Environmental Assessment Report

Initial Environmental Examination
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Kingdom of Tonga: Cyclone Ian Recovery Project – Component 1 (Energy Sector)

Prepared by the Tonga Power Ltd for the Asian Development Bank

CURRENCY EQUIVALENTS

(as of 23 January 2015)

Currency Unit	=	Tonga: pa'anga (TOP)
TOP1.00	=	US$ 0.48
US$1.00	=	TOP 1.79

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
MLECCNR	-	Ministry of Lands, Environment, Climate Change and Natural Resources
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
TERM - IU	-	Tonga Energy Road Map – Implementing Unit
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., FY2014 ends on 31 December 2014.

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

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A. EXECUTIVE SUMMARY

1. The Tonga Cyclone Ian Recovery Project (the project) is to support the Government of Tonga reconstruct and climate proof the main electricity grid network and school buildings and facilities on the Ha'apai Island Group, which were damaged by Tropical Cyclone Ian. On 11 January 2014, Tropical Cyclone Ian, a Category 5 cyclone and the most powerful recorded in Tongan history, passed directly over the northeast islands of Ha'apai causing substantial damage. An estimated 5,000 people were directly affected and an estimated 800 homes were destroyed or heavily damaged. The Prime Minister declared a state of emergency for Ha'apai on the same day. The preliminary estimates of damage and losses amount to $53 million, equivalent to some 12.1% of the GDP.

2. The 'Tropical Cyclone Ian Response Plan', which was prepared by the government with the assistance of development partners, serves as the government's post-disaster needs assessment. The response plan identified immediate requirements and priority recovery and reconstruction needs. The 'build back better' principle is included in the assessment of these needs in order to ensure improved climate resilience. The Government of Tonga, through the Ministry for Finance and National Planning (MFNP), requested ADB support for post-cyclone reconstruction on 7 February 2014, to reconstruct the Ha'apai electricity grid network and other key government infrastructure such as school and related facilities.

3. The scope of the Project is divided into three components as:

- **Component 1:** Reconstruction and climate- and disaster-proofing of the electricity network;
- **Component 2:** Reconstruction and climate- and disaster-proofing of school facilities; and
- **Component 3:** Removal of asbestos from damaged buildings.

4. The project will use the implementation arrangements that are being set up by two existing ADB projects in Tonga, namely the Outer Island Renewable Energy Project (OIREP, G0347/0348) for the reconstruction of electricity grid, and the Climate Resilience Sector Project (CRSP, G0378) for the reconstruction of school buildings and facilities and removal of asbestos from damaging buildings.

5. This is the Initial Environmental Examination (IEE) prepared for Component 1 of the Project. Based on ADB's environmental safeguard policy, Component 1 interventions are categorized as environmental category B considering the most sensitive component. This IEE meets the requirements of the Tonga's Environmental Impact Assessment (EIA) Act 2003 and complies with the ADB's Safeguard Policy Statement (SPS) 2009. The scope of this IEE is limited to the sites on the island of Foa and Lifuka.

6. The cyclone damaged 90% of the Ha'apai power network's distribution lines, 40% of the high-voltage poles and 70% of the low-voltage poles, 65% of the transformers, 90% of the transformer structures, one of its two generators, and 95% of its streetlights. This left almost all of the island group without power and most of the streets without illumination at night. Community-owned solar systems in Tonga's other outer islands were also damaged. Component 1 will thus restore access to the electricity supply network and make it more resilient to extreme weather events and disasters. Repairing the damage to these utilities – assessed at more than 90% of the Ha'apai network on 13 January – and upgrading them requires considerable investment. Following the Government of New Zealand contribution of $1.4 million for the initial emergency restoration of power lines Ha'apai, TPL prepared an

investment plan and cost estimates for the repair and climate-proofing of the electricity network.

7. In this context the project will reconstruct the distribution network and upgrade its capacity from 6.6 kV (kilovolts) to 11 kV. This will include (i) reconstruction of around 15.2 kilometers (km) of high-voltage overhead bundle lines; (ii) construction of around 32 km of low-voltage lines overhead; (iii) underground reconnection to the TPL network of around 1,000 households and around 30 commercial and government buildings; and (iv) construction of 2 km underground cables to proposed new Ha'apai Hospital and High School network. The project will also restore and climate-proof around 161 streetlights and purchase temporary solar lanterns and community solar chargers for approximately 100 households in the outer islands of Ha'apai. Component 1 will use the implementation arrangements established for the OIREP, which is being implemented by TPL.

8. The responsibility for providing grid-connected electricity supply and services rests solely with TPL, which has the concession to operate and maintain the four independent grids for on-grid electricity services on the main island groups of Tongatapu, Vava'u, Ha'apai, and 'Eua. TPL generates, distributes, and retails electricity.

9. Table 1 summarizes the villages included in the CIRP Restoration Plan and number of accounts per village;

Table 1: Summary of Villages in the CIRP Restoration Plan

	Village	Active Accounts	Closed Accounts	Total Number of Accounts
1	Faleloa	95	13	108
2	Fangale'ounga	36	4	40
3	Fotua	52	4	56
4	Ha'ateiho Si'i	17	2	19
5	Ha'ato'u	106	17	123
6	Hihifo	205	32	237
7	Holopeka	39	8	47
8	Koulo	47	8	55
9	Lotofoa	84	16	100
10	Pangai	252	62	314
	TOTAL	**933**	**166**	**1,099**

10. Investment will allow reconstruction of the network (assuming all materials will be readily available together with reclaim material that can be used). The budget assumes full rebuild to cater for all 1,000 odd network connections present as on the day before the cyclone struck. In reality many connections will be completed after new homes are constructed, in the interim TPL proposes to construct service line connections for the vacant lots where new homes will be built, providing temporary connections at a more efficient cost than if the connections were made on an ad hoc basis upon request from home owners over a longer period of time.

B. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

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

1. The Government Environmental Laws and Regulations

12. 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 Lands, Environment, Climate Change and Natural Resources, Government of Tonga (www.mecc.gov.to)

2. Environmental Assessment Process in Tonga

13. Under the Tongan regulatory framework (the EIA Act 2003 and the EIA Regulations 2010), all development activities must be referred to the Minister of Environment, Energy, Climate Change, Disaster Management, Meteorology, Information and Communication. 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.

14. 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 Environment, Energy, Climate Change, Disaster Management, Meteorology, Information and Communication to undertake its assessment process as required under the regulations as any Major Project.

3. ADB's Environmental Safeguard Requirements

15. 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.

16. As per the SPS the objective of Environmental Safeguard 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.

17. 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 is carried out using 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

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

5. Extent of IEE Study

19. The interventions proposed under the Project are located in the Island Group of Ha'apai. This is the Initial Environmental Examination (IEE) prepared for the reconstruction of the electricity network in Ha'apai Islands proposed under the Project. The scope of this IEE is limited to the existing electricity distribution grid system on the islands of Lifuka and Foa only. The purpose of this IEE is to assess potential environmental, health, safety and social impacts of the proposed interventions.

20. This IEE is prepared during the project preparation work in the month January 2015. 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 accordingly in compliance with the ADB's SPS 2009.

21. 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 MEECCDMMIC, 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

22. The emergency nature of the project entails that the most practical way to expedite project implementation is to employ existing project arrangements in Tonga. The Ministry of Finance and National Planning (MFNP) will thus be the executing agency (EA) and TPL through the project management unit (PMU) established under OIREP will be the implementing agency (IA). The final technical and engineering designs and bidding process will be conducted by TPL. TPL staff will carry out the design, supervision, and installation work. ADB will finance the incremental labor costs TPL incurs in carrying out the project civil works, using force account. TPL will use ADB disbursement procedures and financial management guidelines. TPL will maintain separate accounts for the project, which will be audited by an independent auditor.

23. The procurement capacity assessment of TPL indicates that Tonga's procurement regulations and procedures are comprehensive and that TPL has a functioning procurement unit. Procurement of goods, works and related services under the project will be processed through TPL, oversight by ADB, and carried out in accordance with ADB;s Procurement Guidelines (2013, as amended from time to time).

24. The scope of the Project include:

- Replacement and reconstruction of the high voltage and low voltage networks including power poles, converters, fuses and insulators;
- Replacement of distribution grid assets such as cable, poles, distribution transformers, switchgears in the Ha'apai group that was damaged or destroyed by Cyclone Ian; and
- Replacement of existing street lighting with LED street lighting.

2. Location of Project

25. All the physical components are located in the Ha'apai Island Group. This island group consisting of high volcanic and low limestone islands is located in the centre of Tonga with Lifuka the main island located at about 175 km northeast of Tongatapu and the national capital of Nuku'alofa. The group consists of 62 Islands covering a total land area of 110 sq. km. As of the 2011 census, the island group had a total population of 6650 households. Land use around the proposed project sites of Lifuka and Foa islands is remote rural/residential with a flat topography.

