



Ref: 5038008

TA-8345 REG: Due Diligence of Tonga Nuku'alofa Distribution Network Upgrade Project

Due Diligence Report

07 November 2016





**TA-8345 REG: Due Diligence of Tonga Nuku'alofa Distribution Network Upgrade Project
Due Diligence Report**

This page blank for double siding

TABLE OF CONTENTS

0.0	Executive Summary	I
0.1	Due Diligence Report	I
0.2	Implementing Agency Assessment	I
0.3	Technical Assessment	I
0.4	Environmental Assessment	I
0.5	Social Development Assessment	II
0.6	Financial & Economics	II
1.0	Background	1
1.1	Appointment	1
1.2	Project Team	1
1.3	Due Diligence Report	1
1.4	Terms of Reference	1
1.5	Due Diligence	2
1.6	Project Working Group	3
1.7	Counterpart Team	3
1.8	Acknowledgements	3
2.0	Proposed Project	4
2.1	Project Paper	4
2.2	Project Paper Update	4
2.3	Scope of Work	4
2.4	Tonga Energy Road Map	9
3.0	Implementing Agency Assessment	11
3.1	Background of TPL	11
3.2	TPL Operations	12
3.3	2017-2020 Business Plan	14
3.4	Conclusion	14
4.0	Technical Assessment	15
4.1	11 kV Network Upgrade	15
4.2	LV Network Upgrade	15
4.3	Customer Services Upgrade	15
4.4	Work Programme	16
4.5	Risk Assessment	16
4.6	Results Framework	17
5.0	Procurement Assessment	18
5.1	Existing Procedures and Policies	18
5.2	TPL Procurement and Facilities	19
5.3	Project Management	21
5.4	Past Issues	21
5.5	Packaging of Procurement	21
6.0	Environmental Assessment	22
6.1	Introduction	22
6.2	Environmental Laws and Environmental Safeguards Policies of Potential International Partners	22
6.3	Existing Environmental Condition of the NNUP Project Area	26
6.4	Assessment and Prediction of Environmental Impacts of NNUP and Mitigations	29
6.5	Environmental Management Plan	36
6.6	Public Consultation and Disclosure	40
6.7	Grievance Redress Mechanism	41
6.8	Conclusion and Recommendations	42
7.0	Social Development Assessment	43
7.1	Due Diligence Purpose and Methodology	43
7.2	Social Safeguard Policies	43
7.3	Findings - Current Social Dimensions and Concerns	45
7.4	Potential NNUP Impacts and Benefits	51
7.5	Suggested Way Forward	52
7.6	Conclusion	54
8.0	Economic Analysis of Network Upgrade	55

8.1	Introduction	55
8.2	Macroeconomic Context	55
8.3	Sector Context	56
8.4	Demand analysis	56
8.5	Alternative Project Option	57
8.6	Valuation of Project Costs	57
8.7	Valuation of Project Benefits	59
8.8	Cost-Benefit Analysis and Economic Internal Rate of Return	61
8.9	Sensitivity Analysis of the Project	63
8.10	Conclusion	64
9.0	Financial Analysis of Network Upgrade	66
9.1	Introduction	66
9.2	Project financial costs	66
9.3	Project financial benefits	66
9.4	Weighted Average Cost of Capital	67
9.5	Cost-Benefit Analysis and Financial Internal Rate of Return	67
9.6	Sensitivity analysis of the Project	70
9.7	Financial Analyses for Subprojects	70
9.8	Project Funding	71
9.9	Tariff Affordability, Efficiency and Sustainability	71
9.10	TPL Financial Performance and Projections	74
9.11	Conclusion	78
Appendix 1	Terms of Reference	81
Appendix 2	Glossary	85
Appendix 3	Project Villages	87
Appendix 4	Project Risk Assessment	89
Appendix 5	Work Programme	91
Appendix 6	Results Framework	93
Appendix 7	Environmental Assessment	95
Appendix 8	Social Development Assessment	105

Tables

Table 1. Summary of Project Costs, Financial and Economic Assessments	1	Table 21. Cost of Additional equipment	57
Table 2. Summary of Projects	5	Table 22. Financial and Economic costs of the Project/ Subprojects	58
Table 3. TERM Status (Power Component)	10	Table 23. Project and Subprojects EIRRs and ENPVs	61
Table 4. Key 11 kV Quantities	15	Table 24. Overall EIRR - Without Project Incremental (NZD million)	61
Table 5. Key LV Quantities	15	Table 25. Overall EIRR - With Project Incremental (NZD million)	62
Table 6. Key Customer Services Quantities	16	Table 26. EIRRs and Sensitivity analysis for Subprojects	63
Table 7. Sequence of Subproject Implementation	16	Table 27. EIRRs and Sensitivity analysis for Subprojects	64
Table 8. EIA Related Laws and Regulation of the Kingdom of Tonga	23	Table 28. EIRRs and Sensitivity analysis for Subprojects	64
Table 9. NZMFAT Categorisation of Activities According to Environment and Social Impacts	25	Table 29. Project and Subprojects EIRRs and ENPVs	65
Table 10. Category of Projects According to the Need for ESIA	26	Table 30. Project/ Sub-projects financial costs	66
Table 11. EIB Categorisation of Projects According to Risk	26	Table 31. Weighted Average Cost of Capital (Option 1 - Non-concessional financing).	67
Table 12. Vegetation clearance for overhead line	32	Table 32. Weighted Average Cost of Capital (Option 2 - Concessional financing).	67
Table 13. Responsibilities in EMP Implementation	36	Table 33. Project and Subprojects FIRRs and FNPVs	68
Table 14. Environmental Management and Monitoring Plan	37	Table 34. Overall FIRR - Without Project Incremental (NZD million)	68
Table 15. NNUP Grievance Redress Procedures	41	Table 35. Overall FIRR - Without Project Incremental (NZD million)	69
Table 16. Estimate of households connected to the grid in Greater Nuku'alofa	46	Table 36. FIRRs and Sensitivity analysis for Subprojects	70
Table 17: Greater Nuku'alofa Electricity Consumption June 2016	47	Table 37. Results of Sensitivity analysis for Subprojects	71
Table 18: 'Affordability' based on a number of assumptions and focus group responses	48	Table 38. Total Project costs (NZD)	71
Table 19. Energy Generation, Consumption and Losses	56		
Table 20. Project / Subproject main financial costs	57		

Table 39. Tariff in Tonga as at 1 July 2016	72	Table 46. Project and Subprojects FIRRs and FNPVs	79
Table 40. Cost of Supply across Islands	72	Table 47. Total Project costs (NZD)	79
Table 41. TPL Financial Performance 2010-15	75	Table 48. Project Villages	87
Table 42. TPL Key Performance Indicators 2010-15	76	Table 49. Project Risk Assessment	89
Table 43. TPL Revenues and Operating costs 2014-15	77	Table 50. Project Results Measurement Table	93
Table 44. Summary of Financial Projections for TPL	78		
Table 45. FIRRs and Sensitivity analysis for Subprojects	79		

Figures

Figure 1. Project Area	5	Figure 5. Lapita excavation sites around Fanga'uta Lagoon (Burley and Dickenson, 2001)	29
Figure 2. TPL Core Purpose	11	Figure 6. Lisbon Treaty	44
Figure 3. Seasonal Rainfall and Temperature at Nuku'alofa (after PCCSP, 2011)	27	Figure 7. Tariff Changes during 2013-2015	73
Figure 4. Protected Areas around Nuku'alofa	28	Figure 8. TVUNP Governance Organisation	75

Photos

Photo 1: Typical Conditions in Area 1	6	Photo 9: Project LV ABC Conductor	20
Photo 2: Typical Conditions in Area 2	6	Photo 10: Project Vehicles	20
Photo 3: Typical Conditions in Area 3	7	Photo 11: Typical Work on the Distribution Lines	30
Photo 4: Typical Conditions in Area 4	8	Photo 12: Distribution line closest to the shoreline of Fanga'uta and Fangakakau Lagoon Marine Sanctuary	32
Photo 5: Typical Conditions in Area 5	9		
Photo 6: Old and New Network	12		
Photo 7: Typical Stores Requisition	19		
Photo 8: Distribution Transformers in TransNet Store	19		

Abbreviations

ADB	Asian Development Bank
AMS	Advanced Metering Systems
CBD	Convention on Biodiversity
CITES	Convention on International Trade of Endangered Species of Wild Fauna and Flora
DD	Due Diligence
DFAT	Australian Aid, Department of Foreign Affairs and Trade
E & S	Environment and Social
EA	Executing Agency
EC	European Commission
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EIRR	Economic Internal Rate of Return
EMMoP	Environmental Management Monitoring Plan
EMP	Environmental Management Plan
ENPV	Economic Net Present Value
EOCC	Economic Opportunity Cost of Capital
EOCK	Economic Opportunity Cost of Capital
FIRR	Financial Internal Rate of Return
FNPV	Financial Net Present Value
FNPV	Financial Net Present Value
GRM	Grievance Redress Mechanism
HIES	Household Income and Expenditure Survey
IA	Implementing Agency
ICB	International Competitive Bidding
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
LCOE	Levelling Cost of Energy

LRMC	Long-Run Marginal Cost
MEIDECC	Ministry of Environment, Energy, Climate Change, Disaster Management, Meteorology, Information and Communications
MoFNP	Ministry of Finance and National Planning
MoI	Ministry of Infrastructure
MoPE	Ministry of Public Enterprises
NNUP	Nuku'alofa Distribution Network Upgrade Project
NPAT	Net Profit after Tax
NPV	Net Present Value
NZMFAT	New Zealand Ministry of Foreign Affairs and Trade
O&M	Operations & Maintenance
OIREP	Outer Islands Renewable Energy Project
PA	Protected Area
PCC	Project Coordination Committee
PIC	Project Implementation Committee
PPA	Pacific Power Association
PRIF	Pacific Regional Infrastructure Facility
RCMS	Residual current monitoring systems
SAIDI	System Average Interruption Duration Index
SMEC	SMEC International Pty Ltd
TERM	Tonga Energy Road Map
TPL	Tonga Power Ltd
TVNUP	Tonga Village Network Upgrade Project
UNDP	United Nations Development Program
WBG	World Bank Group
WTP	Willingness-to-pay

Electrical Terminology

V	(Volt)	-	Unit of voltage
kV	(kilovolt)	-	1,000 volts
W	(Watt)	-	Unit of active power
kW	(kilowatt)	-	1,000 watts
MW	(Megawatt)	-	1,000 kW
Wh	(watt-hour)	-	Unit of Energy
kWh	(kilowatt-hour)	-	1,000 Wh
MWh	(Megawatt-hour)	-	1,000 kWh
GWh	(Gigawatt-hour)	-	1,000 MWh
TWh	(Terawatt-hour)	-	1,000 GWh
VA	(Volt-ampere)	-	Unit of apparent power
kVA	(kilovolt-ampere)	-	1,000 VA
MVA	(Megavolt-ampere)	-	1,000 kVA
VAr	(volt-ampere reactive)	-	Unit of reactive power
Low Voltage Distribution (LV)		-	400/230 V distribution and service lines
Medium Voltage ¹ Distribution System (MV)		-	11 kV lines supplying distribution substations

¹ In Tonga, 11 kV is referred to as HV (high voltage); whereas international practice (e.g. TR IEC 61000.3.7:2012) defines medium voltage (MV) as >1 kV to ≤35 kV and HV as >35 kV to ≤230 kV.

0.0 Executive Summary

0.1 Due Diligence Report

This *Due Diligence Report* sets out the findings of an assessment of the proposed *Nuku'alofa Distribution Network Upgrade Project* (NNUP). This includes a Technical Analysis, Procurement Assessment, Safeguards Assessment and an Economic and Financial Analysis.

The proposed project includes five contiguous subproject areas and 56 villages in Nuku'alofa. Table 1 lists the five subprojects with their respective costs and financial and economic assessments.

Table 1. Summary of Project Costs, Financial and Economic Assessments

Area	Name of Subproject	N° of Villages	Costs NZDm	EIRR %	ENPV NZDm	FIRR %	FNPV NZDm
1	Kolomotu'a and Kolofo'ou	12	11.20	40.2	6.55	27.0	13.45
2	Mataki'eua, Tofoa to Fanga	11	12.19	22.3	4.35	15.9	9.68
3	Fasi, Halaleva to Ma'ufanga	14	11.16	22.7	5.24	16.4	11.24
4	Anana, Touliki to Popua	11	7.74	15.5	1.55	12.0	4.87
5	West to Sopusu	8	9.17	12.3	0.16	9.6	3.49
	TOTAL	56	52.8*	20.2	19.4	15.4	45.0

*Includes an additional NZD 1.33m of remaining value in equipment not included in the sub-project costs, plus small rounding error.

0.2 Implementing Agency Assessment

An assessment of Tonga Power Ltd (TPL), the proposed implementing agency, confirmed that the organisation is well capable of taking on and managing the proposed new NNUP project. TPL has the necessary resources, experience and technical and commercial resources to ensure a successful outcome.

0.3 Technical Assessment

The proposed scope of the NNUP project in the five subproject areas includes the rehabilitation of the existing 11 kV overhead network, installation of new 11/0.4 kV distribution transformers, rehabilitation of the existing low voltage overhead network using modern aerial-bundled conductors, and installation of new underground service cables to customer premises with new smart meters. The proposed designs follow international good practice and will improve customer safety and reduce non-technical losses.

The proposed works are anticipated to start in January 2017 with a five year implementation programme. PL will utilise its existing construction resources which are expected to be shortly available then after completion of other on-going projects.

0.4 Environmental Assessment

The environmental assessment includes an environmental management monitoring plan and outlines the requirements of a detailed environmental management plan to be prepared at the time of the NNUP project implementation.

The completion of NNUP and the attainment of its objectives will have very significant socio-economic benefits coupled with positive environmental achievements for the Kingdom of Tonga. No significant adverse impacts are anticipated, neither are residual impacts predicted and all impacts can be mitigated. The assessment of the environmental and social impacts of NNUP according to Tonga regulations and environmental and social safeguards policies of potential Development Partners showed that NNUP will have minimal adverse impacts and will have a low level of risk. NNUP according to the NZMFAT environment and social procedures is Category B (P) with site specific adverse impacts that may be prevented or mitigated. According to EIB environmental and social standards, NNUP is Annex II with some ESA requirement; and it is likely to be categorised as Minor project as per Tongan EIA Law.

0.5 Social Development Assessment

The social due diligence review confirmed that the NNUP will not require physical or economic displacement or involuntary land acquisition. All the work in the scope of the upgrade are on property which is owned by the State. Therefore, a resettlement plan is not needed.

Key social dimensions which can be improved through the upgrade include:

- Network Accessibility and Affordability whereby households and businesses are encouraged to improve energy consumption habits
- Human Rights dimensions and Grievance Redress Mechanisms which do not only improve relationships with clients, but also encourage local buy into the programme
- Improved Service Provision which can strengthen client satisfaction and longer term sustainability of the network.

While these social dimensions are often perceived by technical experts to provide the 'soft' solutions to infrastructural development, they are critical to enable the longer term success and sustainability of such projects as the proposed NNUP.

0.6 Financial & Economics

The financial and economic results are summarised in Table 1. The total Project cost was estimated at about NZD 52.8 million with TPL's minimum contribution of about 6% of the total costs or NZD 3.0 million.

It is worth noting that TPL and the Government are approaching their debt ceiling so may not be able necessarily take on more commercial loans at this point. Based on the financial analysis, the Project can be financed by non-concessional funding with no grant elements and including potential private co-financing. Government and TPL need to seek potential private co-financing. It is important to note that the current tariff is at cost recovery level. This allows sound financial positions and long-run sustainability not only for TPL, but also positive return for involved private parties.

The economic analysis indicated that the overall Project is economically viable with EIRR = 20.2% and NPV = NZD19.40 million, since EIRR is higher than the benchmark of the economic opportunity cost of capital (EOCK=12%). Based on the results of the sensitivity analysis, the Project is resilient to key risk factors.

The Subprojects are individually economically viable.

The Subprojects are resilient to key risk factors based on the results of the sensitivity analysis, except three sensitivity cases for Project Area 5 (Investment costs increase by 20%, O&M costs increase by 20%, and Expected increase of consumptions less by 20%). However, in all those cases FIRRs are higher than 11%, and taking into account other non-quantified benefits such as benefit from smart / pre-paid metering, the Subproject Area 5 is also economically viable.

The financial analysis indicated that the overall FIRR for the Project is financially feasible with FIRR=15.4% and NPV=NZD 45.02 million, since FIRR is higher than WACC=6.68%. Based on the sensitivity analysis, the Project is resilient to key risk factors.

The Subprojects are individually financially viable and are resilient to key risk factors based on the sensitivity analysis.

The political economy and political will with regard to the Project has been assessed by analysing sustainability of funding implications, tariff and affordability for the Government. Also, NNUP contributes towards Government target of 50% RE by 2020, as without sound and reliable network with sufficient capacity it is impossible to provide RE to the population of Tonga.

It was calculated that the Project can reduce the levelised cost of energy (LCOE) supplied by TPL by 5 Seniti/kWh if the Project is financed with non-concessional loan at current TPL's financing costs of 6.3%; and can reduce LCOE by 9 Seniti/kWh if the Project is financed with concessional loans (assuming 80% to 20% of debt to equity ratio). The Government and TPL will get more potential for Tariff decrease in case if

concessional funding with grant elements becomes available. Potential funding sources include ADB, NZ Government, EIB and others.

1.0 Background

1.1 Appointment

SMEC International Pty Ltd has been appointed Consultant on the **TA-8345 REG: Due Diligence of Tonga Nuku'alofa Distribution Network Upgrade Project** (DD NNUP) under a contract dated 24 May 2016 with Asian Development Bank (ADB).

Implementation of the due diligence is being co-ordinated through the Pacific Regional Infrastructure Facility (PRIF); current PRIF Members include:

- Asian Development Bank (ADB)
- Australian Aid, Department of Foreign Affairs and Trade (DFAT)
- European Commission (EC) and the European Investment Bank (EIB)
- Japan International Cooperation Agency (JICA)
- New Zealand Ministry of Foreign Affairs and Trade (NZMFAT)
- World Bank Group (WBG) including International Finance Corporation (IFC).

PRIF is the Executing Agency (EA) of the Due Diligence. Tonga Power Ltd (TPL) is the Project Implementing Agency (IA) and EA of the NNUP project.

The members of the Project Implementation Committee (PIC) include:

Lorena Estigarribia	Project Manager and Technical Assistance Officer, PRIF, Sydney
Katrin Bock	Business Analyst, EIB, Sydney
Martin Garrood	MFAT, Wellington

1.2 Project Team

The members of SMEC Team assigned to the Project are as follows:

Michael Breckon	Energy Specialist/Team Leader
Janybek Omorov	Energy Financial and Economic Specialist
Emmanuel Bate	Environmental Specialist
Rosemary Faletoese	Social Development Specialist

1.3 Due Diligence Report

The Government of Tonga through TPL is seeking financial and technical assistance from PRIF in order to implement the Nuku'alofa Network Upgrade Programme. PRIF is a multi-agency coordination mechanism aimed at improving the delivery of development assistance from donors and development partners to the infrastructure sector in the Pacific region. The New Zealand Ministry of Foreign Affairs and Trade (NZMFAT) and European Investment Bank (EIB), both partners in PRIF, are assisting in this process.

This **Due Diligence Report** sets out the findings of an assessment of the proposed project. This includes a Technical Analysis, Procurement Assessment, Safeguards Assessment and an Economic and Financial Analysis. It also incorporates feedback received from the stakeholders on the draft report first published on 27 July and then updated and reissued on 08 August 2016.

1.4 Terms of Reference

The Terms of Reference (ToR) for the DD NNUP assignment are reproduced in Appendix 1 and include the following key tasks:

- Technical Analysis
- Procurement Assessment
- Safeguards Assessment.
- Economic and Financial Analysis.

1.5 Due Diligence

As indicated briefly in SMEC's proposal, the following confirms the proposed due diligence process to fully address the tasks listed in the ToR (refer Appendix 1) by the SMEC team:

Technical Assessment: TPL's existing and proposed 11 kV and LV distribution network upgrade and extensions for the proposed NNUP will be reviewed for technical appropriateness, features and efficiency characteristics and risks. The proposed scope and designs will be assessed with respect to best international design and practice, particularly with customer service, electrical safety in the home, quality of supply, reliability and the need for reduction in technical and non-technical losses. This includes compatibility with local conditions and local capacity for operation and maintenance. The applicability of AMS (advanced metering systems) including smart meters, distribution system operation, construction, repairs and maintenance will also be assessed. Similarly training requirements and need for transfer of technology to TPL will be considered. The overall objective of this task will be to offer appropriate recommendations to improve the efficiency of Nuku'alofa's power system, to the mutual benefit of both customer and TPL.

Economic and Financial Assessment: This assessment will provide the necessary assurance that the proposed project work will be financially and economically sound - and if not what needs to change! SMEC will work closely with the TPL financial group to carry out an assessment of their financial position, using the ADB guidelines. The proposed project costs and ensuring benefits will be evaluated to determine both economic and financial benefits. Components of this analysis include affordability, sustainability and make-up of possible financing packages. Specific components include: cost benefit analysis (including sensitivity and risk analysis); financial viability and sustainability of the project (including the impact on connection fees and tariffs and associated affordability and willingness-to-pay issues); financing structures combining different shares of grant and credit sources (terms and tenors of DPs financing sources for Tonga will be provided by relevant DPs) and TPL's counterpart financing; possible financing plans including grant and concessional loans as well as other potential sources; minimum amount of grant needed to reach financial closure - combined with other sources; political economy and will in regards to the project by analysing whether the scope and implications for funding and tariff are acceptable to the Government (Ministry of Finance); review and analysis of financial performance and projections of IA and EA (assuming these to be TPL for the NNUP project); measures to improve financial position of IA and EA. Where relevant, the above will be assessed for each of the five project areas as well as the overall project as a whole.

