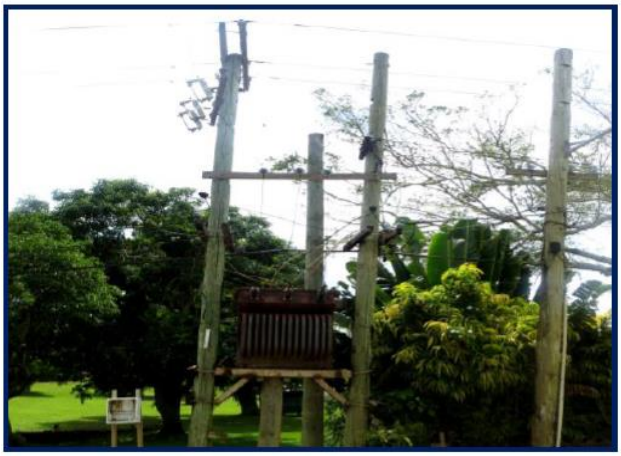

Photo 9: Old pole mounted distribution transformer on TPL distribution grid in Vava'u

Photo 10: Existing overloaded wooden pole on the verge of felling in Vava'u Island

Photo 11: TPL Distribution Grid connecting two Islands in Vava'u

Photo 12: Existing storage yard within the premises of TPL generation unit in 'Eua

B. Photographs (Stakeholder and Community Consultations)

Photo 5: Consultation with stakeholders in Vava'u (Governors' Office)

Photo 6: Consultation meeting with stakeholders and community leaders in 'Eua (Town Hall)

APPENDIX 2: REA CHECKLLIST

POWER TRANSMISSION / DISTRIBUTION

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: TONGA: Outer Island Energy Efficiency Project – Additional Financing

Sector Division: PARD / PATE

Screening Questions	Yes	No	Remarks
A. Project Siting Is the Project area adjacent to or within any of the following environmentally sensitive areas?			No new locations. All work to be carried out on exiting system which involve rehabilitation and upgrading of existing power distribution system. The scopes include replacement of grid assets i.e. cable, poles, distribution transformers, and switchgear). No significant impacts. **Environmental Category 'B'.**
▪ Cultural heritage site		**X**	
▪ Protected Area		**X**	
▪ Wetland		**X**	
▪ Mangrove		**X**	
▪ Estuarine		**X**	
▪ Buffer zone of protected area		**X**	
▪ Special area for protecting biodiversity		**X**	
B. Potential Environmental Impacts Will the Project cause…			
▪ encroachment on historical/cultural areas, disfiguration of landscape and increased waste generation?		**X**	
▪ encroachment on precious ecosystem (e.g. sensitive or protected areas)?		**X**	

Screening Questions	Yes	No	Remarks
▪ alteration of surface water hydrology of waterways crossed by roads and resulting in increased sediment in streams affected by increased soil erosion at the construction site?		X	
▪ damage to sensitive coastal/marine habitats by construction of submarine cables?		X	
▪ deterioration of surface water quality due to silt runoff, sanitary wastes from worker-based camps and chemicals used in construction?		X	
▪ increased local air pollution due to rock crushing, cutting and filling?		X	
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?		X	
▪ chemical pollution resulting from chemical clearing of vegetation for construction site?		X	
▪ noise and vibration due to blasting and other civil works?	X		Possible during the construction phase. Measures will be included in the EMP.
▪ dislocation or involuntary resettlement of people?		X	
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		X	
▪ social conflicts relating to inconveniences in living conditions where construction interferes with pre-existing roads?		X	
▪ hazardous driving conditions where construction interferes with pre-existing roads?		X	
▪ creation of temporary breeding habitats for vectors of disease such as mosquitoes and rodents?		X	
▪ dislocation and compulsory resettlement of people living in right-of-way of the power transmission lines?		X	
▪ environmental disturbances associated with the maintenance of lines (e.g. routine control of vegetative height under the lines)?		X	
▪ facilitation of access to protected areas in case corridors traverse protected areas?		X	
▪ disturbances (e.g. noise and chemical pollutants) if herbicides are used to control vegetative height?	X		Possible. Noise could be an issue- at the wavelength of the transformer excitation frequency, and first two to three harmonics thereof. Incremental noise likely to be low due operations of transformers.
▪ large population influx during project construction and operation that cause increased burden on social infrastructure and services (such as water supply and sanitation systems)?		X	

Screening Questions	Yes	No	Remarks
▪ social conflicts if workers from other regions or countries are hired?		X	Not anticipated; consultations indicate broad public support for project.
▪ poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases from workers to local populations?		X	
▪ risks to community safety associated with maintenance of lines and related facilities?		X	
▪ community health hazards due to electromagnetic fields, land subsidence, lowered groundwater table, and salinization?		X	
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?		X	
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project (e.g., high voltage wires, and transmission towers and lines) 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	

Climate Change and Disaster Risk Questions The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.	Yes	No	Remarks
▪ 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	
▪ Could changes in precipitation, temperature, salinity, or extreme events over the Project lifespan affect its sustainability or cost?		X	
▪ 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	
▪ 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 3: SUMMARY OF IUCN PROTECTED AREAS CATEGORIES SYSTEM

IUCN Category	Categorization System[11]
IA - Strictly Protected Areas	Category IA are strictly protected areas set aside to protect biodiversity and also possibly geological/geomorphical features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values
IB - Protected Areas	Category IB protected areas are usually large unmodified or slightly modified areas, retaining their natural character and influence without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition.
II - National Parks	Category II protected areas are large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible, spiritual, scientific, educational, recreational, and visitor opportunities.
III-Natural Monument or Feature	Category III protected areas are set aside to protect a specific natural monument, which can be a landform, sea mount, submarine cavern, geological feature such as a cave or even a living feature such as an ancient grove. They are generally quite small protected areas and often have high visitor value.
IV - Habitat/ Species Management Area	Category IV protected areas aim to protect particular species or habitats and management reflects this priority. Many Category IV protected areas will need regular, active interventions to address the requirements of particular species or to maintain habitats, but this is not a requirement of the category.
V Protected Landscape/ Seascape	A protected area where the interaction of people and nature over time has produced an area of distinct charcter with significant, ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values.
VI Protected area with sustainable use of natural resources	Category VI protected areas conserve ecosystems and habitats together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area

[11] Source: UNCN (http://www.iucn.org/about/work/programmes/pa/pa_products/wcpa_categories/)