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

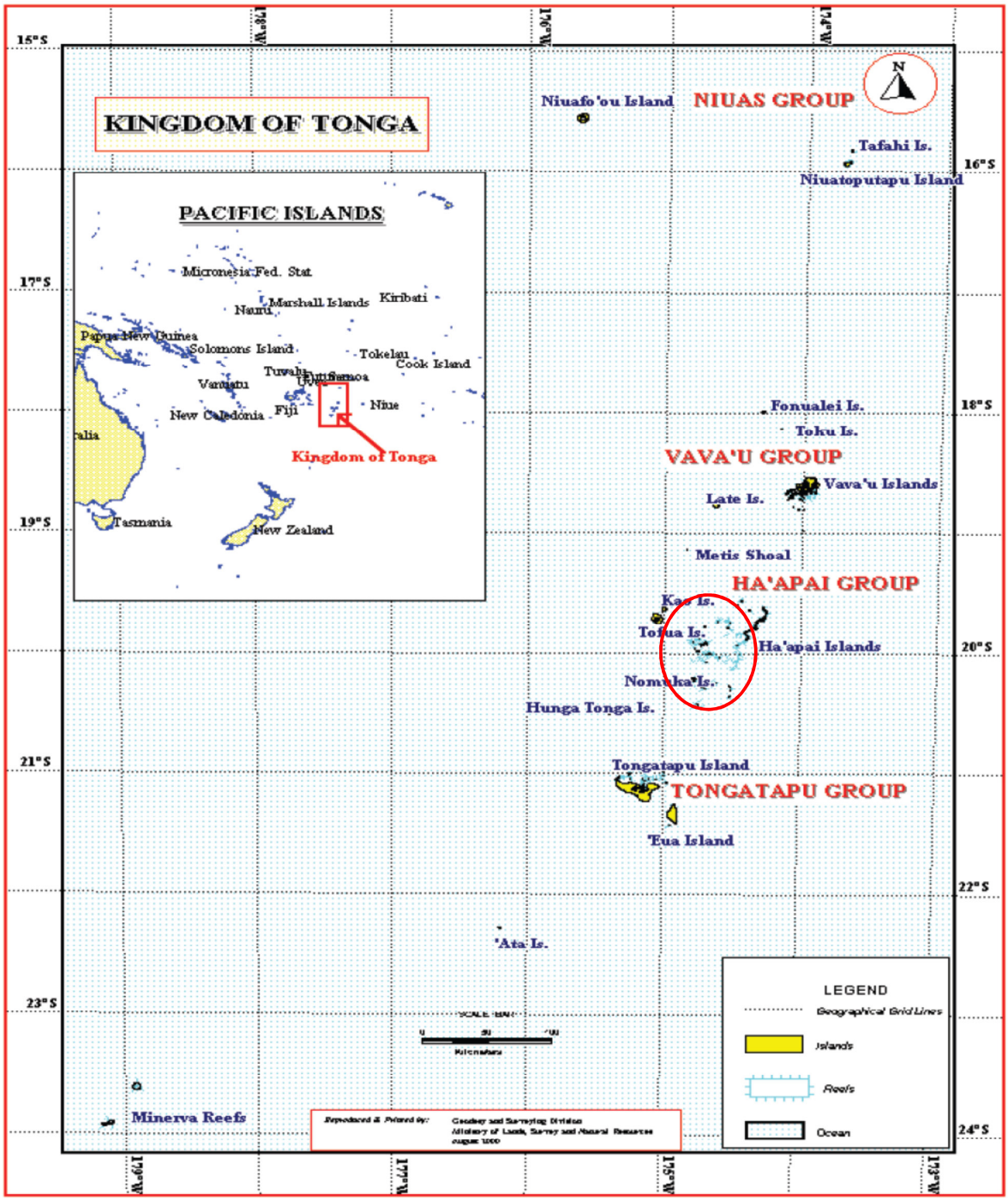


Figure 1: Locations of Project Areas on Country (Tonga) Map[1]

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

3. Project Components and Activities

27. The Project will replace existing distribution grid assets with new and efficient grid assets to reconstruct a more disaster resilient grid. A climate-proofing component will be the construction of a new electrical reticulation connection to the proposed Ha'apai Hospital site and High School. Repairing and climate proofing of street lights will also be part of the proposed reconstruction with temporary solar lanterns for damaged community systems also to be distributed. The main islands of Foa and Lifuka are the only islands in the Ha'apai Group that is connected to TPL's electricity grid.

28. Table 3 below summarizes the island wise grid details and summary of existing features and proposed interventions under the OIREP project. The highlighted grey column contains the specific components and activities to be addressed under the Cyclone Ian Recovery project.

Table 3: Summary of Existing Features and Proposed Interventions

Parameter	Targeted Islands				
	Ha'apai	**Nomuka**	**Ha'afeva**	**'Uiha**	**Ha'ano**
Island Group	Ha'apai	Ha'apai	Ha'apai	Ha'apai	Ha'apai
Number of Households	1268	86	48	145	106
Existing Grid	Overhead LV (6.6 kV and 240V) distribution system managed by TPL	Underground LV (6.6 kV and 240V) distribution system managed by IEC.	Underground LV (6.6 kV and 240V) distribution system managed by IEC.	Underground LV (6.6 kV and 240V) distribution system managed by IEC.	Underground LV (6.6 kV and 240V) distribution system managed by IEC.
Proposed Interventions	Replacement of cable, poles, distribution transformers, and switchgears; and replacement of existing street lighting with efficient lighting powered by solar panels.	Replacement of underground cable, distribution transformers, and switchgears; and replacement of existing street lighting with efficient lighting powered by solar panels.	Replacement of underground cable, distribution transformers, and switchgears; and replacement of existing street lighting with efficient lighting powered by solar panels.	Replacement of underground cable, distribution transformers, and switchgears; and replacement of existing street lighting with efficient lighting powered by solar panels.	Replacement of underground cable, distribution transformers, and switchgears; and replacement of existing street lighting with efficient lighting powered by solar panels.
Sites of proposed interventions	Pangai and Foa Islands of Ha'apai	Entire Island	Entire Island	Entire Island	Entire Island

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

- Replacement of existing inefficient cables[2] (11kV, 6.6kV, 240V.)
- Replacement of existing inefficient overhead (open) conductors (11kV, 6.6kV, 240V.)

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

- Replacement of wooden/concrete poles
- Replacement of inefficient transformers
- Replacement of inefficient switchgears
- Replacement and commissioning of street lighting system with energy efficient street lighting system powered by solar power.

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. The roads and wharf will be needed to transport necessary materials and equipment during installation. It is estimated that a maximum of 5 trucks will be moving daily for a maximum number of 3-4 days during peak construction time.