Procurement Assessment: This task will involve the assessment of TPL's existing procurement procedures and policies, and past issues encountered in this process. SMEC will compare current practice with the requirements of ADB's standard ICB (international competitive bidding) procurement requirements as well as EIB's procurement guidelines², review existing types and packaging of procurement; and look at ways to attract more international competition to reduce equipment costs. This review will identify any possible risks and shortfalls in TPL's existing national procurement processes, including their complaints mechanism and practice. Past procurement assessments if available will be reviewed and reconsidered where still relevant.

Implementing Agency Assessment: SMEC will carry out a risk assessment of TPL with respect to its current and future role as network operator, asset management and maintenance, as well as its capability and capacity as project IA (Implementing Agency) and EA (Executing Agency). Risk management plans and mitigation measures will be prepared.

Safeguards Assessment: The two SMEC safeguard experts will work alongside TPL to confirm the environmental and social safeguard aspects of the proposed project, in accordance with the latest version of the applicable ADB and EIB³ guidelines. Compliance with stakeholder policies will be confirmed.

Due Diligence Report: The findings of each of the above assessments will be documented in a **Due Diligence Report**. This will first be issued and presented in a draft version, for review by all stakeholders. Feedback and comments will be requested over a two week timeframe, following which this will be incorporated as soon as possible into a final version. This report can then be made available by TPL to potential donors.

² EIB's procurement guidelines: <http://www.eib.org/infocentre/publications/all/guide-to-procurement.htm>.

³ EIB guidelines: <http://www.eib.org/infocentre/publications/all/environmental-and-social-practices-handbook.htm>.

1.6 Project Working Group

As noted in Section 3 - *Implementation Arrangements* of the ToR, the Government of Tonga is to establish a small working group to assist with facilitating consultations, and general support for the due diligence. This has been already been actioned by MEIDECC who have set up⁴ a 12-member TERM Monitoring Group chaired by the CEO of MEIDECC and comprising various interested parties including TPL and the Electrical Regulatory Commission.

Through this group, TPL have been able to facilitate consultations such as the introductions and discussions held by the SMEC team during the due diligence with the various Ministries.

1.7 Counterpart Team

In addition to the Project Implementation Committee listed in Section 1.1 and the SMEC project team identified in Section 1.2, the following key personnel from TPL and other interested organisations were involved or were contacted during the project:

Tonga Power Ltd (TPL)

Robert Matthews	Chief Executive Officer
Setitaia Chen	General Manager Operations
Murray Sheerim	Power Station Superintendent.
Simon Wilson	Major Projects Manager
Nikolasi Fonua	Strategic Development Manager
Jane Guttenbeil	Communications & Marketing Manager (Power, Water & Waste)
Sosefina Mailleseni	Risk & Compliance Manager
Fekita-'i-muli Mataele	Business Development Analyst
Ian Skelton	Network Investment Manager

Other Interested Parties

Vinoka Hewagé	Project Officer, PRIF, Sydney
Roland M Rajah	Senior Economics Officer, ADB, Sydney
Adam Bruun	EIB, Sydney
Neil Jones	Project Leader, Tonga Village Network Upgrade Project
Johnny Lillis	ADB Representative, Tonga OIREP
Aholotu Palu	Deputy CEO of Aid Management Division, MoFNP
Inoke Finau Vala	TERM-IU Director, MEIDECC
Sione 'Akua'ola	CEO for Public Enterprises, MoPE
Faka'iloatonga Taumoefolau	Development Programme Coordinator, NZ MFAT

1.8 Acknowledgements

The Project Team gratefully acknowledge the excellent co-operation and assistance of Tonga Power Ltd management and officers in providing all necessary project office facilities, project information, and support resources needed for the due diligence.

A glossary of the key background documents applicable to the project is given in Appendix 2.

⁴ MEIDECC letter dated 09 March 2016.

2.0 Proposed Project

2.1 Project Paper

Details of the proposed *Tonga Nuku'alofa Distribution Network Upgrade Project* (NNUP) are summarised in the Project Paper issued by Tonga Power Ltd in July 2014. This 36-page document sets out the background and objectives of the project, which is consistent with the key objectives of the Tonga Energy Road Map 2010-2020 (TERM) - refer Section 2.4. The main objectives of the NNUP include:

- Reduction in network losses
- Reduction in reliance on fossil fuels and reduction in greenhouse gases
- Increased access to energy (including some households (HHs) will regain access)
- Improve reliability and safety of the distribution network.

The Project Paper includes cost estimates, safeguard impacts, risk assessment and implementation arrangements.

The Project Paper stated the following specifics as of July 2014:

- Project to benefit 7,811 households and business in the greater Nuku'alofa area
- Estimated cost NZD 30.057 million, of which NZD 1,816 m to be funded by TPL
- Commencement in March 2015 and completion in September 2019.

2.2 Project Paper Update

During the due diligence, TPL agreed to update the original project paper to incorporate their latest statistics, to reflect actual progress on their on-going projects and to update the cost estimates and details of the proposed works. The overall objectives and scope of the project remain unchanged. This draft due diligence report correlates with the expected update of the Project Paper.

The latest key NNUP particulars in the updated Project Paper include:

- Project to benefit 8,472 households⁵ and business in the greater Nuku'alofa area
- Estimated cost NZD 52.8 million
- Total villages: 56
- Total 11 kV lines: 64 km and 1,944 poles
- Total LV lines: 283 km and 9,701 poles.

2.3 Scope of Work

2.3.1 Background

Urban 'drift' has considerably affected the growth of Greater Nuku'alofa with a population of 25,000 or 6255 households (Census 2011⁶) (34% of the national population). With a similar growth rate to the 2006-2011 Greater Nuku'alofa rate of 5.1 percent (Census 2011), Nuku'alofa would have an estimated 31,375 people in 2016. Furthermore, if the district continues at this high rate there can be an expected population of up to ~50,000 by 2030. Migration to Nuku'alofa from Tonga's outer islands is significant especially as urban growth has not been matched by the provision of, or improvement in the delivery of, urban services. The existing urban infrastructure is already insufficient to meet the demands of the current urban population.

2.3.2 Project Area

The proposed project includes five contiguous subproject areas as listed in Table 2. The areas are shown in Figure 1. The complete list of villages, including the updated lengths of the proposed new/rehabilitated 11 kV lines, included in the project is listed in Table 48 in Appendix 3. A brief description of each area is given in the following pages.

⁵ Includes existing active plus long-term disconnections in the project area.

⁶ Government of Tonga Census of Population and Housing, 2011. Key indicators. Online at: <http://tonga.prism.spc.int/tonga-documents?view=download&fileId=46>

Table 2. Summary of Projects

Area	Name of Subproject	Nº of Villages
1	Kolomotu'a and Kolofo'ou	12
2	Mataki'eua, Tofoa to Fanga	11
3	Fasi, Halaleva to Ma'ufanga	14
4	Anana, Touliki to Popua	11
5	West to Sopo	8
	TOTAL	56

Figure 1. Project Area



Source: TPL

2.3.3 Brief Description of the Project Areas

Area 1 -Kolomotu'a and Kolofo'ou

Area 1 encompasses the central business district (CBD) of Nuku'alofa, the seat of government and residence of the monarchy. The CBD is fringed by moderate density residential land use. Commonly interspersed within the residential area are commercial establishments like grocery stores, restaurants, car rental garage and others.

At its northern edge Area 1 is bound by Vuna Road, the coastal road that runs along the northern coast of Nuku'alofa. A shore protection, boulder dike, separates the beach from the promenade that parallels the road. The boulder dike is now grown with coastal vegetation of trees and scrubs. The Royal Palace is located along the coast of Area 1 which is adjoined by low density development area with residences, restaurants and apartments.

A prominent land mark with wide open spaces in the central part of Area 1 is the Royal Tomb. The main sports venue located in this area is the Teufaiva Sport Stadium. A major commercial site is located within the Area 1 and this is the Talamahu Market which is surrounded by grocery stores and department stores. The Tonga High School and a number of other schools are also spread in Area 1. Government offices are likewise situated in this part of Nuku'alofa. The presence of restaurants, bars and open spaces used as venues for festivities and public gatherings makes the central part of Area 1 a busy area. Vehicular traffic is highest in this area, particularly along Taufa'ahau Road, the major access road to the CBD.

The photos below show the typical conditions in Area 1: top left photo shows the Saturday traffic along Taufa'ahau Road; Top right shows some of the buildings along Taufa'ahau Road; Bottom left shows the residential area at the western fringe of Area 1; Bottom right photo shows the waterfront, Vuna Road.

Photo 1: Typical Conditions in Area 1



Area 2 Mataki'eua, Tofoa to Fanga

Area 2 is predominantly residential with some commercial land uses along Taufa'ahau Road, which is the southern extension of the Nuku'alofa CBD. The residential land use is low to moderately dense in most areas with open areas and cultivated lands mostly present at the southern and western sides. The major health facility located in Area 2 is the Vaiola Hospital. The Mataki 'Eua Urban Water Supply tanks and well field, Nuku'alofa's water source, are also located in this area. Bounding Area 2 to the east is the Fanga'uta and Fangakakau Lagoon marine reserve.

The photos below depict the typical land use and development in Area 2. The top left photo shows part of the commercial area along Taufa'ahau Road, the main thoroughfare through Area 2; top right is the entrance to the Mataki 'Eua Water Supply; bottom left is the typical condition within the low to moderate density residential areas and bottom right is residential area along the shore of the lagoon.

Photo 2: Typical Conditions in Area 2





Area 3 Fasi, Halaleva to Ma'ufanga

Area 3 of NNUP is situated at the peninsula that forms the northern enclosure of the Fanga'uta and Fangakakau Lagoon. Area 3 is bound to the north by the sea and to the south by the Fanga'uta and Fangakakau Lagoon. Development at the waterfront (north side) area includes tourism and recreation consisting of hotels and restaurants. An industrial area is likewise located at the waterfront where the Nukualofa Wharf, is located. Another small industrial zone is located at the southern part of Area 3 where some industries like the Royal Brewery are located. Medium density residential with small commercial establishments and churches are located in the central part of Area 3. Open spaces with brush vegetation mixed with fruit trees and cultivated lands are spread in the southern central part.

The photos below show the development and land uses in Area 3. Top left shows the Siamelei Market along Vuna Road, top right, the Nuku'alofa Port; bottom left part of the residential area and bottom right part of the industrial area at the southern part of Area 3.

Photo 3: Typical Conditions in Area 3





Area 4 ‘Anana, Touliki to Popua

Area 4 on the eastern end of the Nuku’alofa peninsula is bound to the north by the sea, to the south by the lagoon and to the east by the channel that separates Nokunukumotu Island. Popua on the eastern end of the peninsula is a low lying tidal flat with tidal channels and lagoons with patches of mangroves. Parts of the tidal flat in Popua have been filled and now occupied by houses as shown in Error! Reference source not found.. community of informal settlers reside in this part of Area 4. This area is reportedly flood prone, a condition that may aggravate the hazards for occupational and public safety during repair and maintenance works.

The industrial areas in Area 4 include the Total Petroleum depot along Vuna Road and TPL’s Popua diesel and the Maama mai solar facility are also located in the southwestern part of Area 4. The housing of the New Zealand High Commissioner is also located in this area along the eastern side of Vuna Road.

The photos below show the existing condition in selected areas of Area 4. Top left photograph shows the residential area of Ma’ufanga; top right shows a section of the residential area of Popua; bottom left is the Total Petroleum’s depot along Vuna Road; and bottom right photo shows part of the informal settlers’ community in Popua.

Photo 4: Typical Conditions in Area 4



Area 5 West to Sopu

Area 5 occupies the western end of the NNUP project site. It encompasses Hofoa, Puke and Sia'atoutai. The northern section of Area 5 is bound by Vuna Road and the coastline. To the northwest of Area 5 is a mangrove lagoon. The built up land use in Area 5 is mostly residential with small commercial establishments. A larger proportion of Area 5 is open land and agricultural land. It is noted that waste management is a serious concern as piles of refuse are noted along the road side and the lagoon.

The photos below show selected sections of Area 5. Top left photograph shows the lagoon and residences built next to the lagoon in Hofoa; the top right photo shows the unpaved road within the residential area of Hofoa near Hihifo Road; bottom left is a section of Sia'atoutai; bottom right photo is at the junction of Hihifo Road and Alaivahamama'o Bypass Road.

Photo 5: Typical Conditions in Area 5



2.4 Tonga Energy Road Map

The *Tonga Energy Road Map 2010-2020 (TERM)* was published in June 2010 by the TERM Committee. The document is a *ten-year road map to reduce Tonga's vulnerability to oil price shocks and achieve an increase in quality access to modern energy services in an environmentally sustainable manner* and was intended to be a guiding document for GoT (Government of Tonga) actions and development partner support.

Of particular relevance to NNUP is the need to provide better energy security, greater tariff stability, improved affordability and greater accessibility to electricity.

In August 2015, the TERM committee published the *Tonga Energy Road Map (TERM) Review/ Implementation Report 2010-2014*. This Progress Report provided an update on the TERM activities and performance outcomes, the way forward and lessons learned. Results of the three phases pertaining to the power sector were reported as follows:

Table 3. TERM Status (Power Component)

Phase	Activities	Status
0	Institutional Strengthening and the Legal Framework	
	Initial end use efficiency / demand side management (DSM) programme launched and development of data and analysis to design and implement more extensive end use efficiency programme underway	Moderately Progressing
	Off-grid programme launched	Progressing Well
	Necessary TPL investments for safety, data acquisition and improved efficiency launched	Progressing Well
1	Proof of Concept Renewable Energy projects Implementation	
	Implementation of second-generation end-use efficiency DSM measures	Progressing Well
2	Private Sector Participation, Efficiency and Renewable Energy Investments, Institutionalising Renewable Energy Investments	
	A full-scale development of renewable energy projects on an IPP basis	Progress dependent on completion of Phases 0&1 and the policy, objectives proposal for the sector

An assessment of key performance outcomes for the power sector at that time was as follows:

- TERM has achieved 6% renewable energy generation and anticipates accomplishing 50% by the year 2020.
- Access to electricity target of 100% (grid and off-grid) by 2020 is on track with the completion of the ADB, Australia and European Union (EU) funded *Outer Island Renewable Energy Project* and the continuation of the NZMFAT funded *Tonga Village Network Upgrade Project*.
- To complement RE, energy efficiency is important. Work is in progress and TPL are working with potential donors to identify financing sources for upgrading the Nuku'alofa grid (NNUP). The new system will reduce line losses, improve safety and reduce negative environmental impact.
- Affordability is still a major concern. Despite a number of programmes implemented by TERM, the outcome has not met the GoT's expectation in relation to affordable energy - as the price of electricity is still considered to be one of the highest in the region.

3.0 Implementing Agency Assessment

3.1 Background of TPL

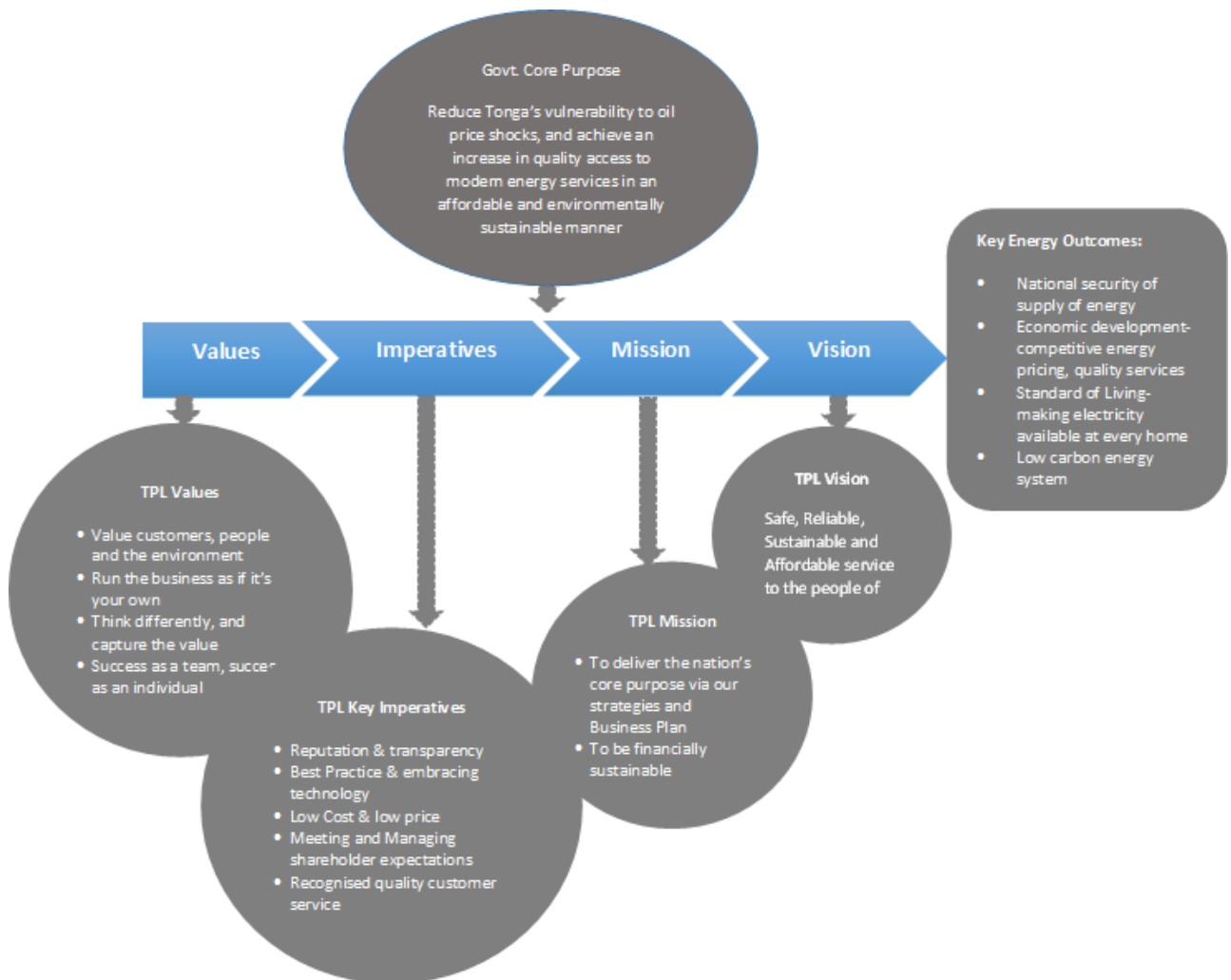
Tonga Power Ltd (TPL) was established in July 2008 as a state owned enterprise under the Ministry of Public Enterprises (MoPE). Its role is to act as the sole generator, distributor and retailer of electricity throughout the Kingdom of Tonga. TPL has its own Company Constitution and has an independent Board of Directors drawn from the commercial sector of Tonga. TPL’s major objectives are to:

- Provide a safe, reliable, affordable and sustainable electricity supply throughout Tonga
- Maximise shareholder value while maintaining prudent levels of exposure to operational and financial risks.

TPL operates under a strict regulatory framework through an Electricity Concession Contract (ECC) in which tariffs, tariff adjustment formulas, operational efficiency benchmarks, consumer service standards and penalties are specified between the Electricity Commission (EC), GoT and TPL. TPL now operates under the Public Enterprises Act 2010 which provides greater commercialisation incentives for state owned corporate entities.

TPL’s core purpose is illustrated in Figure 2.

Figure 2. TPL Core Purpose



Source: TPL Annual Report 2015

3.2 TPL Operations

TPL has its head office in Tongatapu, plus operates networks and regional offices in Vava'u, Ha'apai and 'Eua. The following statistics⁷ for Tongatapu only are as of 31 March 2016:

The Nuku'alofa distribution network was developed in the 1950s. Initially households were provided with one light and one power point as a part of the electrification project (Nuku'alofa respondent 2016). This has expanded considerably and in accordance with growth has required a continual maintenance and upgrade process since. While power poles and lines have been upgraded at different times (refer photos below), the entire system needs an upgrade to enhance greater safety and resilience in line with similar standards to the Village Network Upgrade.

Photo 6: Old and New Network



Poor condition of wiring and power poles in Nuku'alofa



Recently upgraded power poles and lines

3.2.1 Generation

Existing generation capacity is 13.74 MW with a peak demand of 8.4 MW.

Popua Power Station has two 2.67 MW Leroy Somer alternators (first commissioned 2005; second in 2015) coupled with 2.88 MW Cat 6CM32C engines. In addition, there are six 1.4 MW Caterpillar 3516B diesel engines driving 11 kV Kato/Cat alternators (five commissioned 1998; sixth in 1999). This provides sufficient capacity to meet current peak demand, even with one of the diesel units out of service (N-1 reliability⁸).

In addition, there is the *Maama Mai* 1.34 MW solar farm at Popua (commissioned 2012) and the *Mata 'o e La'a* 1.2 MW solar farm at Vaini (commissioned 2015). Both farms incorporate (i) a short-term (60 seconds) energy storage unit to reduce the effects of power fluctuations; and (ii) an automatic micro-grid controller to optimise the output from a mix of renewable energy and diesel generation whilst stabilising the frequency. Since solar output is variable depending on cloud cover and only available during the day, the solar units are not considered as firm capacity and do not fully alleviate the requirement for replacement diesel generation capacity in the medium term. However they do significantly offset diesel generation, with obvious fuel saving.