31. 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. Implemented under the auspices of the OIREP project, existing and newly established institutions will support project implementation. Under OIREP, the government through its Ministry of Finance and National Planning (MFNP) is the executing agency (EA) of the Project. The implementing agencies are the Tonga Energy Road Map Implementing Unit (TERM-IU) and Tonga Power Limited (TPL). The government has appointed TERM-IU as the energy sector cross-cutting implementing agency. TPL has key hands-on expertise and will nominate counterpart staff with adequate capacity in engineering and power system planning, finance, environment, and social areas. An international team comprising power distribution specialist, solar energy specialist, field engineer, safeguards specialist, and financial expert established as the Project Management Consultant (PMC) is supporting the EA and IAs. The PMC overlooking project implementation will design and conduct operations and maintenance (O&M), and capacity building of Tonga Power Limited (TPL) staff and members of the island electricity committees to guarantee for at least five years project sustainability. A project steering committee chaired by the MFNP supervises project implementation.

33. The OIREP Project will be implemented between November 2013 and November 2016. The Cyclone Ian Recovery Project which was effective in August 2014 is expected to wrap up physical works within the first 12 months by December 2015. The project however is scheduled to fully be completed by June 2017

6. Project Benefits and Justification

34. The successful implementation of the Project will improve power distribution network efficiency by supplying at least 2575 MWh[3]/year more electricity to customers in the networks of targeted islands. It will also increase the solar power share in generation mix.

35. The added value of the OIREP 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 2025 tons of CO_2 per year. 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 Grass Domestic Product (GDP). The Cyclone Ian Recovery Project implemented under OIREP will adhere to the same values but in addition will

[3] Baseline: 23177 GWh gross generation per year with 20% losses of net generation.

climate proof the electricity network against future natural disasters reducing its vulnerability to damage and improving energy security and services due to quicker reconnection times after disasters.

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 has a total population of 103,036 (2011 census) compared to 101,991 at the census of 2006, an increase of 1045 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.

39. Ha'apai Group consists of 62 Islands covering a total land area of 109 km^2. As per the 2011 census the Group had a total population of 6650 and 1268 households. The land use around the existing grid network is mixed type dominated with rural residential areas followed by open area. Topography is mostly flat. Ha'apai has high volcanic and low limestone islands.

40. Table 4 presents the physiographical features of the islands that form the OIREP Project area. Highlighted in the grey column are the site specifics for the Cyclone Ian Recovery project.

Table 4: Physiographical Features of the Proposed Sites

Parameter	Targeted Islands				
	Ha'apai	**Nomuka**	**Ha'afeva**	**'Uiha**	**Ha'ano**
Island Group	Ha'apai	Ha'apai	Ha'apai	Ha'apai	Ha'apai
Total Geographical Area (sq.km.)	109	7.0	1.8	5.36	6.58
Number of Households	1268	86	48	145	106
Population[4]	6650	477	270	672	511
Geographical Location	Ha'apai main island is located 175 km northeast of the National Capital	Nomuka is a small island in the southern part of the Ha'apai Group	Ha'afeva is located 42 km southwest of Pangai in the	'Uiha is an island in Lifuka district, in the Ha'apai	Ha'ano is an island in the Ha'apai islands of Tonga. To

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

Parameter	Targeted Islands				
	Ha'apai	**Nomuka**	**Ha'afeva**	**'Uiha**	**Ha'ano**
	Nuku'alofa.	of islands in the Tonga.	Ha'apai group of islands.	islands of Tonga	the south are the islands of Foa and Lifuka.
Land Use	Mixed (residential and open)	Mixed (residential and open)	Mixed (residential and open)	Mixed (residential and open)	Mixed (residential and open)
Terrain	Plain to undulating	Plain to undulating	Plain to undulating	Plain to undulating	Plain to undulating
Existing Grid	Overhead LV (6.6 kV and 240V) distribution system managed by TPL	Underground LV (6.6 kV and 240V) distribution system managed by IEC	Underground LV (6.6 kV and 240V) distribution system managed by IEC	Underground LV (6.6 kV and 240V) distribution system managed by IEC	Underground LV (6.6 kV and 240V) distribution system managed by IEC.
Proposed Interventions	Replacement of cable, poles, distribution transformers, and switchgears; and replacement of existing street lighting with efficient lighting powered by solar panels.	Replacement of underground cable, distribution transformers, and switchgears; and replacement of existing street lighting with efficient lighting powered by solar panels.	Replacement of underground cable, distribution transformers, and switchgears; and replacement of existing street lighting with efficient lighting powered by solar panels.	Replacement of underground cable, distribution transformers, and switchgears; and replacement of existing street lighting with efficient lighting powered by solar panels.	Replacement of underground cable, distribution transformers, and switchgears; and replacement of existing street lighting with efficient lighting powered by solar panels.
Location of proposed sites for interventions	Pangai and Foa Islands of Ha'apai	Entire Island	Entire Island	Entire Island	Entire Island
Ownership of proposed land	Government	Government	Government	Government	Government
Land requirement	No additional land requirement	No additional land requirement	No additional land requirement	No additional 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, the Wet and Dry seasons.

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 apart from Cyclone Ian, four other cyclones have severely affected Tonga. Cyclone Flora in March, 1961 affected both 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 and Cyclone Renee in 2010 severely affected the whole groups of Tongatapu, Vava'u and Ha'apai. All of these cyclone events caused severe damages to crops and food supply, infrastructure, tourist resorts, the natural environment, buildings and disrupted essential services and the wellbeing of the people of affected communities for a prolonged period of time.

44. Ha'apai has semi-tropical climate with mean monthly maximum and minimum temperatures at 25.5^0C and 23.5^0C, respectively. Average annual rainfall is 1619 mm, which is not usually sufficient to support plant growth during the dry season and frequent droughts occur in the period June - August. Soil erosion occurs as a result of high intensity rainfall (including hurricanes) during the wet season from November to March.

45. A climate risk profile for Tonga[5] 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 grid assets with 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. Among the 63 islands of Ha'apai group, 43 are coral islands, with very low topography and coraline soils. Ha'apai has high volcanic and low limestone islands or atolls.

1.4 Water Resources

47. 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.

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

2. Ecological Resources

2.1 Flora and Fauna

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

49. 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 root crops, 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.

50. 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 of Ha'apai. All islands have a cover of coconuts, and few other trees.

51. Knowledge of Tonga's terrestrial fauna is limited with most past researches 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 which prominence relate more to their destructive impact on agriculture as oppose to being biologically rare and unique.

52. 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.

53. 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

54. 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 present the overview of the protected area system in Tonga and corresponding IUCN category. 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	MECC
Managed resource terrestrial protected areas	6	2,100	II, V,VI	Forestry & MECC
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 Lands, Environment, Climate Change and Natural Resources

3. Socio-economic Conditions

3.1 Demography

55. 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. Due to steady migration (urban drift) to the capital of Nuku'alofa, with a population growth of 0.8%. In Ha'apai the annual growth rate is recorded -2.6% during this period. 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.

56. 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 main islands agreed that the level of electricity supply they are getting from 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, level of power supply is not enough to meet the requirements of the households as they are getting interrupted power supply.

3.2 *Economic Development*

57. The economy of Tonga is largely based in 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 the GDP. This indicates a gradual diversification from the agricultural sector to the services sector. During the consultation it is reported that about 15-20% of their monthly income goes to the 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

58. The proposed project locations and the surrounding areas are for mainly residential and rural 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-reconstruction Activities

1.1 Physical Environment

59. 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 the government land, therefore proposed project facilities do not encroach on any 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.

60. 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 the impacts. Therefore no adverse impacts due to project design are anticipated. To ensure that all the environmental mitigation measures however are implemented, an EMP has also been prepared.

61. 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 centimetres 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. The project will provide equipment and assets with resilience to climate change through compact and preassembled systems resistant to marine environments.

1.2 Biological Environment

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

1.3 Social Environment

63. The impacts on the social-economic environment will be mostly positive. This is evident by the positive community response to consultations and surveys undertaken in project preparation. However, during implementation, if any unanticipated 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 Reconstruction Activities

2.1 Physical Environment

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

65. Visual impacts are anticipated due to 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.

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

67. The current hydraulic trucks do not have oil spill trays attached.

68. The distribution poles are treated to hazard class H5 under NZS3640:2003 whereby such preservative treatment will not filter into the surrounding soil. The poles are specifically treated and dried over a period of time.

69. The Project will involve only minor civil works such as digging of trenches for poles and underground connections to households. Mechanical and electrical works will take place at various locations along the project sites. Clearing of vegetation and trimming of tress may be required during the installation work. There will not be any significant change in the drainage pattern.

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.

70. The impacts from operation and maintenance are mainly the clearance of vegetation to reduce the risk of short-circuits and the occasional repairs with regular maintenance. However, these impacts will not involve any major change to the newly constructed project and are spatially limited to the new pole locations. There is no endangered wildlife that is reported in close proximity to the projects.

71. A summary of impacts is contained below;

	Negative Impacts	Positive Impacts
Social Impacts	• Traffic disruption on narrow roads • Loss of fruit trees that encroach on lines either in part or in full.	• Reduction in deaths caused by electrocution • Reduction in house fires • Improvements in the quality of life from the availability of electricity such as the use of household appliances (refrigerator, etc.) • Opportunities for alternative livelihoods, generating socio-economic benefits • Affordable electricity options • Lighting for homes, streets and community centers
Environmental Impacts	• Tree cutting and loss of vegetation • Noise pollution produced by machinery and trucks • Oil spill from trucks	• Reduction in green house-gasses through renewable energy sources and the reduction from burning kerosene • Efficiency gains • Decreased consumption on imported diesel • Contributing to long term goals of TERM

72. 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 system using checklist of all contractual environmental requirements
- Appropriate contact clauses to ensure satisfactory implementation of contractual environmental mitigation measures.

2.2 Biological Environment

73. The project does not require cutting of trees or clearing of large areas of vegetation as most trees and vegetation were destroyed by Cyclone Ian. During installation work, clearing of small land area for the footing of the poles and trimming of trees near the conductors may be required. Additionally, trenching of the underground cabling will require removing vegetation; however impacts on the natural 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 Environment Department.

74. There will be minimal effect from Soil erosion and any changes to soil composition due to clearing of vegetation because vegetation clearing will only be carried out is absolutely necessary. With the type of cable strung (ABC Bundle) it eliminates the need to remove the vegetation completely, rather trimming will allow for clearance issues overhead and with underground service, the underground route will be to trench around the tree is this is far more economical than uprooting.

75. 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 (if any) prior to 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

76. 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.

77. 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 the TPL.

78. 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.

79. Since there are no cultural resources near the project sites, there will be no impacts on physical cultural resources through the implementation of the 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 minimal waste products most of which will be recycled, 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, trenching of underground cabling and disposal of old cables and electrical wires.

3.1 Physical Environment

80. Existing concrete poles will be donated to local Tongan companies and communities within the allocated villages or others who would re-use the concrete poles for other activities such as fence line post, structural foundation or support for a temporary roofing shelter, however the project will ensure the concrete poles will be fit for service according to its required use.