In addition, TPL have 65 kW of roof-top micro-solar capacity plus 111 kW of third-party micro-solar capacity owned by private customers. A 4 MW wind farm in east Tongatapu is currently also being considered by TPL.

⁷ Source: *TPL Business Plan 2017-2020*, June 2016

⁸ N-1 criterion is the ability of the power system to maintain the same level of supply in the event of one major item of equipment or linkage being removed from service (either scheduled or non-scheduled) without causing an overload or failure elsewhere.

TPL claim that total fuel savings from renewable projects from their inception dates amounts to ~2.8 million litres, which is equivalent to TOP 4.4 million in cost savings- which is passed directly to consumers.

3.2.2 Distribution

The TPL distribution system, based on the British system and similar to New Zealand and Australia, provides a low voltage (LV) 50 Hz supply operating at a three/single phase standard of 415/240 V. This is supplied from TPL's 11 kV system¹ emanating from the generating plants. The 11 kV is the highest voltage level used in Tonga.

In Tongatapu, TPL has 187 km of 11 kV overhead line, 12 km of 11 kV underground cables, and 1 km of 11 kV submarine cable. The overhead 11 kV system design and construction and is based on New Zealand and Australian practice, using *Fly*⁹ and *Weta*¹⁰ standard sized conductors. The 11 kV network is generally radial, however an on-going study is looking at the possibility of an interconnected ring 11 kV system to provide a more versatile and reliable operation.

TPL's standard ratings for 11 kV/LV distribution transformers are 30, 50, 100 and 150 kVA being single pole-mounted; plus 300 and 500 kVA for ground mounted units, particularly in the Nuku'alofa area.

The LV system includes 452 km of single and three phase LV lines. The older LV is flat-mounted 4-wire construction using bare conductors and LV insulators. In keeping with modern international best-practice, all new LV construction uses three-phase ABC (aerial bundled conductor). TPL have one standard size being 4-wire 95 mm² AAC. XLPE insulated, conductor, attached directly to the pole using ABC fittings. The ABC is more economic than the older open wire system and minimises losses (both technical and non-technical) and improves voltage quality. It is not susceptible to outages due to tree interference, especially in poor weather conditions.

Public street lighting connects directly to the ABC and is controlled by individual sensors (and not group switching).

3.2.3 Customers

TPL currently has 12,277 domestic and 3,037 commercial¹¹ customers in Tongatapu.

Overhead service wires into customer premises from the old LV system are mostly twin PVC insulated copper conductor; much of this is in very poor condition. All new services and services from the new ABC system connect to the ABC LV using IPCs (insulation piercing connectors), via pole-mounted service fuse, then a neutral screen copper conductor insulated cable is run underground to a meterbox mounted on the external wall of the customer's house. The cable is buried at a depth of 1.0 m and covered by a plastic warning strip. The meterbox contains a tariff meter, main switch and surge diverter.

TPL has adopted a digital kWh tariff meter with an optical coupling device to enable accurate recording of the usage. This has an extended terminal cover to minimise illegal interference. Under the on-going *Smart & Prepay Metering Project*, TPL has a goal to install, by 31 December 2016, 3,000 single-phase meters to the most disconnected customers and 500 three-phase meters for industrial customers. The single-phase digital meters provide for both pre-pay and post-pay options; the three-phase units are *smart meters* which provide for real-time communications including remote monitoring and customer usage data logging. TPL advise that 500 smart meters have been installed to date.

3.2.4 Tariff

TPL has a one-tariff-for-all customer types across the entire Kingdom and this is based a fuel component and a non-fuel component. The fuel component is based on the cost of diesel as determined by the GoT. The latest tariff¹² with effect from 01 July 2016 is 72.11 seniti/kWh (fuel 77.21 seniti /kWh, non-fuel 44.35 seniti /kWh).

⁹ *Fly* conductor is 7 strand 3.40 mm AAC, 62.75 mm².

¹⁰ *Weta* conductor is 19 strand 3.35 mm AAC, 164.56 mm².

¹¹ Commercial sector includes churches and schools.

¹² The new rate is an increase from the previous 69.99 seniti/kWh which took effect in March 2016. This is directly related to the increase in the regulated price of diesel of 16.04 seniti per litre (or 18.4%) from 87.34 seniti per litre in February to \$1.0338 per litre in June 2016. Source: <http://www.tongapower.to/NewsRoom/>

3.3 2017-2020 Business Plan

TPL's most recent business plan was published on 30 June 2016 and covers the period 2017 to 2021. It includes and addresses the following six key strategic objectives in keeping with TPL's vision:

- i. Achieving 50% electricity generation from RE generation by 2020 in order to achieve the government TERM objective and significant tariff reductions.*
- ii. Adopting technologies to manage the complexities arising from the increasing levels of RE penetration.*
- iii. Improving the network and replacing ageing assets to improve safety and reliability of TPL's services.*
- iv. Cultivating a hazard free safety culture to minimise any electrical hazards to both the public and staff.*
- v. Investing in leading business processes and systems to improve operational efficiency and quality of TPL's services to customers.*
- vi. Managing all external funding and internal financing sources successfully in order to maximise the shareholder value.*

The business plan includes specific strategic measures to address and track these objectives throughout the four year planning period. In order to achieve the future target performance, TPL plans to invest \$252 million on capital projects comprising:

- \$166 million on priority projects essential to achieve 50% RE penetration target in the future
- \$67 million on on-going projects
- \$20 million on committed projects.

3.4 Conclusion

It is clear from TPL's on-going operations that the organisation is well capable of taking on and managing the proposed new NNUP project.

TPL has the necessary resources, experience and technical and commercial resources to ensure a successful outcome, as already demonstrated by TPL's successful implementation of the *Tonga Village Network Upgrade Project* (TVNUP).

4.0 Technical Assessment

4.1 11 kV Network Upgrade

The proposed project in five areas provides for upgrading of 11 kV feeders. This includes new conductor, new 11 kV insulators, pole fittings, connectors, etc. Where there are existing 11 kV feeders, then these poles can be reused in some cases provided the poles are sound (to be assessed at the time of construction). Otherwise new poles will be required.

In some cases where there is a need for two 11 kV feeders, then the second circuit will be underbuilt with the requisite vertical clearance between circuits.

Three phase 11 kV/LV distribution transformers will be pole mounted in one of TPL's standard sizes (refer section 3.2.). Transformers are protected by 11 kV drop-out fuses. On the LV side, each feeder will be protected by HRC fuses.

The key quantities are shown in Table 4. The proposed works follow international good practice and are considered acceptable.

Table 4. Key 11 kV Quantities

Key Item	Quantity
Transformers new	68
Transformers rebuilds	126
Total transformers	194
11 kV poles light	972
11 kV poles heavy	972
Total 11 kV km	64

Source TPL

4.2 LV Network Upgrade

All new LV will be installed as ABC (refer section 3.2.) because of the inherent safety and technical advantages over the open wire system.

The key quantities are shown in Table 5. The proposed works follow international good practice and are considered acceptable. It is expected that the new works will reduce system losses.

Table 5. Key LV Quantities

Key Item	Quantity
Supply under built LV 3 phase	107
Supply LV 3 phase	176
Total LV 3 phase	283
Poles LV 9 m 6 kn	7,179
Poles LV 9 m 12 kn	2,522
Total Poles LV	9,701

Source TPL

4.3 Customer Services Upgrade

Customer services will be laid underground, to replace the existing overhead services which in many cases are in poor condition and often an associated danger to the customer. This will run from a riser down the LV pole in the street to a meterbox mounted in an accessible place on the side of the customer's house. Each meterbox will contain a tariff meter, main switch and surge diverter. Apart from added safety advantage, the underground service will also minimise the risk of damage during cyclones.

Currently TPL standard installation provides a digital tariff meter (without full smart meter features) on all new connections; however a recent pilot project in the Nuku'alofa area has installed a limited quantity of smart meters as a trial. It is recommended that only smart meters be used in future in keeping with modern international practice.

It is also recommended that the main switch be replaced by a RCD¹³ type to provide full safety protection to the power outlets in the house. Fitting of RCDs is mandatory in new domestic installations in New Zealand and Australia.

The key quantities of customer connections (service lines) are shown in Table 6. The proposed works follow international good practice and are considered acceptable. The proposed designs will improve customer safety and reduce non-technical losses.

Table 6. Key Customer Services Quantities

Customer Service Lines	Quantity
Single phase	8,048
Three phase	424
Total	8,472

Source TPL

4.4 Work Programme

The proposed work programme is shown in **Error! Reference source not found.** in **Error! Reference source not found.**. This is based on the following assumptions:

- Project start expected to be in January 2017
- ICB Bidding period will be a minimum of six weeks
- Each ICB package will provide for one contract, with staged delivery over the project duration
- Installation works will start in April 2018, to coincide with (i) the completion of the TVNUP stage 2&3 project; and (ii) first delivery of ICB goods
- Construction will be carried out over five years, utilising the TVNUP construction crews and assuming the same rates of installation.

The expected sequence and start date of the five subprojects is shown in Table 7.

Table 7. Sequence of Subproject Implementation

Sequence	Area	Name of Subproject	Expected Installation	
			Duration (months)	Start Date
1	5	West to Sopa	10	Q2 2018
2	4	Anana, Touliki to Popua	9	Q1 2019
3	3	Fasi, Halaleva to Ma'ufanga	12	Q4 2019
4	2	Mataki'eua, Tofoa to Fanga	13	Q4 2020
5	1	Kolomotu'a and Kolofo'ou	13	Q4 2021

4.5 Risk Assessment

A risk assessment of the project is presented in Table 49 in Appendix 4. This addresses the political, organisational, safeguards and financial risks likely to impact on the project.

Overall, the perceived risks can be mitigated with the overall risk profile considered to be low.

¹³ RCD (residual current device) is a device to protect electricity users from electric shock. The RCD continuously monitors earth leakage and in the event of a person touching a live wire will immediately switch the circuit off, significantly reducing the risk of death or serious injury.

4.6 Results Framework

The results framework is shown in Table 50 in Appendix 6. Key indicators include:

- Improved power supply with less outages and better quality of supply
- Reduction in losses (both technical and non-technical); piggy-backing of customers supplying neighbours eliminated
- Previously disconnected customers reconnected; better access to a reliable supply
- Less damage during cyclones with more resilient network
- Short-term outcomes continue
- Reduced number of non-payment disconnections
- Medium-term outcomes continue
- Improved electrical safety.

5.0 Procurement Assessment

5.1 Existing Procedures and Policies

All procurement by TPL must comply with TPL's *Procurement Policy*¹⁴ under the jurisdiction of TPL Finance Department. The Policy sets out the framework to:

- Maximise efficiency of procurement and distribution
- Standardise procurement processes by providing certainty to employees of their obligations
- Negotiate with suppliers in an open and transparent manner
- Ensure maximum value in the procurement of goods and services.

The *Procurement Policy* defines TPL's requirements for:

- Compliance - monitoring and consequences of non-compliance
- Code of Ethics - including transparency of transactions, declaration of any conflicts of interest, maintaining confidentiality and anti-bribery
- General procedures - documentation requirements, three methods of procurement based on value, authorisations and emergency procurement.

TPL have also published a separate *Motor Vehicle Procurement Policy*¹⁵ covering the procedure for purchase of all mobile plant.

TPL's *Financial Delegated Authorities Policy*¹⁶ sets out the framework of financial delegated authority within which TPL manages and safeguards its financial resources. The policy provides TPL with the necessary authority and discretion to commit Company funds, and the subsequent payment for goods and services purchased in the course of TPL's operations. It defines the differently levels of financial delegated authority based on level of expenditure.

It is noted that the above three policies do not specifically address procurement related to goods being procured under donor-funded projects, whereby procurement must be in accordance with the donor's mandatory procedures.

For example, all ICB (international competitive bidding) under ADB's funding must follow *ADB Procurement Guidelines April 2015*¹⁷ document. The ADB also has standard bidding documents for procurement of goods and works. Similarly, under EIB funding, all procurement must follow their *Guide to Procurement for Projects Financed by the EIB June 2011*¹⁸ document. National donors such as MFAT, JICA, DFAT, etc., especially on multi-lateral funded projects, generally allow procurement to follow the guidelines of the major party.

The *Public Procurement Regulations 2010* published by the Ministry of Finance sets out the arrangements, methods and procedures for procurement to be followed by all Government Departments. As a state owned enterprise coming under MoPE, TPL is run as a private business and not deemed to be part of the government. However in practice, TPL does follow the intent of the *Public Procurement Regulations* as reflected in TPL's *Procurement Policy*. The *Public Procurement Regulations*, state¹⁹ that *Where these Regulations conflict with the **procurement rules of a donor or funding agency**, the application of which are mandatory pursuant to or under an obligation entered into by the Government, **the requirements of those rules shall prevail**, but in all other respects, procurement shall be governed by the provisions of these Regulations*. Based, on this, it is clear that procurement for projects funded by international funding agencies can proceed using the donor's procurement procedures.

Our conclusion is that TPL's procurement procedures are (i) in compliance with GoT statutory requirements; (ii) follow best practice; and (iii) for donor-funded projects, the donor's standard procedures can be followed.

¹⁴ TPL *Procurement Policy*, last reviewed and issued in April 2013.

¹⁵ TPL *Motor Vehicle Procurement Policy*, last reviewed and issued in April 2013.

¹⁶ TPL *Financial Delegated Authorities Policy*, last reviewed and issued in April 2013.

¹⁷ <http://www.adb.org/documents/procurement-guidelines>

¹⁸ http://www.eib.org/attachments/thematic/procurement_en.pdf

¹⁹ Reference *Public Procurement Regulations 2010* Clause 3 (2) - *Scope of the Regulations*.

5.2 TPL Procurement and Facilities

5.2.1 TPL General Procurement and Stores Warehouse

TPL general procurement and stores warehouse is currently contracted out to Transnet Co Ltd, a New Zealand based company with a diverse range of products and specialised in supplying electrical equipment throughout Australasia²⁰. Under an agreement with TPL, TransNet initially set up in 2010 a secure stores warehouse building adjacent to TPL's Line Depot at Small Industries Centre, Ma'ufanga, on the outskirts of Nuku'alofa. In May 2014, a new Supply Agreement was signed between TransNet and TPL for a term of three years, with the provision to further extend another three years by mutual consent.

All MV and LV stock items for TPL's normal day-to-day operations are maintained with agreed minimum stock levels, and are replenished quickly by the regular sea freight service from Auckland and in urgent cases by airfreight. Such items include distribution transformers; 11 kV conductor, insulators and switchgear; ABC conductor; fuses, tariff meters, line hardware and the like. The stores also stock the 11 metre treated wooden poles sourced from NZ and used for 11 kV construction.

The TransNet store is open normal business hours, but also offer an after-hours emergency service. TPL line crews requiring equipment complete a requisition form listing the items and the TransNet storemen then issue the equipment in a timely manner, usually immediately. TPL are then charged for the transactions on a monthly basis. This process of outsourcing the process also has the advantage that TPL does not have to carry the cost of unused assets, nor the cost of running and operating a stores.

Photo 7: Typical Stores Requisition



Photo 8: Distribution Transformers in TransNet Store



The 9 metre treated wooden poles used for LV construction are supplied Tonga Forest Products, which was set up under NZMFAT funding in 2011 to promote locally sourced renewable products, grown on 'Eua Island. A Supply Agreement was signed between Tonga Forest Products and TPL in April 2012, for an initial term of five years, plus provision to extend an additional five years by mutual consent. The scope of supply provides for regular deliveries of treated wooden poles of varying lengths and pole-top strengths.

Our conclusion is that the existing arrangement with TPL stores contracted out to TransNet is an excellent commercial arrangement; overall the process is efficient and appears to work well.

5.2.2 TPL Project Procurement

TPL's procurement for project specific works is carried out by TPL internally and independently of the TransNet arrangement. This process has been followed for both the on-going implementation projects (OIREP - ADB funded; and TVNUP - NZMFAT funded). This procurement has followed the donor's (ADB

²⁰ <http://www.transnet.co.nz/>

and NZMFAT) ICB procedures and the delivered goods are received and stored within TPLs lines depot at Small Industries Centre, Ma'ufanga.

For the TVNUP project, only two packages were procured by ICB bidding. Package 1 - *Conductors* was won by TransNet and included LV ABC conductor and underground neutral-screen service conductors; Package 2 - *Hardware* included all line hardware. Other key items such as 11 kV lines and insulators, distribution transformers, wooden poles, etc. were supplied directly by TPL, as their contribution to the project funding, through their main (TransNet) stores.

When required for installation, the project stock items are uplifted from the stores area by the construction crews. They first verbally request the items; the storeman then manually records the transaction and the recipient signs the form. After installation, an as-built check of the quantities are assessed and correlated against the stores records to ensure there are no discrepancies. Stocktakes of the project materials are carried out at one to two month intervals to identify shortages and initiate repeat orders. Whilst the project stores system is not computerised, TPL confirm that this manual system satisfies their requirements and there have been no issues to date. It is also noted that the project store is in a security monitored compound and there have been no stock losses due to theft.

Photo 9: Project LV ABC Conductor



Photo 10: Project Vehicles



In August 2015, NZMFAT commissioned an *independent Pre-Tender Stage and Post-Tender Stage Probity Assurance* review of TPL's procurement documentation for the TVNUP stage 2&3 project being funded by MFAT.

The Pre-Tender Stage report²¹ concluded that the TVNUP procurement process was sound and satisfied all requirements for conducting good practice procurement. The report included the following main recommendations to improve the procurement process:

- TPL to utilise more of the NZ Ministry of Business, Innovation and Employment templates relating to procurement plan, conflict of interest declarations and the evaluation plan
- Update the TVNUP procurement plan
- Allow for a bidding time of 45 days
- TPL to update the project's risk register with advised mitigation strategy and actions
- TPL to update some evaluation criteria
- Establish a bid evaluation committee with independent chair.

The Post-Tender Stage report²² reported that the TVNUP tender process fully met with NZMFAT's Grant Funding Arrangement, was conducted in a fair and ethical manner, was in accordance with GoT's Procurement Regulations 2010, followed acceptable good procurement practice and was consistent with applicable procurement rules. Although not specifically mentioned in this report, TPL have confirmed that the above recommendations were all implemented.

²¹ McHale Group (Auckland, New Zealand) letter dated 31 August 2015.

²² McHale Group (Auckland, New Zealand) letter dated 11 November 2015.

5.3 Project Management

5.3.1 Project Coordination Committee

Based on the Pre-Tender Stage report recommendation mentioned above, a PCC (project coordination committee) was set up for Stages 2&3 of the TVNUP project. This PCC was responsible for approving all project procurement documentation such as bidding documents, bid evaluation reports and contract documents. Once PCC approval is received, the documents are then signed off by TPL CEO and then submitted for donor no-objection.

The PCC for the TVNUP project comprised a representative each from MoFNP, MoPE, MEIDECC and TPL, plus an auditor representing the donor and an independent chairperson.

5.3.2 Project Management Unit

For the TVNUP project, TPL has established a PMU (project management unit) responsible for the implementation of the project. This includes a project manager/distribution engineer, a procurement officer and a project accountant.

5.3.3 Project Construction Team

For the TVNUP project, TPL has established a project construction team responsible for all 11 kV, LV and customer service construction and installation specifically for the project. They are independent of TPL's line team used for operations and maintenance. The Stage 2&3 unit currently comprises the following team:

- Project leader
- 6 TPL linesman
- 13 trainee linesmen
- 4 students - assigned from the Tonga Institute of Science and Technology for work experience
- 3 planners - responsible for preparing the implementation designs and drawings
- Storeman.

The linesman are all in the process of training for registration as registered linesmen under the NZ Electricity Workers Registration Board (EWRB) requirements.

In addition, about four gangs of contractors, each with about 8 - 10 labourers, are used for digging all the customer services trenches. The use of these gangs has proved more viable than the original practice of using a mechanical digger. These are contracted on a rate per metre of trench dug and then trench reinstatement after the line crew lays the service line.

5.4 Past Issues

In general, project procurement carried out by TPL has been without major incident or issues. The only issue was with the TVNUP Stage 2&3 ICB procurement. Originally it was intended to place repeat orders to the same suppliers of the Stage 1 equipment. However, an objection was received by MFAT as the funding agency and an audit of the TVNUP procurement systems was conducted.

TPL subsequently actioned the recommendations of the audit and there were no further issues.

5.5 Packaging of Procurement

Packaging of proposed equipment into lots or procurement packages needed for project implementation has not yet been advised by TPL. It is anticipated that the lots will be organised to provide staggered deliveries to suit the timing of the implementation programme and at the same time be packaged to encourage maximum participation by potential bidders.

6.0 Environmental Assessment

6.1 Introduction

This environmental impact assessment is undertaken as part of the due diligence (DD) study of the Nuku'alofa Network Upgrade Project in accordance with Safeguard Policies of NZMFAT and EIB as well the national environmental regulations and standards of the Kingdom of Tonga.

This section presents the outcome of the environmental assessment of NNUP. The main source documents for the conduct of the environmental assessment includes the Inception Report (June 2016), the Terms of Reference of the Due Diligence of Tonga Nuku'alofa Network Upgrading Project, the NNUP Project Paper, the environmental assessment reports of the other TPL projects (TVNUP, Grid Upgrade, Outer Islands). The environmental assessment of TVNUP is most useful as it is the model for the implementation of NNUP. According to TPL, valuable experiences gained in the implementation of TVNUP Stage 1 will be applied in NNUP. Additionally, the TPL annual reports published in its website provided insights into the operations of TPL and its commitment to environment, health and safety.

The sources of secondary information for the environmental characterisation of Tongatapu and NNUP project sites are from various references published in the world wide web. The web published references are screened for credibility with only reports authored or published by credible authors and/or organisations are used as references with proper citation.

The ocular inspections of the NNUP area were carried out on 02 July 2016 and on 12 July 2016. The site inspections are carried out with the aid of a tablet based GIS application that allowed recording of geo-referenced field data and photographs.

Courtesy calls to the Ministry of Energy Environment and Department of Environment were done together with the Social Safeguards Specialist.

The environmental assessment report follows the ADB format for initial environmental examination which is deemed appropriate for the purpose of the DD. ADB's environmental and social assessment procedure and safeguards policies are consistent with EIB's and other major international financial institutions. The environmental assessment report is presented in the following format:

- Environmental Summary
- Introduction
- Policy and Legal Frameworks
- Description of the Project
- Description of Existing Environmental Condition
- Environmental Impacts and Mitigation
- Environmental Management Plan
- Public Consultation and Disclosure
- Grievance Redress Mechanism
- Conclusion and Recommendations.

6.2 Environmental Laws and Environmental Safeguards Policies of Potential International Partners

A review of the national laws of the Kingdom of Tonga on environmental protection, environmental management, pollution control, biodiversity conservation and related regulations was carried out. Among the objectives of the review is to determine if NNUP is within the purview of the GoT's environmental impact assessment regulations and if it is, what are the requirements for NNUP to secure environmental approval? The particular focus of the review includes: (1) The procedural requirements for screening, review of EIA reports and permit issuance; (2) The scope and contents of environmental impact assessment reports; (3) The prevailing environmental standards and related government issuances.

Further, in support of TPL's effort to pursue a Development Partner for the implementation of the NNUP, a review of the environmental and social policy and safeguards requirements of selected potential Partners

was undertaken. NNUP was assessed according to the environmental and social safeguards policies of the potential Development Partners to identify the requirements and preparations needed to move NNUP forward to compliance. The potential Development Partners initially identified are New Zealand Foreign Affairs and Trade (NZMFAT) and the European Investment Bank (EIB).

6.2.1 Environmental Laws and Regulations of the Kingdom of Tonga

Environmental Impact Assessment

The environmental impact assessment law of Tonga is established by the Environmental Impact Assessment (EIA) Act of 2003, the EIA Regulation of 2010 and the Environmental Management Act of 2010. These acts and regulation are briefly described in Table 8.

Table 8. EIA Related Laws and Regulation of the Kingdom of Tonga

Title	Brief Description
Environmental Impact Assessment Act 2003	This legislated the application of EIA for planning of development projects within the Kingdom of Tonga. The Act delegated the authority for the EIA to the Minister who in turn may appoint a Director for efficient discharge of the function. Provision for the establishment of environmental assessment committee and designates the members of the Committee. The Act stipulates the application of EIA to Major Projects as defined by the Act.
Environmental Impact Assessment Regulations of 2010	This regulation contains the implementing rules of the EIA Act of 2003. It defines the procedures to be followed for application, review and approval of EIAs. It also distinguishes Minor and Major projects, a list of projects considered major is also provided by this regulation.
Environmental Management Act 2010	Created the Ministry of Environment & Climate Change responsible for managing the environment through the implementation of the environmental regulations which includes approval of EIA applications; the conduct environmental monitoring; engaging the public for sustainable development; lead the GoT's participation and compliance with international agreements and conventions e.g. biodiversity, environment and climate change which GoT is a party to.

As provided by the 2010 EIA Regulation the application for environmental approval starts with the screening of the project using the prescribed form (see Appendix 7). For this purpose, the project proponent needs to submit information required as indicated in the form. If the project is categorised Minor, proponent maybe required to submit additional information. But if classified as a Major project, the proponent will have to conduct the EIA and comply with scope stipulated in the 2010 EIA Regulation. The TVNUP Stage1, the model for NNUP has been classified by the Department of Environment as Minor project (pers com Sete Chen, TPL Operations Manager). Being identical projects, it is anticipated that NNUP will be similarly classified as a Minor Project.

According to the EIA Law, the review of the EIA report is carried out by the Environmental Assessment Committee as constituted by the EIA Act of 2003. Upon completion of the review, the Committee issues an Assessment Review Report that is provided to the proponent and Determining Authority. Based on this report, the Minister then issues a written advice to the proponent of the decision on the application.

The EIA Law includes a provision stating that development proposal submitted with an impact assessment completed under the law of a foreign country may be considered as compliance with the requirements of this Act.

The EIA Regulation of 2010 imposes a processing fee for application for environmental approval of Major projects. The fee consists of (Tongan Pang'an) TOP\$ 10.00 application fee, a TOP\$ 250.00 initial application fee and a final fee of 1% of the capital cost of the proposed activity/development. If final fee is more than \$10,000 the proponent may apply for the reduction of fees, proponent however will have to shoulder the cost of such special meeting to consider the application.

Environmental Standards

Currently, Tonga has no legislated environmental standards, i.e. ambient air quality standards, pollution / emission standards, noise standards, water quality standards. The recently prepared environmental impact assessment report for a major infrastructure project (Ministry of Infrastructures, 2015) adopted international environmental quality standards (e.g. New Zealand, Japan) to evaluate environmental quality data (i.e. water quality and air quality) obtained from the project site.

Biodiversity Conservation

The Parks and Reserves Act of 1976 of the Kingdom of Tonga established a Parks and Reserves Authority with members appointed by the Privy Council. Under the Act the Authority, with consent of Privy Council has the power to declare or cancel any area of land or sea as a park or reserve and draws up regulations to protect, preserve and maintain the natural, historical, scientific or other valuable features of any park or reserve²³.

The Birds and Fish Preservation Act of 1974 sets the limit and prohibits the catching or injuring of certain species of fish, birds and turtles. The Act also establishes the legal authority for the enforcement of the Act. Penalties for violation includes fine and imprisonment and confiscation of equipment used for capture. Declared protected areas under this Act are the two major lagoons of Tongatapu, Fanga'uta and Fanga Kakau. The list of birds and marine species protected under this Act is enclosed in B.²⁴

Protection of Cultural Heritage

The protection of physical cultural / archaeological items is enforced by the Preservation of Objects of Archaeological Interest Act No 15 of 1969, revised in 1988. The Act establishes a permitting procedure for the search and removal of archaeological items and stipulates a procedure for reporting discoveries, with or without permit. The discovery should be reported without undue delay, indicating the precise site and the circumstances of the discovery, to the Committee.

Waste and Hazardous Waste Management

Waste Management Act 2005 provides for the collection, disposal and management of all wastes in the Kingdom of Tonga. The act designates the Ministry of Health as the Authority for wastes for all areas of Tonga except, Tongatapu which is under jurisdiction of another authority. The Act defines the waste management areas, the roles and responsibilities of the authority and Minister and sets the fees for waste management services.

Hazardous Wastes and Chemicals Act 2010 provides for the regulation and proper management of hazardous wastes and chemicals in Tonga 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.

International Conventions / Agreements

The Kingdom of Tonga is party to a number of environment related international agreements such as the UN Convention for Biological Diversity, Convention on Migratory Species, UN Convention to Combat Desertification, UN Framework Convention for Climate Change, the Kyoto Protocol, Montreal Protocol, Cartagena Protocol on Biosafety.

6.2.2 NZMFAT

For social and environmental safeguards, NZMFAT has adopted operational policies for Climate Change (CC-OP) and Environmental and Social Impacts (ESI OP). This is accompanied by an environmental and social impacts guideline for NZMFAT staff to follow to ensure compliance with environmental and social safeguards requirements. The consideration of environment and social impacts is integrated within the New Zealand Aid Programme's entire cycle inclusive of Activity identification, Activity design, implementation and completion.

²³ <https://www.cbd.int/doc/world/to/to-nr-pa-en.pdf>

²⁴ IUCN Directory of Protected Areas in Oceania

The NZMFAT environmental and social impacts guideline contains an Activity classification framework that describes the Activity categories and the corresponding requirement for impact assessment and impact management (The Activity's category is determined through the use of a screening checklist that poses a series of questions under each of the risks to be avoided as outlined in the key principles of the ESI-OP. The questions are designed to help identify potential impacts of risks. A list of examples of Activities and their likely classification under the ESI-OP Classification Framework is enclosed in Appendix 7, Section C.

The categorisation of NNUP using the NZMFAT screening checklist was undertaken and the outcome of the completed checklist (see D) indicated that it is Category B. The basis for the B category is that certain activities that will be undertaken during the upgrade works will have the potential to generate nuisance noise and vibration. This is anticipated to be due to operation of equipment like bucket trucks, pole diggers, etc. Additionally, since it will be implemented by TPL, its category is Category B (P) and supplementary work may be required for compliance.

Table 9). According to the classification framework, Activities are classified according to significance of impacts into Category A, B and C. Note that NZMFAT distinguishes between Activities it implements and those implemented by partners. For Category P, impacts assessment impacts management of Partner will be reviewed and supplementary work may be requested to ensure conformity with the Policy (NZMFAT, 2015).

The Activity's category is determined through the use of a screening checklist that poses a series of questions under each of the risks to be avoided as outlined in the key principles of the ESI-OP. The questions are designed to help identify potential impacts of risks. A list of examples of Activities and their likely classification under the ESI-OP Classification Framework is enclosed in Appendix 7, Section C.

The categorisation of NNUP using the NZMFAT screening checklist was undertaken and the outcome of the completed checklist (see D) indicated that it is Category B. The basis for the B category is that certain activities that will be undertaken during the upgrade works will have the potential to generate nuisance noise and vibration. This is anticipated to be due to operation of equipment like bucket trucks, pole diggers, etc. Additionally, since it will be implemented by TPL, its category is Category B (P) and supplementary work may be required for compliance.

Table 9. NZMFAT Categorisation of Activities According to Environment and Social Impacts

Category ¹	Degree of impact by Activity	Assessment required ^{2,3}
A or P(A)	Significant adverse impacts that are irreversible or unprecedented, and which extend beyond the physical footprint of the Activity	Comprehensive impact assessment and impact management plan
B or P(B)	Site-specific adverse impacts that may be prevented or mitigated	Impact assessment and impact management plan covering adverse impacts only
C	Minimal or no adverse impacts	None – no further action needed

As a Category B, the NNUP will require the preparation of an impact assessment report according to the prescribed scope of the NZMFAT guideline (See Appendix 7, Section E).

6.2.3 European Investment Bank

The European Investment Bank (EIB) as an EU financial institution imbibes the policy objectives of the European Union and its principles of sustainable development, public participation and accountability. The EIB subscribes to the EU environmental law as the primary source of its environmental policy. As part of its environmental and social statement, the EIB has adopted a set of standards consisting of 10 thematic areas that are anchored on EU policies, directives and recognised international best practices. These standards are:

Environmental Standards

- Assessment and management of environmental and social impacts and risks;
- Pollution prevention and abatement;
- Biodiversity and ecosystems
- Climate change related standards

Social Standards

- Cultural heritage
- Involuntary Resettlement
- Rights and interest of vulnerable groups
- Labour standards
- Occupational and public health, safety and security
- Stakeholder engagement.

The EIB Environmental and Social Statement requires that all projects/operations, irrespective of location, comply with the process and content consistent with the requirements of the EU EIA Directive. In compliance with the Directive, EIB Projects are required to undergo an appropriate Bank environmental assessment (EA), based on information provided by the promoter and other stakeholders. Regardless of the need for a formal EIA, this assessment is carried out by the Bank itself, or by an intermediary according to the requirements of the Bank.

Under the EU-EIA Directive, projects are categorised according to the need for ESIA as listed in Table 10.

Table 10. Category of Projects According to the Need for ESIA

Category	Comments
Full E(S)IA	Annex I projects
Full E(S)IA	Annex II projects screened in (i.e. E(S)IA required)
E(S)A	Annex II screened out (i.e. E(S)IA not required)
E(S)A	All other projects

Inspection of Annex II of the EU Directive shows that NNUP belongs to Energy Industry, installation of Overhead Cables. But as a rehabilitation project with very minimal risk, it belongs to the Annex II projects that will not require full ESIA.

The NNUP was screened using EIB's environment and social checklist that is applied during pre-appraisal stage of investment loans and result showed that NNUP has low levels of risk and qualifies as a B Category Project according to the following categorisation in Table 11. The accomplished checklist for NNUP is enclosed in Appendix 7, Section F. The NNUP in fact according to EIB's lists of projects eligible for financing belongs to EIB's high priority areas for environment being a project aimed at energy efficiency.

Table 11. EIB Categorisation of Projects According to Risk

Categorisation	Definition
A	Minimal or no adverse impacts- Low Risk
B	Environmental and social impacts can be readily identified and mitigation and/or remedial measures can be put in place – Medium Risk
C	There may be highly significant, adverse and/or long-term environmental and social impacts, the magnitude of which is difficult to determine at the screening stage- High Risk
D	No acceptable in EIB terms

The details of EIB's environmental and social standards and procedures are contained in the EIB Environmental and Social Handbook (EIB, December 2013).

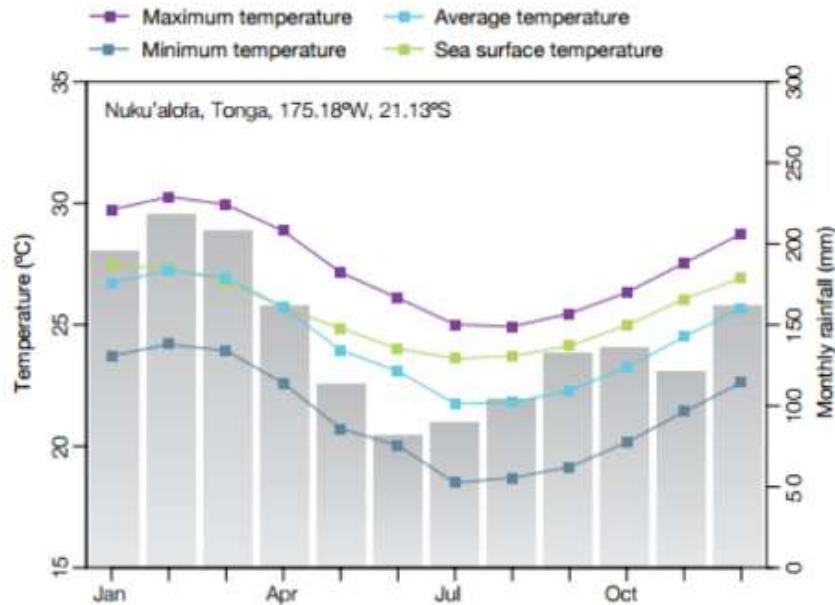
6.3 Existing Environmental Condition of the NNUP Project Area

6.3.1 Climate and Air Quality

Nuku'alofa has a sub-tropical climate and PCCSP (2011) describes the current climate as having two distinct seasons, the warm wet season from November to April and a cooler dry season from May to October (Figure

1). Almost two thirds of the annual rainfall come during the wet season. The seasonal temperature and rainfall variation based on observations made in Nuku'alofa is shown in the graph in Figure 3.

Figure 3. Seasonal Rainfall and Temperature at Nuku'alofa (after PCCSP, 2011)



According to PCCSP (2011), Tonga is affected by tropical cyclones between November and April and that between 1969 and 2010, 71 tropical cyclones passed within 400 km of Nuku'alofa cyclones occurring more frequently during the El Niño years.

PCCSP (2011) reported that the annual and seasonal maximum and minimum temperatures have increased in Nuku'alofa since 1950 and is predicted to continue to increase in the future accompanied by more intense rainfall days and lesser frequency of tropical cyclones but with increased intensity. Maximum temperatures have increased at a rate of 0.10 °C per decade. These temperature increases are consistent with the global pattern of warming.

No air quality data is currently available for Nuku'alofa, but it is presumed to be relatively good due to very limited source of emissions. But dust could be a concern during dry season due to presence of bare areas and unpaved roads.

6.3.2 Geology and Topography

The NNUP will be implemented in Tongatapu Island, the major island of the Kingdom of Tonga. Tongatapu is a low lying coralline island with flat to undulating terrain. The elevation of Nuku'alofa ranges from 3 m to 12 m asl (based on Google Earth imagery) with a total land area of 260 km². The highest elevation within the NNUP area is in Kohua where elevation reaches 21 m asl. The island is highly irregular in outline with a lagoon (Fanga 'uta and Fanga Kukua Lagoon) situated in the middle. The geology of the island is made up of uplifted coralline limestone. The island has no rivers and its water resource consist of only shallow fresh water lenses.

6.3.3 Ecological Setting

The island is under extensive cultivation to support the large population of the island, and very little remains of the native vegetation (Whistler 2011). The vegetation present in the project areas consist of a mixture of natural vegetation including beach vegetation and introduced ornamental and fruit bearing plants. The most ubiquitous natural beach vegetation is the Casuarina sp. trees lining the beach and the roadsides. Hibiscus tiliaceus (Beach Hibiscus, locally known as fau), a flowering tree, is also common and very noticeable because of its attractive flower. Other coastal vegetation includes Barringtonia asiatica, Terminalia catappa, Tournefortia argentea, Morinda citrifolia among others. Mangrove and mangrove associated vegetation are likewise present along the coast in the lagoon and tidal flats at the western and eastern fringes of the NNUP area. Fruit bearing trees including mango, breadfruit and some citrus as well as banana plants and coconuts

are also present around the settlements together with ornamentals. Cultivated lands within NNUP area are mostly planted to root crops.

6.3.4 Bio-diversity Conservation

Figure 4. Protected Areas around Nuku'alofa



Protected Areas

Tonga's protected area network consists of national parks, terrestrial and marine parks & reserves and sanctuary and special management areas declared under the Parks and Reserves Act of 1976, the Birds and Fish Preservation Act of 1974 and the Fisheries Management (Conservation) Regulations of 2008. Figure 4 shows the location of the protected areas in the general area of the project site. The marine protected area closest to the project area is the Fanga 'uta and Fangakakau Marine Reserve. Offshore towards the north are a number of reef reserves and reef sanctuary. There is no protected area within the project site.

Endangered Wildlife Flora and Fauna

According to WWF (<http://www.worldwildlife.org/ecoregions/oc0114>) Tonga currently supports two species of endangered endemic bird species, the Tongan whistler (*Pachycephala jacquiniti*) in the Vava'u Group and the Niufo'ou megapode (*Megapodius pritchardii*) which is restricted to the island of Niufo'ou.

The only listed endangered mammal in Tonga is the Pacific sheath tailed bat, the population of which has serious declined since 1945 for unknown reasons. It is said to be historically present in Samoa, American Samoa, Tonga Fiji, Palau, Northern Marianas and Guam. It was last sighted in 1989 in 'Eua and Niufo'ou Island.

The herpetofauna of Tonga, consisting of 20 known species, is considered depauperate and there is one listed endangered species, an iguanid. The iguanid, the South Pacific banded iguana (*Brachylophus fasciatus*), is also found in Fiji and is believed to have rafted from the Americas (Allison 1996).

Marine turtles are known to be present in Tonga. Green turtles are reported to nest in low levels on several islands in the Ha`apai Group as well as islands in the Vava`u Group. According to turtle hunters about 10 to 20 green turtle nests annually (Maison, et. al. 2010). In Tonga, Hawksbills are the only sea turtle species fully protected by Tongan legislation and harvest of other turtle species is permitted seasonally.

Whistler's (2011) study of rare plants of Tonga identified 30 flowering plant species that are recommended for inclusion in the IUCN Red List. Six (6) of these 30 plants are Tongan endemic, of the 6, 2 have been collected in Tongatapu Island. However, known habitat of one is cliffs where it is well exposed to sunlight and the other is now limited to cultivation. Tongan indigenous non-orchids species recommended for listing

in IUCN Red List are 19 species, of which 7 have records of collection from Tongatapu Island, specifically from the west and southern coast.

Based on the known habitats and the reported location of sightings, it is unlikely that these endangered species are present in the project site.

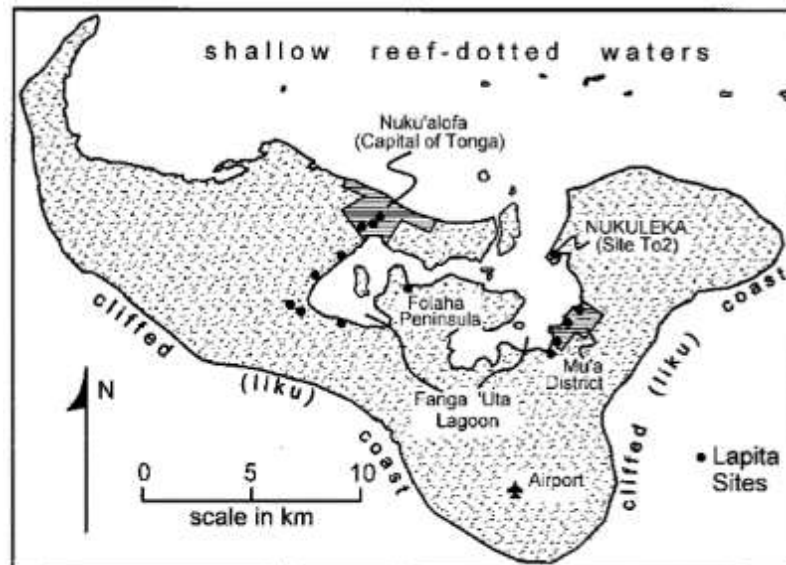
6.3.5 Land Use

NNUP will cover Nuku'alofa, the capital of Tonga and fringing villages. The capital is located at the northern part of the Tongatapu Island and is the seat of government, the residence of the Monarchy and commercial capital of the country. The general land use is built-up interspersed by open lands and cultivations. The development ranges from dense commercial area mixed with institutional land uses and low to moderate density residential.