81. Stick poles in good condition will be recycled and used by TPL for other purposes. Stick poles that cannot be re-used will be donated to local families and communities for the use of fire wood.

82. Wires and cables that are unsalvageable are placed in containers and shipped back to New Zealand where they will be melted down and recycled.

83. Ha'apai Island is vulnerable to the tropical cyclones and hurricanes. To mitigate these impacts, the footing of poles and fixing of cables system will be designed to withstand powerful cyclones and hurricanes, 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.

84. Some switchgear that may 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 in leakage is 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 eradicate the leakage.

85. 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.

86. 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

87. No significant impacts anticipated on biological environment due to operation of 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

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

89. Contractors' emergency response plan including occupational health and safety plan approved by supervision consultant 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

90. 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 based. 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.

5. Cumulative Impacts

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

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

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

F. ANALYSIS OF ALTERNATIVES

94. With and without project alternative were analyzed and it is found that the Tonga and the targeted Islands would continue to pay a heavy price for diesel import and losses incurred due to an inefficient distribution system which will affect the overall economic development of the country and especially in 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; reduction in noise levels from DG sets being currently operated by power station. Also as part of capacity building of local technicians in implementation and operation of distribution grid system, as well as solar and other energy efficient system, future projects will benefit from the capacity building from the installation and operation of grid assets.

95. 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 and best and efficient assets that would meet desired technical requirements will be selected.

G. CONSULTATIONS AND INFORMATION DISCLOSURE

1. Stakeholder / Community Consultations

96. As part of environmental assessment, stakeholders and community consultations were carried out during field visits. The details of such consultation carried out during reconnaissance field visits are presented in Table 7 and Table 8. Also, in total 25 officials from various agencies, i.e., the Tonga Energy Road Map Implementing Unit, the Tonga Power Limited, Office of the Governor of targeted islands, town officers from islands, 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.

97. Consultation will continue at next stages i.e. 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 Dea	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	
HA'APAI GROUP			
Ha'apai Island (Office of the Finance Department, Pangai Island, Ha'apai) – 14 Jan 2013			
7.	Samuela Fakatou	Sub-treasurer, Finance Department, Ha'apai	
8.	Salote Finau	Finance Department, Ha'apai	
9.	'Ilaisaane Tonga	Finance Department, Tongatapu Office	
10.	Taufa Vaka	Manager, Tonga Power Limited, Ha'apai	
11.	Taniela Latu'ila	Technician, Ha'apai Power Station, Tonga Power Limited, Ha'apai	
Ha'ano Island (Town Hall, Ha'ano) – 14 Jan 2013			
12.	Paula Tu'itavuki	District Officer, Ha'ano Island	
13.	Sione F Tu'imoala	Pukotala Town Officer, Ha'ano Island	
14.	Viliami Tanginoa	Ha'ano Town Officer, Ha'ano Island	
15.	Siosaia Langi	Muitoa Town Officer, Ha'ano Island	
'Uiha Island Town Hall, 'Uiha) – 15 Jan 2013			
16.	Siosaia Niumeitolu	District Officer, 'Uiha Island	
17.	Fine Molisi	'Uiha Town Officer, 'Uiha Island	
18.	Sione Tupou	Felemea Town officer, 'Uiha Island	
19.	Selita Tupou	'Uiha Island	

Sl. No.	Name	Designation and Organization	Remark
Ha'afeva Island Town Hall, Ha'afeva) – 16 Jan 2013			
20.	Kisione Taulani	District Officer, Ha'afeva Island	
21.	Viliami Fifita	Town Officer, Ha'afeva Island	
22.	'Isileli Palu	President, Haafeva Electricity Committee, Ha'afeva Island	
23.	Fonia Toto	Secretary, Haafeva Electricity Committee, Ha'afeva Island	
24.	Pita Ikavuka	Treasurer, Haafeva Electricity Committee, Ha'afeva Island	
25.	'Elenoa Vaea	Clerk, Haafeva Electricity Committee, Ha'afeva Island	

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

Date / Venue / No. of participants	Issues discussed / remarks[6]
14 January 2013 / Office of the Finance Department, Pangai Island, Ha'apai / 06	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. Government representative were happy and appreciated the project as it will ensure uninterrupted supply of electricity to households and will also improve economic conditions of the villages. It is informed by the Manager of TPL (Pangai) that some of the poles and transformers are really inefficient and need immediate replacement.
14 January 2013/ Town Hall, Ha'ano Island / Government representative, electrcity committee member, and women groups' groups (21 participants)	Discussions were held together with social team to inform communities about the proposed project, its scope 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 street lights and other community facilities like individual solar panels to town hall etc. It is informed by Government representative that major concern in the Island is supply side which need immediate enhancement. Present of environmental sensitive areas were discussed with the District Officer and he informed that there are no such areas on the Island.
15 January 2013/ Town Hall, 'Uiha Island / Government representative, electrcity committee member and women groups' groups (25 participants)	Discussions were held together with social team to inform communities about the proposed project, its scope 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 street lights and other community facilities like individual solar panels to town hall etc. It is informed by Government representative that major concern in the Island is supply side which need immediate enhancement. Present of environmental sensitive areas were discussed with the District Officer and he informed that there are no such areas on the Island.
16 January 2013/ Town Hall, Ha'afeva Island / Government representative, electrcity committee	Discussions were held together with social team to inform communities about the proposed project, its scope 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 street lights and other community facilities like individual solar panels to town hall etc. It is informed by

[6] 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.

Date / Venue / No. of participants	Issues discussed / remarks[6]
member and women groups' groups (21 participants)	Government representative that major concern in the Island is supply side which need immediate enhancement. Present of environmental sensitive areas were discussed with the District Officer and he informed that there are no such areas on the Island.
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.

98. Local communities and community leaders are well aware of and fully support the proposed Project, as the efficient distribution of electricity 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. Appendix 1 shows the photographic record of the consultations undertaken during preparation of the IEE.

2. Information Disclosure

99. 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. EA through IA 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.

H. GRIEVANCE REDRESS MECHANISM

1. Grievance Redress Mechanism

100. In order to receive and facilitate the resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance an Environmental 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. EA through IAs will appropriately inform the affected people about the mechanism before commencement of any civil works.

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

101. 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:

102. 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.

103. 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.

104. 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.

105. 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.

106. EA through IAs 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.

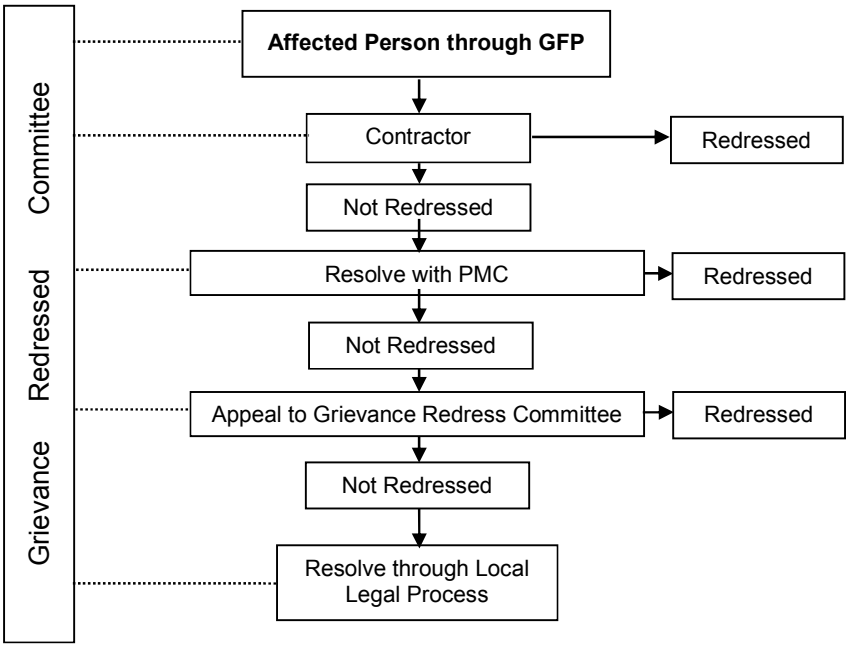


Figure 2: Grievance Redress Mechanism

I. ENVIRONMENTAL MANAGEMENT PLAN

1. Mitigation Measures

107. The likely adverse effects of replacement of grid assets during 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 escape of polluting substances from switchgears and transformers. Discarded material will be handled and stored at designated places and will be recycles and reused to the possible extent. Those equipment which cannot be recycled at TPL grid, they will be sent to authorized waste disposal agencies in New Zealand for final treatment and disposal.

108. If the increased traffic causes an issue with local residents, a scheduled time for shipments to and from the wharf can be created. 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 resilience to climate change through compact and preassembled systems resistant to marine environments.

109. 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 Table 9. The EMP will be updated following detailed engineering design.

2. Monitoring and Reporting

110. 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 implementation agency. In consultation with executing agency and ADB, the implementing agency will establish a system for preparing quarterly reports on safeguards performance monitoring, issues resolution, and corrective action plans.

111. An 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 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 PMC and monitored by implementing agency. The executing agency will submit semi-annual environmental monitoring reports on EMP implementation for ADB's review.

112. 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.

113. 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 processes and systems should be phased out and 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
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	EPC Contractor & PMC	During civil work construction

Project activity /stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation schedule
			cost.		
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 equipment	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 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	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 cost.	EPC Contractor	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	- 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					

Project activity /stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation schedule
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, transformers and switchgears	Impacts from disposal of discarded assets.	Contract agreements with transformer and switchgear suppliers for dismantling and disposal after use.	Maintenance cost	EA	Post operation

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	2000*1 =2000	EPC Contractor & PMC
Air	Emission of dust and particulate matter	At least once during installation period.	Project site	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

114. 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, the Tonga Energy Road Map Implementation Unit (TERM-IU) and Tonga Power Limited (TPL) as Implementing Agencies (IAs), project management consultant (PMC), EPC contractor, and line agencies including the Energy Implementation Unit of MLECCNR.

115. EA has overall responsibility for all aspects of the Project. IAs through support of PMC will be responsible for day to day management of technical aspects of the Project. PMC 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. PMC will provide training to IAs staff on managing the environmental issued associated with project. 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.

116. 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, energy day to day implementation of EMP.

4. Environmental Management Budget and Resources

117. 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$ 5,000 per Island as detailed in Table 09 and Table 10.