6.3.6 Physical Cultural Resources

Archaeological diggings around the Fanga'uta Lagoon have revealed several sites of possible very early Lapita settlements in Tongatapu dating back to around. 2820+ 90 B.P to 870 +90 B.C.E. (Burley and Dickenson, 2001). The locations of the diggings are shown in Figure 5.

Figure 5. Lapita excavation sites around Fanga'uta Lagoon (Burley and Dickenson, 2001)



Additionally, there are other culturally significant sites in Tongatapu which includes the Ha'amonga 'a Mau'i Historic Park at Heketā near Niutoua and the Ancient Royal Tombs at Lapaha in the village of Mu'a. Both have been submitted to the UNESCO World Heritage Commission for inscription as World Heritage Sites.

6.4 Assessment and Prediction of Environmental Impacts of NNUP and Mitigations

6.4.1 Impacts Characterisation

The implementation of NNUP will generate significant cumulative socio-economic impacts. The upgrade will result to improved electric power service to Nuku'alofa, improved public safety and improved occupational safety, reduction of consumption of diesel fuel and reduction of systems loss and the reduction in consumption of diesel fuel will result to reduction in GHG emission.

There are a number of inherent factors that diminish the adverse impacts of the activities of NNUP. Among these are: (1) NNUP is an upgrading project and the works will be confined to existing power grid; (2) work is confined within a limited space along the alignment of the distribution line; (3) work is generally of limited scale that will use a limited number of equipment and limited number of workers; (4) works will have short duration; and (5) the project area is a mixture of open, residential and commercial land uses (low ecological sensitivity). The direct negative impacts of NNUP's implementation are predictable and anticipated to be

short term and temporary (i.e. expected to prevail only during the period of the works); directly affected areas will have very minimal footprint; the impacts are reversible and can be mitigated; and no residual impacts are anticipated.

Based on the review of the works that will be undertaken, the relatively significant adverse impacts of NNUP implementation are noise, temporary interruption of power supply, public safety and occupational hazards and traffic. The trimming of vegetation has been cited as a concern in the other TPL projects, but the impact is assessed to be more of a social and public relations issue rather than ecological or environmental.

6.4.2 Construction and Installation Phase

Photo 11: Typical Work on the Distribution Lines



The works that will be carried out during the implementation of the NNUP will be confined within existing power lines. This includes removal and replacement of LV and MV conductors, removal of old poles and

planting of new poles, trenching for underground service cables, trimming of vegetation, among others. The photographs above depict TPL service crews carrying out similar work to that proposed on the NNUP project.

6.4.3 Impacts on Physical Environment

Air quality

The impacts on air quality is predicted to be minimal since only a limited number of equipment will be used and these are all mobile equipment and will operate intermittently. The good practice of keeping equipment well maintained and regularly serviced and operating the equipment within manufacturer's specification should help control the emission levels. The practice of avoiding idling and shutting down equipment when not in use are mitigation measures that should be adopted.

Noise and Vibration

Nuisance noise is anticipated to be generated during the implementation of NNUP's works. But the impact is expected to be minimal due to the limited type of equipment that will be used, the relatively short duration of the works in each site and the generally moderate to sparse nature of development within most of the NNUP area. Additionally, all the areas are commonly vegetated, a characteristic that helps attenuate noise. Nuisance noise maybe a concern around hospitals or schools. The Vaiola Hospital may not be prone due to the sprawling ground and the distance of hospital building from the road and the distribution line location.

Equipment should be fitted with noise mufflers and again, equipment maintenance and servicing according to manufacturer's specification should be implemented to control noise. TPL vehicles and machineries are scheduled for service every three months to ensure ongoing reliability and compliance with international best practice.

Timing of works to prevent disturbance is another mitigation measure that can be implemented. Additionally, providing advance information to residents on work schedule site will also be helpful so they can make the necessary preparation and adjustment.

Impacts on Soil and Geology

The excavations for pole planting and service line trenches will be shallow and will have very small footprints and hence no or very minimal impacts are anticipated for soil and geology (i.e. geologic processes like erosion and siltation). As part of good practice, trenches should be covered immediately and work site tidied up.

Soil contamination due to leakage of oil and lubricants from the equipment may occur but this is anticipated to be minimal. TPL vehicles and machineries are scheduled for service every three (3) months to ensure ongoing reliability and compliance with international best practice. This service includes an inspection and replacement of all worn parts (hoses, filters, seals, etc.) that may lead to oil leak or spill. Any spill that will occur will be immediately cleaned by the work crew.

Impacts on Hydrology

No impacts are anticipated on water resources and hydrology. Earthworks for trenches and pole planting will have very small footprint and will not affect hydrologic processes (i.e. run-off, percolation, evapotranspiration, etc.).

6.4.4 Impacts on Biological Environment

Plants and Animals

As identified in other TPL projects, tree pruning is the only identified impact on vegetation associated with upgrade and maintenance of distribution lines. Nuku'alofa, although built up, is still lush with vegetation which adds to its natural ambience and aesthetics and lends a sense of ecological well-being. It is thus inevitable that overhead electric lines compete for space with plants and trees along the power line corridors. The pruning of vegetation around electric lines are for public safety and to protect power lines from damage to avoid power supply shut down. For this purpose, TPL subscribe to the "*Maintenance of Trees Around*

Powerlines, 1996²⁵ published by the Occupational Safety and Health Service Department of Labour Wellington New Zealand. For clearance around overhead lines, TPL has set the following limits²⁶:

Table 12. Vegetation clearance for overhead line

Overhead Line	Growth Limit
11 kV - Medium Voltage	2.0 m
400 /230 V - Low Voltage	1.0 m

TPL recognises that cutting of trees within private lands requires negotiation with land owner and corresponding compensation if necessary.

Impacts on Protected Areas and Protected Species

The NNUP works will neither affect protected areas or protected species of wild plants or animals since the NNUP project area is built-up and that works will be confined within existing distribution lines. A short section of Taufa'ahau Road (Area 2) runs close to the shoreline of Fanga'uta and Fangakakau Lagoon Marine Reserve with the TPL power line passing over the road reserve as shown in the photos below. Any work that will be done along this section will be confined within the road reserve and is not expected to encroach into the shoreline of the lagoon.

Photo 12: Distribution line closest to the shoreline of Fanga'uta and Fangakakau Lagoon Marine Sanctuary



Impacts on Forest Resources (Off-site)

The requirement for poles by NNUP will have impacts on forest resources. NNUP will procure 1,889 pcs of HV poles (11 m and 13 m poles) and 6,343 pcs of 9 m poles (LV poles). The 9 m poles will be sourced from

²⁵ <http://www.tongapower.to/OurBusiness/NetworkBusinessUnit/NetworkServices.aspx>

²⁶ <http://www.tongapower.to/OurBusiness/SafetyandAwareness/SafetyTips/TreesonPowerlines.aspx>

Tonga Forest Products Ltd which operates the 'Eua Forest Estate. The Estate consists of a total area of 719 ha of which 500 ha is production forest (Landcare Research, 2010). It is reported that the 'Eua Forest Estate has a potential sustained yield of 5000 cu m per year, but production has been considerably low because of operational constraints (Halatuituia, 2011). Based on this potential sustainable yield, the NNUP requirement for 9 m poles within a period of 4 or 5 years is well within Tonga Forest Products production capability. Provided the Estate is under proper production forest management, no adverse impact is anticipated.

The other possible impact due to importation of poles is introduction of timber pest, but the risk of timber pest associated with imported poles is deemed to be low due to the quarantine requirement. All poles will be treated to a Class H5 hazard level with Copper-Chrome-Arsenate (CCA) as per AS/NZS4676:2000 and NZS3640:2003 standards. Poles will be visually inspected as part of quality assurance procedure. Additionally, pole suppliers shall be required to submit testing reports and proof of certification are to be provided to TPL and shall include among others:

- Timber Species and Source
- Timber Grade
- Peeling & Seasoning
- Physical preparation
- Preservative Treatment
- Branding & Ground Line Depth Marking
- Size & Strength
- Proof Testing.

6.4.5 Impacts on Culture and Socio Economics

Impacts on Employment

The direct positive impact of the implementation of NNUP will be generation of employment, albeit temporary and of limited scale. NNUP implementation will require the hiring and training of field crew members. In addition, NNUP is also expected to generate some business for sub-contractors as TPL will need to engage their services during the implementation of NNUP.

Impacts on Supply of Electricity - Interruption of Electric Power Supply

The NNUP works will require shutting down of electric supply in work sites. Most sensitive to power outages are hospitals i.e. Vaiola Hospital and the water supply facility (Area 2). But these facilities are equipped with emergency power generating sets and have double line connections which allows them to switch electric supply between two lines.

The consumers without emergency power sources will have to bear these interruptions, these includes residences, commercial establishments, schools and other institutions. The power interruption will affect the activities of these consumers and may even cause disruption of activities. Power interruption will also have an impact on public safety if work is done at night and power supply is cut-off, consequently shutting down the streetlights.

Mitigation measures for power supply interruption should include scheduling of power interruptions and the public announcement of the schedule. This way, the consumers will be able to prepare and take the necessary steps to cope with the interruption. TPL has currently a system in place for announcing scheduled power outages through the different media, including a post in its website.

Unplanned power outages may also occur during the works and this can have adverse impacts on the consumers. TPL will need to quickly respond to such contingencies without compromising health and safety of the field crew.

Impacts on Occupational Health and Safety

The works of NNUP will expose TPL work crew to occupational hazards, which according to IFC Guidelines includes:

- Live power lines
- Working at height
- Electric and magnetic fields
- Exposure to chemicals.

In addition to these, OSHA identified challenging weather conditions as among the occupational hazards of electrical linemen.

Occupational health, safety and environment remains to be among the primary focus of TPL management. First aid refresher courses for TPL crews are conducted; monthly health and safety meetings are carried out to discuss incidents, near misses and hazardous events and their mitigation controls. TPL distribution staff who are exposed to the danger and hazards in the field continually conduct toolbox meetings prior to work commencement. TPL continue to upskill staff through relevant training programs on HSE with the continuous aim of improving its approach to safe working practices (TPL, 2015)²⁷. TPL likewise conduct safety audits on a regular basis and outcomes of the health and safety programs are monitored and reported to the board and stockholders through the annual report.

Impacts on Public Convenience and Traffic Safety

Powerlines are installed along road reserves and during the NNUP works, trucks and equipment will be stationed along the roadsides. In which case, a lane will need to be closed to vehicular traffic and the sidewalk closed to pedestrians during overhead works. Closure of one lane in a two lane road, such as those found in Nuku'alofa can cause traffic slow-down and in worse case cause traffic build-up and traffic jam. This impact may occur in Tafua'ahau' Road and other busy roads of Nuku'alofa during peak hours.

Traffic management is essential to mitigate this impact. The public should be informed ahead of time of the schedule of works along busy thoroughfares. Announcements should be made over the radio and TV and signs posted at the work site to notify the public. Separation of the TPL equipment and service vehicles from the vehicular traffic should be done through the use of barriers and safety cones. Fencing of work site should also be done to keep the pedestrian from walking underneath power lines being worked on. In very busy sites, traffic and safety personnel should be posted to control and direct vehicles and pedestrians. If necessary TPL should coordinate with the Police for assistance.

Impacts on public safety

Special concern areas are around schools and other places where groups of people congregate like market, bus stations. Work sites should be demarcated and "*Danger Live Line and Lineman*" sign are to be installed including hazard cones clearly identifying the work site including the areas where and stringing of overhead cables or laying of underground cables is in progress.

Impacts on Physical Cultural Resources - Chance Find

Considering that the works will be carried out in existing distribution lines, the possibility of encountering buried items or structures of archaeological or historical importance is very slim. But nevertheless, the work crew should be aware of the procedure for dealing with chance find. In such eventuality, work should be stopped and the site secured. TPL Project Manager should be notified immediately of the find and in turn report the find to the Ministry of Culture. Work should remain suspended and shall only resume with notice from the Authority.

Impacts on Waste Management

a. Pruning of vegetation

An associated impact of vegetation trimming along the powerline is generation of vegetation cuttings (green waste). The woody parts maybe recovered by the tree owner for use as wood fuel while the rest of the vegetation wastes are to be composted.

b. Replacement of old poles and wirings

The upgrade will require the removal of existing concrete poles and stick poles. The concrete poles will be donated to local Tongan companies and communities within the allocated villages or others who may have use for the concrete poles such as fence line post, structural foundation or support for a temporary roofing shelter. Prior to giving out, the project will ensure the concrete poles are fit and safe for the intended use.

²⁷ Tonga Power Ltd. 2015. Tonga Power Annual Report 2014-2015.

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.

Wires and cables that are unsalvageable are high value scrap materials and shall be shipped out to New Zealand where they can be reprocessed and recycled.

Impacts on Pollution

One possible source of pollution at work site or TPL premises due to electric power distribution project is the treatment of the wooden poles. This impact is not anticipated for NNUP since the project will only procure treated poles. As part of responsible procurement practice, TPL will require declaration from supplier that its treatment plant or process is compliant with environmental regulations and best practices.

6.4.6 Operations and Maintenance Impacts

Impacts on Waste Disposal

Among the sources of negative impacts during operations and maintenance is vegetation pruning. The impact will be generation of organic wastes. This impact can easily be mitigated through collection and composting of the cuttings. Preferably, vegetation wastes are composted rather than disposed in the landfill to prolong service life of the landfill facility.

Impacts from Protection of Poles from Fires (Burning of Tax Allotment)

Wooden poles are susceptible to fire hazards caused by burning of tax allotment lands. To protect the wooden poles, TPL clears vegetation within the one-meter diameter area around the posts. This is efficiently done by applying weed killers. Because of the limited application, the impact to the surrounding area is considered to be minimal. Persons applying the weed killers should wear appropriate protection and observe proper way of handling the weed killers. Use and storage of weed killers / herbicide should conform with standard procedures for hazardous materials.

Impacts from Leaching of chemicals used for Pole treatment

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

Socio-economic Impacts

The completion of NNUP will mean the realisation of its objectives. At household levels, the reliable electric supply will have significant positive socio-cultural and economic impacts. The impact will be more profound to those who are newly connected to the grid. The stable electric power supply will induce change in lifestyle as consumers are able to enjoy the amenities of modern living (e.g. use of electric appliances, home entertainment). Enhanced public safety is anticipated as well with the availability of street lighting. Connection of homes to power supply will contribute to education with students being able to study at night and have access to computer and information. Improved quality of electric supply also translates to savings to consumers. Stable electric power supply is one of the key factors in prolonged service life of electric appliances. Another beneficial impact at household level includes reduction of indoor pollution for those that will shift from gas or wooden fuel to electric stoves.

Impacts on Public and Occupation Health and Safety

The public and occupational health and safety impacts of power transmission and distribution are well recognised and TPL has existing H&S programme as part of its operations. The use of ABC to replace the LV line, replacement of poles, putting the service connections underground, among others, will enhance public and occupational safety.

6.4.7 Residual Impacts

As far as can be determined, based on currently available information, no residual impacts are anticipated due to the implementation of NNUP.

6.5 Environmental Management Plan

6.5.1 Environmental Management Monitoring Plan

The environmental management monitoring (EMMoP) plan is presented in a matrix in Table 14; this summarises the impacts, mitigation measures, monitoring requirement and responsibilities.

6.5.2 Implementation Arrangements and Responsibilities

The responsibilities for implementing the NNUP EMP shall be shared among key stakeholders and these are enumerated in Table 13.

Table 13. Responsibilities in EMP Implementation

Organisation	Responsibilities
PCC	<ul style="list-style-type: none"> Oversee the overall implementation of NNUP including environmental management; Responsible for submitting report to the DP
TPL	<ul style="list-style-type: none"> TPL is implementing and executing agency; responsible for detailed design and Implementation of NNUP; Responsible for preparing and implementing the EMP Responsible for reporting EMP Compliance
Project Manager	<ul style="list-style-type: none"> Manage overall EMP compliance Responsible for reporting to PCC
NNUP Environment and Social Safeguards Specialist (ESSS)	<ul style="list-style-type: none"> Monitor and assess the implementation of the mitigation measures and monitoring as proposed in the EMP Participate in public consultation so they can give their opinions regarding the implementation of the EMP; Liaise with DoE Prepare monthly environmental monitoring report
Town and District Officers	<ul style="list-style-type: none"> Participate in project monitoring Participate in grievance redress procedures
Department of Environment	<ul style="list-style-type: none"> Government's agency tasked with the implementation and enforcement of environmental regulations and policies. Responsible for screening and issuing environmental permits to projects as well as monitoring compliance with environmental regulations.
Development Partner	<ul style="list-style-type: none"> Monitors the project independently including the implementation of the EMP

Detailed Environmental Management Plan

The detailed EMP needs to be prepared by TPL during Phase 3 of NNUP implementation schedule. The detailed EMP should cover the key impacts identified in the environmental assessment and shall include sub-plans covering the following:

- Traffic management
- Occupational health and safety
- Public health and safety management
- Noise Management
- Vegetation Clearing
- Waste management - composting and recovery of recyclables
- Public Communications plan
- Grievance Redress Mechanism.

TA-8345 REG: Due Diligence of Tonga Nuku'alofa Distribution Network Upgrade Project
Due Diligence Report

Table 14. Environmental Management and Monitoring Plan

IMPACT MITIGATION					IMPACT MONITORING		
Project activities	Environmental Impact	Mitigation Measures	Mitigation Responsibility	Mitigation Cost (US\$)	Parameter to be monitored	Frequency and means of verification	Monitoring Responsibility
Impacts Due to Construction							
Physical Environment							
Operations of equipment	Emissions - Impact on air quality	Regular servicing of equipment according to manufacturer's specification; Best practice - avoid idling of equipment, shut down equipment when not in use	TPL or Sub-contractor	Part of TPL operating costs or sub-contract cost	Maintenance record of the equipment	Prior to use of equipment in NNUP and quarterly thereafter	TPL E&S Safeguards TPL Maintenance shop manager
Operations of equipment	Noise and vibration	Regular servicing of equipment; installation of noise mufflers; timing of work during daytime hours; provide advance notice to community	TPL	Part of TPL operating cost	Maintenance record; inspection of equipment's condition; Complaints from affected persons	Equipment inspection prior to use in NNUP; Quarterly inspection of maintenance record; Daily monitoring for complaints	TPL E&S Safeguards TPL Maintenance shop manager
Digging for poles and trenching for service line	Impacts on soil	As part of good practice, trenches should be covered immediately and work site cleaned up.	TPL or Sub-contractor	Part of construction cost	Status of work site	Immediately after completion of work	TPL E&S Safeguards; Work supervisor
Equipment operations	Soil contamination from leaks and spills	Regular servicing of equipment and replacement of worn out parts; Remove of oil tainted soil and place in treatment area with hard standing and allow oil to degrade/ oxidize	TPL	Part of construction cost	Equipment maintenance record; Status of work site	Prior to use in NNUP and every quarter; Upon completion of work	TPL E&S Safeguards; Work supervisor
Biological Environment							
Trimming of vegetation	Impacts on vegetation	Pruning of vegetation is essential for keeping the distribution line safe; pruning to follow code on tree clearing around power lines; TPL will give advance notice to landowners of pruning activity	TPL	Part of construction cost	Schedule of vegetation trimming; notice issued to landowners	Prior to start of work at each site	TPL E&S Safeguards; Work supervisor
Upgrade works on the distribution line	Impacts on Protected Areas	Works should not encroach into the shoreline of the lagoon in sections where transmission lines are near the shoreline (e.g. Haveluloto and Fanga, Area 2))	TPL	Part of construction cost	Actual work area occupied	Site inspection during actual work	TPL E&S Safeguards; Work supervisor
Procurement of poles	Impacts on forest resources (off-site)	Procure poles from legitimate suppliers; Suppliers to present	TPL	Part of construction cost	Inspection of credentials of	Once prior to award of supply contract	TPL procurement

TA-8345 REG: Due Diligence of Tonga Nuku'alofa Distribution Network Upgrade Project
Due Diligence Report

IMPACT MITIGATION					IMPACT MONITORING		
Project activities	Environmental Impact	Mitigation Measures	Mitigation Responsibility	Mitigation Cost (US\$)	Parameter to be monitored	Frequency and means of verification	Monitoring Responsibility
		documentation proof of sustainable forestry management			shortlisted suppliers		officer; E&S safeguards
	Pest in procured poles	Wood treatment and quarantine requirement of imported poles to be part of TPL specification for purchase of poles	TPL	Part of construction cost	Inspection of credentials of shortlisted suppliers	Once prior to award of supply contract	TPL procurement officer; E&S safeguards
Socio-Economic & Cultural Impacts							
Hiring of additional crew	Employment	Positive economic impact; recruitment should be well published so most qualified will be selected	TPL	Part of start-up cost	Recruitment plan	Review of recruitment plan prior to hiring	TPL HR office;
Distribution line work	Shut down of electric power supply	TPL will make advance public announcement of the schedule of power outages	TPL	Part of construction cost	Schedule of power shut down and Information dissemination plan	Prior to start of work in each area	TPL Work Supervisor and E&S safeguards
Distribution line work	Occupation health and safety	Work supervisor to conduct tool box meeting on occupational health and safety prior to work	TPL	Part of construction cost	Schedule of tool box meeting; Record of meeting	Prior to start of work;	TPL Work Supervisor and E&S safeguards
	Public Convenience & Traffic safety	Implement traffic management during works in busy thoroughfares; Issue advance notice on works in busy areas; Coordinate with Traffic Police if necessary	TPL	Part of construction cost	Traffic management plan and communication plan; Implementation of traffic plan	Review of traffic management plan prior to start of work; site inspection of work site	TPL Work Supervisor and E&S safeguards
	Public Health & Safety	Install barriers to delimit work areas; Install appropriate warning signs; Post warning signs as necessary	TPL	Part of construction cost	Work site safety management plan and communication plan; Implementation of traffic plan	Review of safety management plan prior to start of work; site inspection of work site	TPL Work Supervisor and E&S safeguards
Impacts on waste management							
Pruning of vegetation	Vegetation wastes	Composting of organic wastes	TPL	Part of construction cost	Composting site	Once prior to start of work	TPL Work Supervisor and E&S safeguards