J. CONCLUSION AND RECOMMENDATION

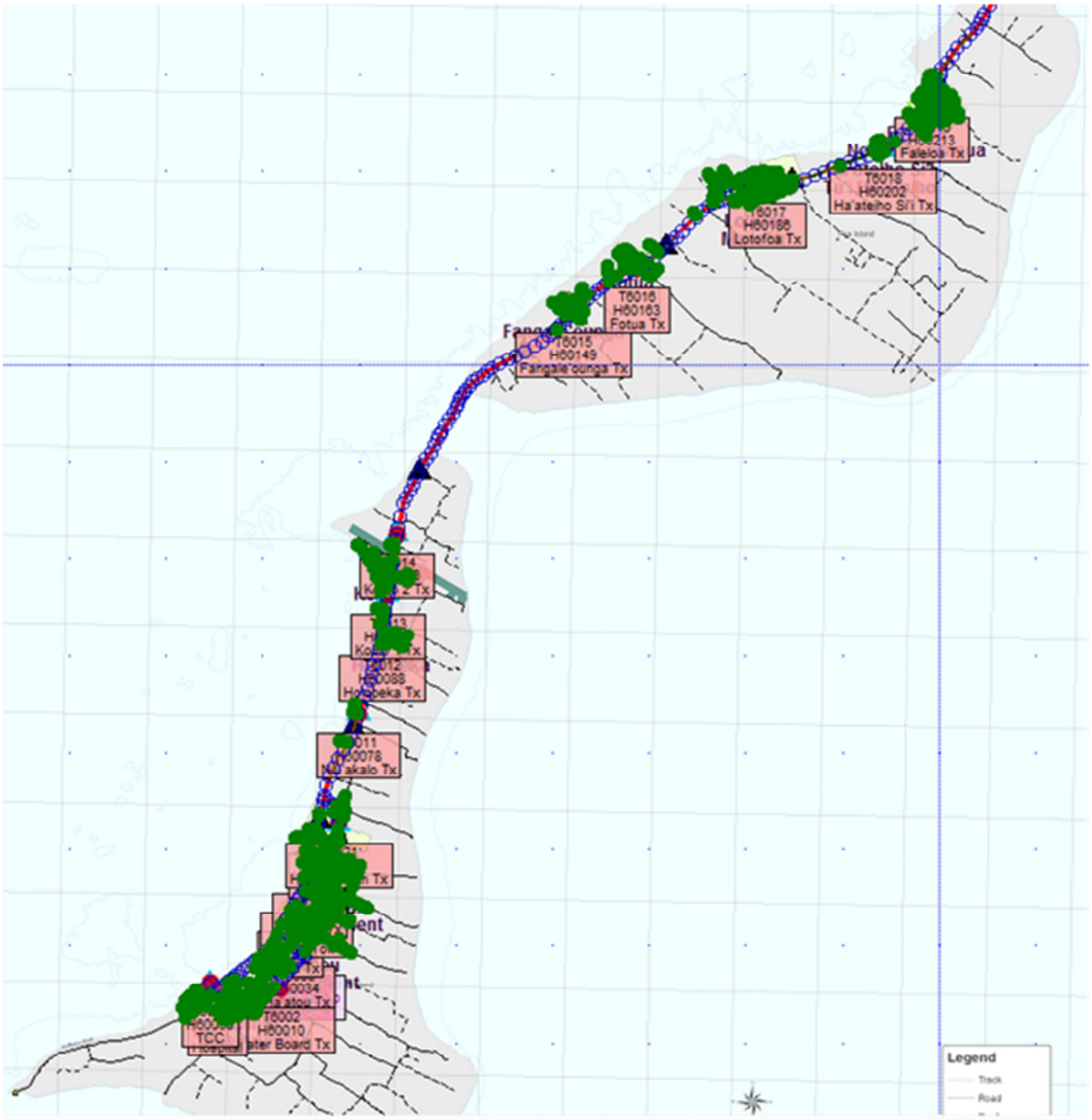
118. The environmental impacts associated with proposed grid rehabilitation activities have been assessed and described in the previous sections of this document. The findings establish that the project sites are not located in a sensitive ecosystem, and have no historical and cultural value. This nature of the project site coupled with the efficient supply of power, 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 locations 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 followed by detailed engineering design stage. It is then 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.

119. 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: LOCATION MAPS OF PROJECT SITES

Figure 1a: Satellite Image of the Project Area to be Re-constructed

Figure 1b: GIS Image of Electricity Network Affected by Cyclone Ian to be re-constructed under CIRP



APPENDIX 2: PHOTOGRAPHS (FIELD AND CONSULTATIONS)

A. PHOTOGRAPHS (SITE AND CONSULTATIONS)

Photo 1: Meter Box blown off from House

Photo 2: Poles snapped into pieces by cyclone.

Photo 3: Temporary poles installed to restore power, will not able to withstand another cyclone.

Photo 4: Temporary overhead cable connections installed to restore power, will be easily damaged by high winds.

APPENDIX 3: 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: Cyclone Ian Recovery Project

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?			No new locations. All work to be carried out on exiting system which involve rehabilitation and upgrading of existing power distribution system. The scope include replacement of grid assets i.e. cable, poles, distribution transformers, and switchgear) and replacement of existing street lighting with efficient street lighting powered by solar panels. 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**	

Screening Questions	Yes	No	Remarks
▪ encroachment on precious ecosystem (e.g. sensitive or protected areas)?		X	
▪ 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.

Screening Questions	Yes	No	Remarks
▪ 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	
▪ 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 4: SUMMARY OF IUCN PROTECTED AREAS CATEGORIES SYSTEM

IUCN Category	Categorization System[7]
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

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