TA-8345 REG: Due Diligence of Tonga Nuku'alofa Distribution Network Upgrade Project
Due Diligence Report

IMPACT MITIGATION					IMPACT MONITORING		
Project activities	Environmental Impact	Mitigation Measures	Mitigation Responsibility	Mitigation Cost (US\$)	Parameter to be monitored	Frequency and means of verification	Monitoring Responsibility
Replacement of old poles and wirings	Old poles and wirings	Recycle old concrete poles, donate to community for use in fencing and other uses; Wires are high value scrap materials, these will be collected and sold to recyclers;	TPL	Part of construction cost	Collection and holding area of recyclables	Once prior to start of work; regular monitoring of recyclable storage site	TPL Work Supervisor and E&S safeguards
Treatment of poles	Impacts on pollution due to treatment of poles	No treatment on site, TPL will procure treated poles; TPL will issue specification for treatment of poles; Suppliers should submit corresponding specification for treatment	TPL	Part of construction cost	Procurement plan for poles and specification for treatment of poles	Once prior to procurement	TPL Procurement officer; E&S safeguards person
Excavation work	Chance find	Follow chance find procedure, stop work, secure site, report to Project Manager, report to Authority, resume work only upon advice of Authority.	TPL	Part of construction cost	Inclusion of the chance find protocol in workers' briefing / orientation	Once prior to construction	TPL safeguards person
Operations Stage							
Vegetation clearing	Waste disposal	Composting of vegetation wastes					
Protection of poles from burning tax allotments	Impacts of herbicide used to clear area around poles	Limit use of herbicide to the area around the foot of the poles;	TPL	Part of operations	Maintenance programme and actual inspection of poles		Health and Safety Manager
	Pollution from leaching of chemicals used for treating poles	Prescribed specification for chemical treatment of poles	TPL	Part of construction cost	(Implemented during construction) specifications of treatment of poles	Prior to procurement	E&S safeguards; Procurement Officer
	Public and Occupational health and safety	TPL has existing health and safety programme as part of its operations	TPL	Part of operating cost	H&S programme and implementation	Regular health and safety audit	Risk and Compliance Manager

Environment, Health and Safety Capabilities - TPL

TPL's commitment to environmental sustainability is exemplified in its principle (see box). TPL's environment, health and safety programme is under the jurisdiction of the Risk and Compliance Department. The company has an existing occupational health and safety programme and the responsibility for its day to day implementation belongs to the division managers (pers com Risk and Compliance Manager). TPL used to have an environment, health and safety manager, but the position has been expanded to Risk and Compliance. As it is, TPL has no dedicated staff to look after its environment, health and safety program. For the implementation of NNUP, it is recommended that TPL engage as part of its NNUP project implementation team an environment and social safeguards person. The safeguards person shall be responsible for preparing the detailed EMP, monitor and reporting the implementation and compliance with the EMP, prepare the public consultation plan, carry out the public consultation, liaise with the public and DoE.

The engagement of the environment and social safeguards person is preferably done during Phase 1 of NNUP implementation. This will give the safeguards person lead time to familiarise with the project and prepare the EMP, consultation plan and other EMP implementation requirements.

TPL may likewise consider integrating into its management team the environment and social safeguards person to look after the environmental management of its expanding power generating facilities.

Reporting

The reporting requirement of NNUP has been set in the Project Paper. Quarterly, semi-annual and completion reports are to be prepared and submitted by TPL to the PCC and Development Partners. The environment and social safeguards aspects of NNUP should be incorporated into these regular reporting. The consolidation of the monthly environment and social monitoring shall make up the contents of the quarterly and semi-annual report.

Cost estimate of EMP

The results of the environmental assessment show that no significant impacts are anticipated during the implementation of NNUP and that the mitigation measures are all part of the construction activities. Given the minimal adverse impacts NNUP will not require instrumental environmental quality monitoring (air quality, water quality, etc.). Visual and photo documentation (before and after) and community feedbacks (complaints) are sufficient for monitoring as part of the EMP. In view of these, the only major cost that will be incurred by the implementation of NNUP EMP is the remuneration a National Environment and Social Safeguards Specialist. The remuneration of this National Safeguards person for the duration of NNUP implementation is estimated based on the assumptions that the monthly salary is TOP\$ 5,000.00, equivalent to total annual cost of TOP\$ 60,000 or a total cost of TOP\$ 300,000 for the 5-year duration.

6.6 Public Consultation and Disclosure

The public consultation done prior to this DD was through letters written to town officials seeking comments and opinions, but there was no response according to TPL.

Under this DD, the Social Safeguards specialist initially planned to conduct consultation with the 5 area. But setting the meetings was rather uncertain. With time running out on the DD team, the Social Safeguards specialist decided to conduct interviews instead of selected households within the 5 areas.

Under the NNUP's implementation plan, public consultation will be best undertaken at Phase 2 in order that results of the consultation can be integrated in the detailed design.

The disclosure of NNUP environmental assessment and EMP can be through the web site of TPL and the Development Partner as needed.

OUR PRINCIPLE

TPL values people and the environment, Tonga Power run the business as if it's our own, think differently, deliver swiftly and capture the value, and strive to succeed as a team and as an individual.

Printing and distribution of flyers about the project, the EMP and the contact persons for NNUP can also be done for information awareness by the people within the NNUP areas.

6.7 Grievance Redress Mechanism

According to EIB Environment and Social Practice Handbook, grievance mechanism should be readily accessible, culturally appropriate, widely publicised and well-integrated in Promoter's management system. A GRM provides a predictable, transparent, and credible process to all parties, resulting in outcomes that are seen as fair, effective, and lasting.²⁸ It is equally important that the GRM should be scaled to the risks and impacts of the project.

Given the low level of risk and minimal impacts of NNUP, it will need a simple GRM set up. Considering that this GRM is focused only on the environment and social grievances due to the implementation of NNUP a 3 level GRM can be set up. TPL has definite advantages in implementing grievance redress mechanism for the NNUP implementation. As an operating utility service provider TPL has an existing customer relations programme to which the NNUP GRM can be tied up with.

For NNUP, the recommended set up for resolving environment related grievances during implementation of NNUP is a 3 level GRM. For effective implementation, TPL should designate a Focal Point Person who is responsible for receiving complaints and organise a GRM committee within TPL. The Focal Point Person can be the town official or the NNUP Environment and Social Safeguards Specialist.

As for the TPL GRM committee, the recommended members are: (1) CEO; (2) Risk and Compliance Manager; (3) Project Manager (PCC); (4) Project Manager (TPL); and (5) NNUP Environment and Social Safeguards Specialist.

The NNUP grievance redress procedures are enumerated in Table 15.

Table 15. NNUP Grievance Redress Procedures

Nº	Actions and Procedures
1	Complaint is filed by the affected person and is received by TPL, either through the customer service desk, field crew, Village officer. The complaint is submitted to the environment and social safeguards person who screens the complaints. For the environment related complaint, the safeguards person enters the complaint in the Environment Complaints Register (ECR), information to include name of complainant, contact information, date complaint is received, name of person who received the complaint, nature of complaint. For social / land issues / resettlement issues, other concerns, the Affected Party is referred to appropriate office.
2	Level 1- Project Implementation Level Upon receipt of the complaint, the ESSS will investigate and discuss the complaint with Project Supervisor to determine the nature of complaint and the needed corrective action to address the complaint. For complaints that are within the capability of Project Supervisor instructs the service crew/ sub-contractor to undertake the corrective actions immediately. The ESSS informs the affected person within 24 hours of the actions taken. Once resolved, the complaint is closed in the ECR. For complaints that will require decisions from TPL management or if the Affected Person is not satisfied with the corrective action, the grievance is elevated to Level 2.
3	Level 2 - TPL GRM committee. Grievances that are not within the authority of the Project Implementation Level are to be submitted to the TPL Management Grievance Redress Committee. The TPL Management Grievance Committee have 24 hours to inform the Affected Person on the action that will be taken and TPL has 15 days to resolve the complaint.
4	Level 3 - If affected person is not satisfied with the resolution, the complaint maybe brought up to the Department of Environment for resolution.

²⁸ Office of the Compliance Advisor/Ombudsman for the International Finance Corporation (CAO). 2008. Advisory Note: A Guide to Designing and Implementing Grievance Mechanisms for Development Projects, Washington, D.C.

6.8 Conclusion and Recommendations

The completion of NNUP and the attainment of its objectives will have very significant socio-economic benefits coupled with positive environmental achievements for the Kingdom of Tonga. No significant adverse impacts are anticipated, neither are residual impacts predicted and all impacts can be mitigated. The assessment of the environmental and social impacts of NNUP according to Tonga regulations and environmental and social safeguards policies of potential Development Partners showed that NNUP will have minimal adverse impacts and will have a low level of risk. NNUP according to the NZMFAT environment and social procedures is Category B (P) with site specific adverse impacts that maybe prevented or mitigated. According to EIB environmental and social standards, NNUP is Annex II with some ESA requirement; and it is likely to be categorised as Minor project as per Tongan EIA Law.

The existing organisation, facilities (including web site), and existing OHS programme of TPL are expected to contribute to the EMP and OHS management of NNUP. The TPL has a department that oversees environment and occupational health safety compliance but presently lacks resources for environment and social safeguards. It is for this reason that the engagement of an environment and social safeguards specialist for NNUP implementation is recommended, TPL may opt to integrate the Environment and Social Safeguards Specialist into TPL's regular operations given the expanding operations, particularly generation which will have a corresponding increase in environmental management, monitoring and reporting requirements.

Updating of the EMP will be necessary as detailed plans for NNUP implementation are drawn up. To facilitate the updating of the EMP it is recommended that engagement of the National Environmental and Social Safeguards Specialist be done in the very early stages of NNUP implementation. Further, in line with EMP implementation, it is recommended that TPL expands its website content to integrate the public engagement and information disclosure requirements of NNUP and other TPL projects for that matter.

7.0 Social Development Assessment

7.1 Due Diligence Purpose and Methodology

This section describes the rationale for the social dimensions of this report and the process followed to undertake the due diligence.

7.1.1 Scope of Social Safeguards Dimensions of this DDR

The purpose of this Social component is to review any land access concerns and potential social impacts from the current electricity distribution network as well as the proposed NNUP. This review is based on the current network situation, the proposed NNUP works and mitigation measures in accordance with key donor social safeguards. It must be noted from the onset that the proposed NNUP project will not entail any permanent land acquisition and resettlement.

7.1.2 Methodology of the Social Due Diligence

The following activities were carried out in preparing the Social aspects of this DDR:

- **Desk review:** Collection and analysis of documents that may have an impact on the upgrading of the system, such as: land access; history and current clients; safety and faults.
- **Stakeholder consultation and participation:** Interviews with stakeholders, including TPL staff in Nuku'alofa.
 - Key government ministries to pull in key initiatives and other relevant projects, such as the pending Energy Bill to be developed
 - Consultations with ~90 community representatives through focus groups and several individual consultations from the five districts in Nuku'alofa. A line of questioning was developed (see Appendix 8). Focus meetings were organised with the assistance of the Ministry of Internal Affairs and Town and District Officers of Nuku'alofa. The consultative process also provided a mechanism to investigate any legacy safeguard issues and consider gender equity and equality related dimensions associated with the energy network in Greater Nuku'alofa.
 - Six focus groups were held with respondents from: Popua; Ma'ufanga; Kolomotu'a; Tofoa and Sopu. Respondents included men, women and youths
 - Individual meetings were held with Town and District Officers, as well as several randomly selected respondents in Popua and Sopu.
 - Consultations included: Ministry of MAIDECC; Statistics Department, Lands Division, Ministry Labour and Commerce as well as with the local chamber of commerce who represent much of the business sector.
- **Field visits:** Visited the communities of interest in order to provide context and gain an understanding of the project and its potential impacts and benefits. The current state of the power lines was also observed.

7.2 Social Safeguard Policies

Tonga is seeking funding and technical support for the NNUP from donors within the Pacific Region Infrastructure Facility. Two donor have indicated interest - NZMFAT and EIB. Consequently, in order to prepare for a submission to these funding agencies the key social safeguard policies of each are summarised as follows:

7.2.1 New Zealand MFAT Social Safeguard Policies

For NZMFAT Social Safeguard standards are guided by *New Zealand International Development Policy Statement*.²⁹ While the core focus is engrained in sustainable economic development by "forging new partnerships and using innovative approaches to bring about a tangible positive difference in peoples' lives today, and to ensure equitable sustainable development". However, it is acknowledged that to be effective in achieving sustainable economic development, consideration must be given to gender, environmental and human rights implications on projects, programmes and initiatives driven or supported by NZ.

²⁹ NZMFAT 2011 International Development Policy Statement: Supporting sustainable development. Online at: <https://www.mfat.govt.nz/assets/securedfiles/Aid-Prog-docs/2012-Aid-Policy.pdf>

7.2.2 EIB Social Safeguards

Social issues are assessed based on internationally accepted good practices, and in developing countries related to the Millennium Development Goals. They focus on labour standards, occupational and community health and safety (including major communicable diseases), population movement (including involuntary resettlement issues), minority rights (including indigenous people, women and vulnerable groups), public consultation and participation, and cultural heritage.

7.2.3 National Context

The Tongan National Strategic Planning Framework aims to improve electricity generation systems and its management in an effort to improve the living standards of all Tongans. The framework highlights a desire to improve services, accountability, and revenue collection, as well coordination of development partners. These are also core drivers behind the Tonga Energy Roadmap approach (refer section 2.4)

The Electricity Act 2007 provides the governance framework for the electricity sector and consequently TPL. The Act includes the following Institutional arrangements:

- Defines the role of the Electricity Commission (EC) in regulating tariffs, consumer service standards and electrical safety, as well as the approval and licensing of electricians, and the creation of regulations for major electrical works.
- Provides the MoF with the authority to be a party in the concession contract between the EC and the Concessionaire, and to establish regulations to ensure effective management of the electricity utility. The Concession Agreement states the utility's operations in detail, including how the tariffs are calculated.
- Creates a Renewable Energy Authority within the Ministry of Lands, Survey and Natural Resources to deal with matters concerning renewable energy, currently exclusively for off-grid uses. Tonga has also set ambitious goals for the utilisation of renewable energy.

The MLSNR has no formal role in energy regulation. However, through developing the energy policy and the direction of energy planning, the Energy Planning Unit of the MLSNR has an indirect role in electricity regulation. The Ministry of Finance is partially involved in energy regulation, through being the Contractual Partner of TPL in the Concession Agreement covering the company's operation.

Figure 6. Lisbon Treaty



Source: Kyrou 2014

7.3 Findings - Current Social Dimensions and Concerns

This section presents the findings of the due diligence assessment and investigations completed for the NNUP. In accordance with donor social safeguard concerns as well as TPL operational focal areas, the following priorities will be accordingly addressed through this Social Safeguards DDR:

- Indigenous peoples
- Land Acquisition and Resettlement
- Human Rights Dimensions
 - Network Accessibility and Affordability
 - Safety
 - Gender Dimensions
- Grievance Redress Mechanisms
- Service Standards
 - Reliability
 - Products.

These aspects will be discussed in terms of the current situation in the context of the Nuku'alofa electricity network as well as what can be improved within the proposed NNUP.

7.3.1 Indigenous Peoples

Nuku'alofa Tonga has a population⁶ of approximately 25,000 people. While about 98 percent of the population are of Tongan descent there are a number of foreign national's resident and citizens of Tonga. In 2001 there were up to approximately 4,000 Chinese people in the country (4% of the population), however riots in 2006 targeting Chinese-owned businesses in the city led to mass emigration.

The communities have the same language, customs, and traditions creating a close knit cultural composition. Social norms readily adopt the benefits that electricity and communications provide. Even in the only Nuku'alofa area not connected to the grid in Patangata there are generators and solar powered street lights.

Similarly, the due diligence review does not identify the potential NNUP project as a threat to local indigenous communities, their identity, dignity, human rights, livelihood systems, and/or cultural uniqueness. This due diligence review has contributed to ensuring that those affected by the project become active participants in the Project.

7.3.2 Land access and involuntary resettlement dimensions

The Nuku'alofa project will not involve involuntary resettlement or land acquisition. All upgrade work within the scope of the proposed project takes place entirely within State owned land - the generators are located on State land under the jurisdiction of TPL, as well as the power poles and lines are situated along dedicated road reserves. The proposed works for the proposed NNUP will not take or require any additional land.

7.3.3 Human Rights Dimensions

A human rights-based approach to energy programmes adds value through directing attention to those members of the community which are poor and marginalised. It also helps to develop more locally grounded, effective, and sustainable programmes. A programme that asserts procedural rights, such as the right to information, addressing gender dimensions, the right to participation and the right to effective grievance redress mechanisms and client confidence in sound governance, improves community(s) access to modern energy use. This is reflected in the subsequent discussion and recommendations which integrates the aforesaid human rights dimensions.

7.3.4 Network Accessibility and Affordability

Network accessibility refers to the financial capacity of customers to use the electricity service and the service provider to provide the service. Such capability identifies whether there is disposable income to enter into a customer-service provider agreement, but is also the capacity of the service provider to provide the service. The variables for network accessibility include:

- **Affordability to connect to the electricity network.** This may involve extending the electricity poles and lines further from their current limits to provide new connections to houses. This can be costly. The proposed NNUP is expected to offer free connections to customers during the upgrade process; and
- **Affordability of the actual electricity service,** the capability of customers to financially commit to access the service. TPL will offer pre-payment metering, linking payment to usage. This will enable households to manage their electricity themselves, increasing use with affordability. This will also eliminate costly disconnections and reconnections.

Affordability to connect to the electricity network: On first consideration the only part of Greater Nuku'alofa not on the electricity grid is Patangata, a swampy squatter settlement along the seaside towards the estuary of the lagoon. Along this area several houses have generators and solar streetlamps which run along the roadside. However, upon discussion with community groups across Nuku'alofa there are scattered households throughout each village which do not have electricity largely for the following reasons:

- Power poles do not extend to a distance upon which connections are affordable
- Long term disconnections for failure to pay
- Some households simply cannot afford the cost of either connection or the monthly bill
- In some households the primary building only has electricity, the outlying buildings either 'piggy back' on this connection or do not have electricity. While the main house will be connected to the grid, the separate smaller building may or may not have their own independent connections. This is where many extension cords are used - providing a source of lighting to these separate smaller houses (Respondents 2016).

Table 16. Estimate of households connected to the grid in Greater Nuku'alofa

Greater Nuku'alofa Totals				
Active meters	Household connections	Average cost of monthly household electricity	Approximation of households in Greater Nuku'alofa	Approximate coverage
6,797	7,103	\$56-\$150 monthly average ³⁰	~8,074 ³¹	~88% ³²

Census 2011; TPL statistics 2016

Note that the definition for a household is based on where the residents 'eat' (Tonga Statistics Department Personal Communication 2016), rather than number of buildings on site. Traditionally the 'boys' of the family resided in a separate building than the girls as part of the respect (faka'apa'apa system).

Affordability of the electricity service: Affordability of the actual electricity service can be obtained assessing the percentage of income spent on electricity. In this regard, the 'rule of thumb' varies regarding the affordability of electricity. While a hypothetical and yet popular value for 'affordability' is that if a household spends more than 10 percent of the income on electricity it is considered unaffordable (UKRN 2015). This is only a rule of thumb and it can vary according to location and energy requirements (SPARC 2011).

The affordability level of electricity to households within the average income band in the Nuku'alofa area can be assessed as varying between 8-27 percent of the monthly average household income, which ranges from affordable to very unaffordable. Despite the cost, households are keen to be connected to the grid recognising the benefits of electricity as a means to help improve their living conditions, education, health service provision and economic development. Those who struggle to pay bills either are frequently disconnected, or request regular assistance from overseas relatives to make payments.

What is evident in conversations is that there is a poor understanding on managing electricity in most households. Reportedly, some houses leave their lights on in rooms although no one is in that room; some turn fridges off at night; few turn power sockets off when not in use; as well as many appliances are old or

³⁰ Based on focus group estimates.

³¹ While exact number of households in each village has not been assessed since the 2011 Census an estimate of 8074 households in Greater Nuku'alofa is based on a consideration of population growth 2006-2011 - 5.1%; and number of persons per household approximately 5.8 persons.

³² Further qualification can be made from respondent's estimate of households in each village.

have poor energy ratings (Respondents 2016). Better household management of electricity, in parallel with efficient appliances can help increase the affordability of the electricity supply.

Table 17 provides a glimpse into active connections and electricity costs over the month of June 2016.

Table 17: Greater Nuku'alofa Electricity Consumption June 2016

District	Village	Active Meters	Disconnected meters	Household connections	Business connections	Average monthly bill cost (\$)	Approximate households not covered by grid % - 2016
Area 1	Kolomotu'a	541	38	483	96	117.92	~10%
	Kolofo'ou	549	81	630	0	300.87	
	Longolongo	131	28	159	0	101.85	
	Mailletaha	501	90	591	0	271.04	
	Kapeta	140	39	154	25	116.87	
	Total	1,862	276	2,017	121	181.71	
Area 2	Havelu	148	31	152	27	124.93	
	Fanga	727	148	727	148	134.93	
	Tofoa	577	105	580	102	153.94	~5% - new connections too costly
	Poutaha	73	15	74	14	223.48	
	Mataki'eua	11	2	7	6	745.92	
	Total	1,536	301	1540	297	276.54	
Area 3	Fasi	399	68	373	94	229.24	
	Ngele'ia	80	18	92	6	137.83	
	Pahu	136	23	140	19	106.25	
	Mataika	112	14	112	14	131.15	
	Halaleva	211	29	211	29	130.76	
	Ma'ufanga	630	78	527	181	639.14	~5% - new - connections too costly
	Pili	124	23	136	11	96.48	
	Total	1,692	253	1,591	354	210.12	
Area 4	Touliki	91	16	74	33	388.25	
	Anana	140	15	125	30	176.87	
	Umusi	55	11	56	10	128.05	
	Houmakelikao	266	59	294	31	96.95	
	Fangaloto	85	11	88	8	187.39	
	Popua	25	128	170	26	56.55	
	Total	772	465	1065	172	159.78	
Area 5	Sia'atoutai	157	21	110	68	89.59	
	Sopu	241	39	238	42	189.29	
	Hofoa	130	18	122	26	106.42	
	Isileli	81	10	81	10	90.26	
	Maui	48	11	52	7	111.53	
	Hala'ovave	123	25	133	15	94.44	
	Tu'atakilangi	155	17	154	18	119.00	
Total	935	141	890	186	114.36		

Source: TPL statistics 2016; Respondents communication 2016.

While the minimum wage varies considerably and there are no current reliable statistics available, Table 18 has considered a number of commonly cited income levels and the associated affordability of electricity associated with each income level. For those living on incomes at or below TOP 600 a month, the cost of electricity can be unaffordable.

Table 18: 'Affordability' based on a number of assumptions and focus group responses

Area	Approximate Monthly income \$TOP	Average Electricity Cost (as per bill)	Items noted to be used in household	Electricity as a % of total income	Affordability	Discussion and Assumptions
Popua	\$400 - 500	~\$56	Fridge, lights	~14%	Unaffordable	HR study 2011 indicated 22.5% Tongans living below basic needs poverty line. Hence while \$400-500 a month is average income there are many residents that live below this level.
Popua with remittances	1200 • Wages • Remittances • Occasional sales of handicrafts	\$100/month	Fridge, lights, washing machine, some appliances	8.3%	Affordable as long as remittances continue	Amount cited in field research in Popua - includes: • 2 local wages • Supplemented by remittances up to \$150/week
Tofoa; Kolomotu'a and Ma'ufanga	\$500 - 600	120-150 month	Fridge, lights, washing machine, toaster and other appliances	17% and up to 27%	Unaffordable	While some earned more this could be sporadic depending on sales from fishing, handicrafts etc.

Source: Community respondents 2016; TPL data - electricity usage and cost by community 2016.

A Human Rights Report in 2011³³ and supported by the HIES in 2009 found that 22.5 percent of the Tongans population (or almost 23 out of 100 Tongans) were living below the basic needs poverty line compared with 16.2 percent (or 16 out of 100 Tongans) in 2001. Women had a higher unemployment rate of 7.4 percent compared to men at 3.6 percent (HR study 2011). Average weekly earnings were around 127 pa'anga compared with 112 pa'anga for women (HR Study 2011; UNDP data 2012). Since this study the 2013 Labour Bill³⁴ enforces equal remuneration for work of equal value.

7.3.5 Safety of the Service Network

Under the Customer Service Agreement that households have with TPL there is a requirement that all equipment and appliances past the point of connection comply with all regulations, the connection and operation standards and any other safety or technical standards required for connection to the distribution network. Also any installation, alteration or maintenance of 'equipment must be certified (where required) by qualified personnel.' (Customer Service Agreement 2015). Enforcement of failing to comply with these responsibilities and requirements may result in the disconnection of the electricity supply.



³³ Human Rights Report 2011 'Tonga: Country Reports on Human Rights Practices for 2011'. United States Department of State. Bureau of Democracy, Human Rights and Labour. Online at: <http://www.state.gov/documents/organization/186525.pdf>

³⁴ Employment Relations Bill 2013. Online at: <http://www.mctl.gov.to/wp-content/uploads/2013/04/Final-Draft-ERB-2013-April-2013-19Apr13.pdf>

There have been several electrocution accidents, some fatal, reportedly as a result of the electricity service. Between 2008 and 2016, Tonga Police recorded 9 fatalities caused by electricity.³⁵ Whether the cause is a result of faulty TPL facilities or service is often not as important to the victim and their families as the suffering from the outcomes. Yet TPL take each case very seriously and do investigate these incidents and accidents. According to the investigations, none of these fatal electrocutions been a result of the TPL service or facilities.

Key causes of electrocution include:

- Tampering with electrical installations
- Substandard appliances. It is acknowledged that safety improvements include the reduction of risks that threaten human safety as well as the effectiveness and safety of appliances (Duke, 2005, p. 9). Relevant aspects of the Nukualofa electricity service include reducing the:
 - The integrity of the TPL service in the area, such as the condition of the poles and wiring; the connections to each household and/or business; and the mapping and maintenance of any underground wiring
 - Risk of electric shock through faulty equipment and poor practices especially shared supply between houses
 - Appliance damage due to electric surges
 - Risk of household fires attributed to electrical faults.

Discussions with the villages in Greater Nuku'alofa highlighted the limited understanding of electricity and its maintenance in the household and community. For example:

- 'Piggy backing' on a neighbour's electricity is not considered a safety issue and is common place. This is despite the knowledge that the most recent death in Tonga was directly attributed to a 'piggy backed' connection as well as a mix between US and Australian and NZ plugs.
- The differences between the American 110 V and the Australia/NZ 230 V systems is poorly understood and a number of respondents mentioned that they bent the US plug to fit into their Australian/NZ sockets.
- Several power lines on private property were covered by tree branches and leaves.

All respondents indicated that they would like training on safe handling and maintenance of their electrical appliances.

7.3.6 Gender Dimensions

Men and women use energy for different purposes and arguably providing energy to women will improve their livelihoods (UN 2012). Furthermore, women can experience greater challenges than men in improving their economic situation as a result of less reliable access to energy. Hence it is important to incorporate the contribution and concerns of both women and men into programme delivery and upgrade. This can both help inform programmes as well as increase access to grid and off-grid electricity access (UNDP 2012). On the other hand, failing to consider gendered interests and the different needs of men and women can limit the effectiveness of energy programmes and policies.

The inputs of both men and women have been included into this Social DDR; that is, the focus groups consisted of both men and women who equally and actively contributed to the discussion.

Furthermore, men and women reportedly use electricity for home duties (lighting, cooking, washing) as well as leisure (internet with facebook and television) (Community respondents 2016). Both men and women also require a consistent source of electricity for their productive purposes, such as shops, welding and other business operations.

7.3.7 Grievance Redress Mechanism

There are many different types of complaints reported to TPL in any month. These fall mainly into the following categories:

³⁵ See Electrical Safety Public Awareness Plan 2016.

- Bill concerns
- Operational faults, disconnections and reconnections.

For example, in May 2016 in Greater Nukualofa the following billing complaints were received:

- 1 household reported a meter error
- 6 households did not receive a bill
- 7 households reported a wrong meter reading (Master Customer Complaints Register 2016).

On the other-hand also for the month of May 2016 across Tongatapu, 522 of the following operational complaints or requests occurred:

- Power failures
- Request for connection
- Disconnections
- House problems needing contractor
- Trees on lines
- Conductor, line and other issues.

While the complaints process may appear adequate from TPL perspective (TPL respondents), it reportedly lacks clarity and ease of access for the clients (community respondents 2016). Several respondents claimed that they submit their complaint to one officer, have then to go to another officer at small industries section and then have to return back to TPL main office again (Community respondents, 2016). Following this process, they often do not receive a satisfactory outcome. Key points with the current system include the following:

- While there is an emergency number to report urgent faults or issues, if this line is busy with one customer, other people cannot get through.
- People can submit a complaint in the front office and be sent to the appropriate sections.
- Complaints can be put in writing and addressed to "Complaints" at Tonga Power. If complaints relate to the supply of electricity they will be attempted to be resolved and acknowledged within five working days of receiving it.
- If its payment that's in dispute, TPL will hold asking for payment of the disputed amount until the process is worked through. TPL will investigate the dispute and respond within ten working days of receiving the complaint or, depending on the nature of the complaint, the timeframe for a decision or other action as appropriate.

7.3.8 Service Standards

Improved reliability of electricity supply: There are service industry standard indicators that measure the average duration that a customer is without supply in a given period (System Average Interruption Duration Index), the number of supply interruptions also in a given period (System Average Interruption Frequency Index) and the duration of such interruptions (Customer Average Interruption Duration Index). The variables for reliability include:

- System Average Interruption Duration Index (SAIDI), a measure of the average duration that a customer is without supply over a period of time (e.g. 40 minutes per month)
- System Average Interruption Frequency Index (SAIFI), a measure of the average number of supply interruptions seen by customers in a period (e.g. 2 outages per month)
- Customer Average Interruption Duration Index (CAIDI), a measure of the average duration of each outage seen by customers (e.g. 20 minutes per outage).
- Damage to customer equipment from faults. Voltage spikes from broken neutrals and other similar faults are also safety incidents.

Service supply outages are reportedly quite rare and the majority of respondents considered the service reliable. The main outages experienced are planned outages which are broadcast over the radio and more recently texted to clients. Respondents indicated that these outages were rarely longer than about three hours and this was considered acceptable.

Other unplanned outages were reported on an occasional basis usually due to car accidents or strong wind related issues. However, in Tofoa, the respondents felt that the network was not as reliable as expected.

Reports included:

- A three phase meter device shorted recently and this resulted in a power surge which affected all of the appliances of at least one resident
- Unplanned power outages have been approximately twice a week over the past month
- The electricity supply is not as reliable as they would expect.

Service support: While service has improved considerably over the past 10 years, there are a number of areas that require ongoing improvement. Key areas that have improved include the following:

- The speed of reconnections is reported by respondents to occur rapidly on payment of the overdue bill.
- The speed of response to service disruption is reportedly good.
- The TPL staff are considered friendly and professional in response to customer enquiries.

Areas that require further attention include:

- Need for training regarding safe electricity, appliance maintenance, household energy budgeting and management
- Improved complaints and grievance redress process.
- Several respondents perceived that the meter readers at times did not accurately record the electricity use and queried whether at times the bills were based on a 'guestimate' rather than actual readings
- Bills should be issued at the time of readings with a household member present for accuracy rather than TPL having to visit twice - once to read the meter and once to issue the bill.

Products: With regards to the Social aspects of the electricity product the most important considerations relate to electricity budgeting and safety. While a number of prepaid meters are currently being trialled across Tonga, these have not been put in place in Nuku'alofa.

7.4 Potential NNUP Impacts and Benefits

The following section includes a brief assessment of social impacts, including both potential adverse impacts and positive benefits throughout the construction, operation and decommissioning phases of the proposed upgrade.

7.4.1 Adverse Social Impacts

No significant adverse social impacts can be directly attributed to the current Nuku'alofa Network. While several electrocutions have occurred periodically in Tonga these cannot be directly attributed to the electricity network.

Furthermore, considering the proposed NNUP will take place within existing State owned land and entirely within the existing Plant infrastructure, there will not be impacts on livelihoods as the Project will not interfere with existing cultural, commercial or agricultural practices. Potential adverse impacts on local households and businesses will largely be confined to the construction phase.

Construction workers: Operating in the urban area where there is regular interaction with numerous people employed in a range of industries is a norm for urban residents. Therefore, the arrival of electricity upgrade construction workers is unlikely to pose a potential risk to family structures and social networks.

Traffic: Minimal traffic disturbances will be noticeable during construction, considering the type of work required for the refurbishment.

7.4.2 Positive Social Benefits

Reliable electricity supply: Villages and businesses in the Nuku'alofa area already have access to electricity. Household uses are mainly for lighting, refrigeration of food and access to information, communication and entertainment through appliances such as televisions and mobile phones. Commercial applications include: miscellaneous shops retailing food, clothing and other essentials and small and medium sized businesses. Electricity also supports social services present in the area such as education, other utility provision and health.

The proposed Nuku'alofa Upgrade Project will improve the reliability of the service and increase the ability of commercial enterprises to meet service and product provision more efficiently. Customers will have access to more efficient and safer means for cooking, and lighting in their premises, as well as more reliable electricity to commercial enterprises.

Increased service utilisation and demand: Improved perceived quality and value of a service usually leads to an increased utilisation and demand for the service. It is expected that following the upgrade new customer connections will be created especially due to an increased accessibility and opportunity for connection to the network. This includes:

- **Providing connections to households which could not otherwise afford it** - a number of respondents indicated that they could not afford the connection, especially where there was the need to extend the electricity lines and poles to their houses. Some people quoted costs of several thousand dollars if they are in a newly built up area.
- **Improved safety of energy use** as households have the opportunity to gain free connections to the network and no longer need to 'piggyback' onto a lead house.

Improved Products: The upgrade is likely to bring in the option for householders to remain on the current billing system or going onto a 'prepaid' meter service. This latter service will enable the home owner to better manage their electricity costs, recognise major electricity drains in their household appliances and extend electricity use within their budget.

Creation of employment and business opportunities: it is not expected that there will be temporary or permanent employment opportunities created during the NUUP or for ongoing maintenance services. TPL have their labour team and given the OHS and technical nature of the upgrade, it is unlikely that local labour opportunities will be generated.

However, as indicated in the Customer Service Agreement with TPL, customers are '*responsible for any repairs or maintenance that may be required to your meter board or box and any associated fuses and wiring*'.

7.5 Suggested Way Forward

Improving supply reliability in those communities with an upgraded electricity supply is expected through the proposed NNUP with improved infrastructure, equipment and power lines that will better withstand local weather conditions, provide greater safety and offer a greater reliability of electricity supply. Further to these technical provisions, a number of 'soft' solutions have been suggested in order to improve the social dimensions of the NNUP.

7.5.1 Network Accessibility and Affordability

Key actions which would help to strengthen the accessibility and improve affordability in particular for the more disadvantaged households include:

- Staggered payment for connections - whereby households can pay off the costs of extending a powerline to reach their household over a predetermined timeframe.
- Prepaid meters for low income families - whereby households can manage their electricity use and costs.
- Reinforcement of pamphlets (see Appendix 8) which highlight energy efficiency measures through community training.

7.5.2 Safety

Despite pamphlets, radio announcements, newspapers and media sources to the public, households do not appear to understand the importance of, and the necessary safety measures for their electricity supply. Consequently, the following has been requested in community focus groups:

- Overwhelmingly community respondents requested training in various dimensions regarding electricity including: appliances - recommended brands, appliance management, electricity management, understanding of the greater safety of having underground connections for Nuku'alofa.
- Standards to be imposed especially for 'cheap' imported appliances to ensure that they meet international safety standards.
- Reduce the risk of electric shock through faulty equipment and poor practices especially shared supply between houses through putting in such appliances as the 'RCMS' and the 'smart meter'.
- Endorsed the use of RCMS in households, this to become a standard for all new houses.

7.5.3 Gender Dimensions

The proposed NNUP will require the development of a GAP with achievable actions including such aspects as:

- The recruitment of a part time gender officer responsible for carrying out: gender sensitisation training, project monitoring and reporting on the GAP
- Key gender equity indicators which identify the benefits of the improved electricity service to men and women, especially for productive activities.

7.5.4 Grievance Redress Mechanisms

An effective and efficient Grievance Redress Mechanism provides an avenue to strengthen the human rights approach to energy consumption in Nuku'alofa. Households can develop a better client relationship with TPL which in turn encourages improved service and consumer satisfaction. Despite the current system attempting to manage client complaints and concerns, the community responses indicate that this is an area that can be improved and responses improved in a timely manner through the following means:

- One or two dedicated community engagement and grievance redress officers within TPL who will be the main contact for all grievances. Their role will be to: record, divert and monitor faults and grievances
- The officers need to show commitment to helping resolve the client's issues, that is either to the clients benefit or carefully explained if no positive outcome. This way the clients will gain an understanding on what they may do in the future to prevent the reoccurrence of the issue.

7.5.5 Service Improvements

The due diligence review identified that communication between stakeholders and TPL is an area for improvement. Information gaps and conflicting perceptions among stakeholders were identified as common through community consultations. To address these service concerns, improvements that can be made to better meet the needs of the clients. These can include:

- Capacity Building
 - TPL capability strengthening especially in areas of client relationships and community engagement
 - Community training initiatives based on the following key areas: - electricity management; electrical appliances use and safety.
- Improved mechanisms for bill distribution
 - Short term efforts - bills issued upon reading of meter with householder
 - Proposed paperless bills.

7.6 Conclusion

The social due diligence review confirmed that the NNUP will not require physical or economic displacement or involuntary land acquisition. All the work in the scope of the upgrade are on property which is owned by the State. Therefore, a resettlement plan is not needed.

Key social dimensions which can be improved through the upgrade include:

- Network Accessibility and Affordability whereby households and businesses are encouraged to improve energy consumption habits
- Human Rights dimensions and Grievance Redress Mechanisms which do not only improve relationships with clients, but also encourage local buy into the programme
- Improved Service Provision which can strengthen client satisfaction and longer term sustainability of the network.

While these social dimensions are often perceived by technical experts to provide the 'soft' solutions to infrastructural development, they are critical to enable the longer term success and sustainability of such projects as the proposed NNUP.

8.0 Economic Analysis of Network Upgrade

8.1 Introduction

This economic analysis was carried out as part of the due diligence to determine the economic viability of the proposed distribution network upgrade project, and thus to support the project for funding including potential attraction of private co-financing.

Economic projections are in line with current goals outlined in the major strategic documents of the Government of Tonga and Tonga Power Limited (such as Tonga Strategic Development Framework, 2015-2025, Tonga Energy Road Map 2010-2020, Tonga National Infrastructure Investment Plan 2013, and Business Plan 2017-2020) and the overall economic assessments of the Project take into account the expected demand and willingness to pay for the grid electricity.

The economic analysis of the project is evaluated in accordance with ADB's Guidelines for the Economic Analysis of Projects (ADB, 1997).

The proposed network upgrade project will support the economic growth of Tonga and social well-being of its population. Better access to reliable and safe electricity can stimulate local economic development and employment and reduce social costs related to cases of fire and electrocution.

8.2 Macroeconomic Context

The Kingdom of Tonga comprises five main island groups: Tongatapu, 'Eua, Ha'apai, Vava'u and Niuaus. The total surface area is about 750 km² scattered over 700,000 km² in the southern Pacific Ocean. About 73% of its population of around 106,000³⁶ people reside on the main island of Tongatapu.

Tonga's Gross Domestic Product (GDP) grew by 3.4% in FY2015 as low oil prices cut input costs in the transport and electricity. GDP growth in Tonga is expected at 2.8% in FY2016 and 2.7% in FY2017. The projected growths are slightly lower than average growths in the Pacific countries (3.8% and 3.1% respectively)³⁷. GDP per capita is TOP 7,636 (or USD3,800), however, there are substantial amount of receipts of remittances running at over 20% of GDP³⁸.

Tonga is heavily reliant on imported oil fuels to meet national energy needs including electricity generation and transportation (land, sea and air). Fuel imports represent about quarter of all imports³⁹, much of which is for the diesel fuel used for power generation.

Approximately 90% of households in Tonga⁴⁰ are electrified and people rely on an affordable and reliable supply of electricity to maintain the current standard of living. Similarly, both government agencies and private sector enterprises rely on electricity in order to provide services to the Tonga community including health, education and communication services.

Government of Tonga has made a strong commitment to reduce the dependency on imported fuel and reduce Tonga's vulnerability to oil price shocks by replacing diesel generation with generation from renewable energy sources and also by upgrading the networks and reducing energy losses. The Government's energy sector plan "Tonga Energy Road Map 2010-2020" (TERM) had identified opportunities in supply side management, demand side management/energy efficiency and in renewable energy generation. These opportunities included the upgrading of networks to improve reliability and safety and to reduce distribution losses.

³⁶ Estimated for 2016 based on the 2011 Tonga Population Census data of 103,252 and growth rate. The Government expects a new Census later this year.

³⁷ Asian Development Outlook 2016.

³⁸ Tonga Strategic Development Framework, 2015-2025.

³⁹ Tonga Statistics Department, 2015.

⁴⁰ Including TVNUP connections.

In line with the TERM, TPL has developed its "Business Plan 2016-2020". Central to this strategy is an efficient and 'smart' electricity distribution system where the benefits of renewable energy generation can be effectively delivered to the consumers of electricity and increase percentage of population with access to modern energy services to 100% by 2020, from current level of around 90%.

Based on its strategy TPL has developed number of project proposals that range from renewable energy generation through natural resources such as solar, wind and biomass, to network upgrades⁴¹ and advanced and prepayment metering. Few projects aimed at distributing electricity safely, effectively and efficiently.

NNUP is one of the projects identified by TPL and prioritized in the Tonga National Infrastructure Investment Plan 2013 and it affects the most densely populated area of the Tonga's main island Tongatapu where the majority of the daily economic activity and about 60% of electricity consumption in Tonga as whole occurs. The Project is expected to improve safety of the network for both customers and TPL, improve reliability of supply and accessibility to the grid power, reduce power losses, and reduce O&M costs.

8.3 Sector Context

Electricity is generated, distributed and retailed by fully government owned vertically integrated enterprise "Tonga Power Limited" (TPL). A complementary business is the provision of infrastructure services such as electrical lines services within Tonga. TPL recently diversified into LPG supply and distribution businesses with the acquisition of Tonga Gas and Homegas.

While TPL operates on a strictly commercial basis to fully recover of costs of supply, the tariff is levelled across Tongan geography and various customer groups resulting in cross-islands and cross-customers subsidisation. TPL operates under regulatory framework through the Electricity Concession Contract (ECC) in which tariffs, tariff adjustment formulas, operational efficiency benchmarks, consumer service standards and penalties for non-compliance are specified between the Electricity Commission, the Government and Tonga Power Limited.

Currently, TPL has more around 22,000 customers⁴² (Tongatapu consumption is approx. 85%, Vava'u 10%, Ha'apai 2.5% and 'Eua 2.5%). As of March, 2016, TPL had installed firm (diesel) generating capacity of 17.2 MW in all four islands.

Table 19. Energy Generation, Consumption and Losses

	2010	2011	2012	2013	2014	2015	2016 est.
Generation (MWh)	51,845	53,160	52,391	53,313	54,561	55,405	56,000
Billed (MWh)	42,625	44,566	44,731	46,388	47,818	49,165	50,000
System losses (%)	17.78%	16.17%	14.62%	12.99%	12.36%	11.26%	11.00%
Nº of Customers	20,773	20,758	20,498	20,580	20,633	20,932	21,000

Current total generation (diesel plus renewables) is about 56 GWh. The overall system losses reduced substantially to 11.3% due to improved metering (non-technical losses) and upgraded conductor sizes and transformers capacity (technical losses) within the Tonga Village Network Upgrade project. The losses are expected to reduce further to 10.0% in 2018 when TVNUP is completed, and then further down to its estimated lowest level of 9% in 2019⁴³ due to upcoming other upgrades, mainly the NNUP.

8.4 Demand analysis

Currently, Tongatapu capacity is 13.8 MW. Firm capacity is 10 MW with (N-1) reliability. Peak demand was 8.4 MW last year, but it has gone up to about 9.5 MW recently. There is sufficient capacity to meet current peak demand even with one of the diesel units out of service thus providing (N-1) reliability. However, the network capacity is being bottleneck for the consumption. Some existing and potential businesses cannot get power due to access costs (installation of new substations and connection lines) and network connection capacities.

⁴¹ Tonga Village Network Upgrade project (TVNUP) (Stage 1 in 2011-2014, Stage 2&3 expected to be completed by September 2018).

⁴² TPL Business Plan 2017-2020.

⁴³ TPL Business plan 2017-2020.

Current consumption in the Project area is 33.22 GWh according to the TPL Accounting data (April 2015-May 2016). Average consumption growth is assumed at 2% per annum according to the updated TPL Business Plan 2017-2020. This is an estimated by TPL average annual rate of growth in the long run. In the short term the consumption growth will be higher due to NNUP. The Project allows additional consumption due to reconnection of the disconnected consumers (over 1,400) and consumption increase (by 8% in the Project area) due to capacity improvements as quantified below in the benefits section.

Project timing. This network upgrade project was proposed to cover Tongatapu's densely populated areas in Nuku'alofa as continuation of the TVNUP that covers village areas. Main installation works are being planned to start around mid-2018. The economic cost and benefit streams were estimated for the expected project life of 40 years for each subproject and the Project. Total Project assessment period is from 2022 (end of Project implementation) till 2062.

8.5 Alternative Project Option

An alternative option (Option 2) to the main Project option (Option 1) was to exclude replacement of the main HV feeder conductors⁴⁴, as this asset still has a remaining life of around 5 to 10 years and its replacement cost is NZD 5.4 million. So, if it is not replaced now, it is expected to be replaced in about 7 years (end of life) at the cost of NZD 10.85 million considering new mobilisation of contractor and additional work relating to poles and LV line shifts. The economic benefit of including the replacement of the HV conductors is ENPV=NZD 0.09 million, and the financial benefit is FNPV=NZD 1.99 million. So, it is more economic do this work now as Part of this Project. Thus, the main Project option is preferred over the Alternative option.

8.6 Valuation of Project Costs

Project costs computed at constant mid-2016 prices include investment costs and costs for operation and maintenance (O&M). Taxes and duties on capital expenditures for the subprojects are exempted by the government. Also, normally the Tonga's National Reserve Bank applies a 3% charge to payments flowing through Government and it was exempted for the Project items. In any case, all these taxes, duties and Government fees need to be excluded from the economic costs.

The proposed project area is based on five contiguous subproject areas. The investment costs for the five subprojects (Project areas) are presented in Table 20.

Table 20. Project / Subproject main financial costs

Subproject	Cost, NZD m
Area 1	10.90
Area 2	11.88
Area 3	10.86
Area 4	7.44
Area 5	8.86
Total main costs	49.94

Table 21. Cost of Additional equipment

Additional Equipment to be used for all Subprojects	Cost, NZD m
Vehicles	2.69
Technical tools	0.19
Total additional equipment	2.88

However, there will also be additional equipment (vehicles and tools) to be purchased to implement all the subprojects. The costs of the subprojects were adjusted to include the cost of actual use of this additional equipment as shown in Table 21. Some of this equipment (large vehicles) will have remaining values after

⁴⁴ The main 185 mm² feeder from the power stations.

the project implementation for other uses by TPL and it is accounted for in this analysis. The remaining value of the Additional equipment was calculated and included in the Project cost streams accordingly.

O&M for the Investment components have been included at the rate of 2.5%⁴⁵ of Investment costs. However, it should be noted that a methodology has been applied that considered the total O&M costs (for the Project area) before and after the Project. The total O&M costs after the Project represent full O&M costs including the O&M costs for the Project components. That way the O&M costs for the Project components are fully included. The existing O&M costs after the Project will be reduced due to renewed network components (i.e. new Poles, LV lines, HV lines, etc.). The difference between the O&M costs before and after the Project is contributing to the Net benefit of the Project. Thus, the O&M costs are covered quite prudently.

Since most of the investment components deals with renewing network components, capacity of TPL to maintain the investment components is sufficient provided it will maintain the right staff who have appropriate training. Likewise, equipment, materials stock, vehicles shall be planned to be kept updated and stocked accordingly. Additional training might be needed for use of smart metering and related new technology. The cost of such training can be accommodated within the allocated provision for O&M costs.

Border price numeraire was used for the sake of convenience, as most parts of the investment (about 66%) and other Project related costs (O&M and additional generation) are foreign costs. The costs in financial prices are adjusted to reflect the economic resource cost of project inputs in terms of the border price numeraire. For the purpose of calculation of the economic cost of the Project, breakdown of the investment costs were estimated as follows: 65% of the costs are traded goods and services, 13% non-traded goods and services, and 22% labour. The O&M cost allocation was estimated at 72% for traded goods and services, 8% for non-traded goods and services, and 20% for labour⁴⁶. Traded goods and services are assumed to reflect the economic prices, no conversion is applied. Non-traded goods and services are multiplied by standard conversion factor of 0.9 and labour costs are multiplied by the shadow wage rate factor of 0.8⁴⁷ (as assumed for Tonga).

Table 22. Financial and Economic costs of the Project/ Subprojects

Subproject	Local labour, NZD m	Local material, NZD m	Foreign costs, NZD m	Financial costs adjusted, NZD m	Economic costs, NZD m
Area 1	2.53	1.41	7.26	11.20	10.55
Area 2	2.71	1.67	7.81	12.19	11.48
Area 3	2.48	1.41	7.27	11.16	10.52
Area 4	1.72	1.04	4.98	7.74	7.29
Area 5	2.00	1.25	5.92	9.17	8.65
Remaining value of Additional equipment			1.33	1.33	1.33
Project cost	11.44	6.78	34.57	52.80⁴⁸	49.82

Note: Adjusted for use of Additional equipment.

Total financial cost of the Project (refer Table 22) is estimated at NZD 52.80 million, of which NZD 3.01 million to be funded by TPL.

Annual O&M costs were calculated for both “without” and “with” Project scenarios as the O&M costs are expected to be reduced after the Project implementation. The incremental benefit included the difference between the two estimates.

As the Project is expected to increase net electricity consumption including saved electricity from reduced losses, incremental generation costs were calculated and included on the Project cost side by calculating

⁴⁵ Indicative figure used by TPL.

⁴⁶ On the assumption that 80% of the total costs is material cost and 20% is labour cost for both O&M costs and CAPEX; then 90% of the material is imported (10% is local).

⁴⁷ These figures are similar to those in the Cook Islands and PNG.

⁴⁸ Rounding error

separately cost of generation for "with" and "without" Project scenarios, as described further in the following section.

8.7 Valuation of Project Benefits

The Project is to benefit around 8,500 customers (households and businesses) in the greater Nuku'alofa area, including enabling reconnection of over 1,400 customers⁴⁹. These customers were mainly disconnected due to non-payment. Then they would not get reconnected due to reconnection fee and also poor network capacity would not encourage them to get reconnected. Under the Project reconnection fee will be reduced and also capacity of the network will be substantially improved.

The expected major Project benefits are:

- Improved access to electricity (improved business environment, improved quality of life for people with positive impact on education, health, etc.)
- Improved quality of supply (improved business environment enabling new businesses to operate in Tongatapu; small businesses able to install larger rated plant, previously not possible due to excessive voltage drops and capacity constraints in the network)
- Improved safety of the supply (results in reduced faults, accidents, loss of life and hospitalisation owing to electric shock and house fires)
- Improved reliability of supply (fewer interruptions).
- Cost savings from the installation of pre-pay meters. Consumers with inconsistent income will find it easier to buy credit when they have money rather than having to pay for electricity at the end of every month. It is a budgeting tool for both the customer and the utility a means of receiving payment without having to force an expensive disconnection and debt collection.
- Loss reduction benefits (less generation costs and diesel, less greenhouse gas emissions as externality, etc.)
- Improvement in Tonga's economy in the long run. These include sustainable economic development.

Loss reduction benefit. In "without Project" scenario the losses would increase from current 12% till it collapse when the LV lines reach end of their lives in around 7-10 years. Conservatively it was assumed loss increase by 0.5% annually and 20 years as the remaining life of the current assets. In "with Project" scenario the losses are expected to decrease to around 5% as it has happened in the other areas of Tongatapu after similar upgrades done under the TVNUP. The loss reductions are expected to be realized within the 5 years of project implementation based on the size of consumer coverage by each subproject (Project areas). Base consumption is kept at current demand as the system will not be deteriorating due to the Project upgrades, conservatively assuming no growth of the base demand.

Additional consumption in the Project area due to improved network capacity is estimated at 8% after the completion of all Subprojects (Project areas) based on data collected by a Project's focus group surveys on the current consumption and affordability indicators. For the additional consumption growth, the capacity of the network is sufficient according to the TPL Business Plan 2017-2020 and also there is sufficient generating capacity as estimated below. Many households use power for basic needs such as fridge and lights, but they wanted to use also washing machine, toaster and other appliances⁵⁰.

Net additional generation required for the additional consumption was calculated considering the savings from the loss reduction. This calculation showed that (i) the electricity saved from losses will be fully consumed due to the additional consumptions, and (ii) TPL's generation capacity can still cover these additional consumptions. Current TPL generation is 56 GWh with peak demand at 8.4 MW. TPL has capacity of 13.8 MW and 10 MW of firm capacity (with (N-1) reliability) so it can generate 87.6 GWh (10 MW x 8760 hours/year) of firm power that is about 32 GWh (or 57%) above the current consumption. Thus, the calculated additional consumptions due to the Project won't require expansion of generating capacity of TPL.

⁴⁹ Currently, there are 7,053 active meters and 1,419 disconnected, according to TPL data as of 19 July 2016.

⁵⁰ For details please refer to Social assessment report under this Project.

This additional consumption of the existing consumers is valued at tariff that is cost recovery in Tonga. This is still a conservative approach as some of the businesses might be using gensets for their additional power needs at higher cost than Tariff.

Additional consumption due to new connections is calculated based on the additional consumers (meters) that are going to be added by the Project. These are around 1,420 disconnected meters that the Project is going to allow them to get reconnected. The number of consumers will be increased from current 7,050 to around 8,500. The increase of consumption is estimated as number of new consumers (1,420) multiplied by 70% of the average consumption of the existing consumers, conservatively assuming that 30% of the disconnected consumers (that will be connected) are already using electricity through their neighbours. The new incremental consumption of these newly connected consumers is valued at Willingness-to-pay (WTP), meaning that before the Project they incurred costs of running diesel gensets (typically commercial consumer) or candles (residential) to get the needed electricity.

Willingness-to-pay is estimated based on the costs of alternative generation such as small diesel generation sets (commercial consumers) and candles, kerosene and torch batteries (residential consumers). WTP was estimated at 2.32 TOP /kWh (or 1.02 USD/kWh) that is similar to that in other Pacific countries⁵¹. WTP for smaller consumers who cannot afford such small gensets is higher due to higher kWh costs of candle, kerosene, and dry cell batteries.

Tariff affordability. Number of actual potential consumers that are considered to be benefited from the provided grid electricity due to the Project shall not be restricted by electricity tariff affordability. The electricity tariff affordability of prospective consumers was checked and determined based on average monthly household income collected from the Project's socio-economic focus group survey. For instance, some non-electrified households use dry cell batteries at cost energy of around 250 TOP /kWh⁵² and monthly cost of around TOP 30⁵³. These households could consume at least about 42kWh of grid electricity for the same cost if get connected (30/Tariff of TOP 0.72). However, actual consumption can go up to 100 kWh (more than 3 times) that is a lower part of averages in the Project area according to the Project's survey.

Improved Reliability. Power outages. During the FY2015/2016 a connected customer on average has experienced about 1,125 minutes (about 19 hours) of power outage (SAIDI index)⁵⁴ that is substantial decrease from 4,765 minutes in 2013. However, during last year, SAIDI increased by 67 minutes due to the planned outages caused by TVNUP project. Conservatively, it can be assumed that the SAIDI index will reduce by 20% due to the Project. (In TVNUP the number of monthly network faults were estimated to be reduced by 74%⁵⁵). **Low voltages.** Also, the number of consumer complaints on low power voltages is reducing, mainly due to the current village network upgrade project. The total number of complaints in FY2015/16 was 144 (it was 195 previous year).

Improved Safety. Cases of death from electrocutions. In the past there have been 2 cases of death from electrocution each year, except for some years, according to data from Police department (G). Averaged annual number of such fatality from electrocution for the past 7 years is 0.86. This is a substantial social cost that should be considered as part of economic costs. Due to non-availability of detailed data and time constraint, the benefit of improved safety due to the Project was not estimated and included in both the economic and financial analysis. It can be noted that 95% reduction in the instances of electrocutions caused by the distribution network was already considered by the TVNUP.

Fire damages. Annual average damage loss caused by fire is calculated at TOP 2.55 million based on data for the past 7 years from Police department. The benefit of reducing electric risks of fire was not calculated and included in this analysis, since the data did not show what part of these fire cases were due to electricity faults.

The benefit estimates have been converted to economic prices.

⁵¹ It is around 1.4 USD/kWh in PNG.

⁵² This is calculated for a high capacity AAA battery that has 1.9 Wh and cost TOP 0.5 in Nuku'alofa (25 July 2016).

⁵³ 4 battery torch with radio last about 2 days at 5 hours/day use. This gives 60 batteries a month, or 60xTOP 0.5/piece = TOP 30/month.

⁵⁴ SAIDI (System Average Interruption Duration Index). TPL 2015 Annual report.

⁵⁵ TVNUP Stage 1 report.

Other benefits. Network upgrade does not only result in cost reductions and additional consumptions, but other aspects such as better lighting quality, more useful hours for productive activities, education, leisure, entertainment, and better access to information. Over, these will lead to better economic development of the Project areas and Tonga as a whole in the longer run. These positive externalities have not been measured and included in the analysis making a conservative approach of valuing the economic benefit.

8.8 Cost-Benefit Analysis and Economic Internal Rate of Return

The economic evaluation is carried out using real (constant) prices for costs and benefits. Costs and prices estimates are done as at mid-2016. When earlier assessments for price values were used, adjustments for inflation rates in Tonga in the past years are applied.

The economic modelling was set up in order to estimate economic effect (net benefits) of the investment programme by calculating Economic Internal Rate of Return (EIRR) and Net Present Value (NPV) of the Subprojects. Project life span was taken 40 years with no residual values assumed in the final year. An economic (social) discount rate of 12%⁵⁶ was used.

The results of the economic analysis indicates that the overall EIRR for the Project is 20.2% and NPV is NZD 19.40 million indicating that the overall Project is economically viable. Table 23 shows EIRR and ENPV of the Project, as well as those for the Subprojects that are analysed further below.

Table 23. Project and Subprojects EIRRs and ENPVs

Subprojects	EIRR	NPV, NZD million
Area 1	40.2%	6.55
Area 2	22.3%	4.35
Area 3	22.7%	5.24
Area 4	15.5%	1.55
Area 5	12.3%	0.16
Overall Project	20.2%	19.40

The details of the cost and benefit streams and calculated EIRR and Economic NPV for the Project are presented in Table 24 and Table 25.

Table 24. Overall EIRR - Without Project Incremental (NZD million)

	Current CAPEX	Total O&M	Benefit of consumption	Net benefit
2016	2.05	2.30	13.47	9.12
2017	2.05	2.30	13.74	9.39
2018	2.05	2.30	14.02	9.66
2019	2.05	2.30	14.30	9.94
2020	2.05	2.30	14.58	10.23
2021	2.05	2.30	14.87	10.52
2022	2.05	2.30	15.17	10.82
2023	12.38	2.30	15.48	0.79
2024	2.05	2.30	15.79	11.43
2025	2.05	2.30	16.10	11.75
2026	2.05	2.30	16.42	12.07
2027	2.05	2.30	16.75	12.40
2028	2.05	2.30	17.09	12.73
2029	2.05	2.30	17.43	13.08
2030	2.05	2.30	17.78	13.42
2031	2.05	2.30	18.13	13.78
2032	2.05	2.30	18.50	14.14
2033	2.05	2.30	18.86	14.51

⁵⁶ Typical ADB threshold for Economic analysis.

TA-8345 REG: Due Diligence of Tonga Nuku'alofa Distribution Network Upgrade Project
Due Diligence Report

	Current CAPEX	Total O&M	Benefit of consumption	Net benefit
2034	2.05	2.30	19.24	14.89
2035	2.05	2.30	19.63	15.27
2036	2.05	2.30	20.02	15.67
2037	2.05	2.30	20.42	16.07
2038	2.05	2.30	20.83	16.48
2039	2.05	2.30	21.24	16.89
2040	2.05	2.30	21.67	17.32
2041	2.05	2.30	22.10	17.75
2042	2.05	2.30	22.55	18.19
2043	2.05	2.30	23.00	18.64
2044	2.05	2.30	23.46	19.10
2045	2.05	2.30	23.93	19.57
2046	2.05	2.30	24.40	20.05
2047	2.05	2.30	24.89	20.54
2048	2.05	2.30	25.39	21.04
2049	2.05	2.30	25.90	21.54
2050	2.05	2.30	26.42	22.06
2051	2.05	2.30	26.94	22.59
2052	2.05	2.30	27.48	23.13
2053	2.05	2.30	28.03	23.68
2054	2.05	2.30	28.59	24.24
2055	2.05	2.30	29.16	24.81
2056	2.05	2.30	29.75	25.40
2057	2.05	2.30	30.34	25.99
2058	2.05	2.30	30.95	26.60
2059	2.05	2.30	31.57	27.22
2060	2.05	2.30	32.20	27.85
2061	2.05	2.30	32.84	28.49
2062	2.05	2.30	33.50	29.15

Table 25. Overall EIRR - With Project Incremental (NZD million)

	Project Investment cost	Current CAPEX	Total O&M	Cost of additional Generation (1)	Benefit of Base consumption (2)	Benefit of Additional consumption due to improved network capacity	Benefit of Additional consumption due to new connections	Net benefit With Project	Net benefit Incremental
2016	0.00	2.05	2.30	0.00	13.47	0.00	0.00	9.12	0.00
2017	0.86	2.05	2.30	0.00	13.74	0.00	0.00	8.53	-0.86
2018	9.11	2.05	1.93	0.00	14.02	0.00	0.00	0.92	-8.74
2019	7.29	1.72	1.57	-0.01	14.30	0.15	0.54	4.42	-5.53
2020	10.52	1.39	1.20	-0.02	14.58	0.29	1.09	2.87	-7.36
2021	11.48	1.07	0.83	0.04	14.87	0.56	2.07	4.08	-6.44
2022	9.22	0.74	0.83	0.09	15.17	0.81	3.00	8.10	-2.72
2023		0.41	1.69	0.25	15.48	1.24	4.60	18.96	18.17
2024		0.41	1.69	0.23	15.79	1.26	4.69	19.41	7.98
2025		0.41	1.69	0.21	16.10	1.29	4.78	19.87	8.12
2026		0.41	1.69	0.18	16.42	1.31	4.88	20.34	8.27
2027		0.41	1.69	0.15	16.75	1.34	4.97	20.82	8.42
2028		0.41	1.69	0.12	17.09	1.37	5.07	21.31	8.58
2029		0.41	1.69	0.09	17.43	1.39	5.18	21.81	8.74
2030		0.41	1.69	0.06	17.78	1.42	5.28	22.32	8.90

	Project Investment cost	Current CAPEX	Total O&M	Cost of additional Generation (1)	Benefit of Base consumption (2)	Benefit of Additional consumption due to improved network capacity	Benefit of Additional consumption due to new connections	Net benefit With Project	Net benefit Incremental
2031		0.41	1.69	0.03	18.13	1.45	5.38	22.85	9.07
2032		0.41	1.69	-0.01	18.50	1.48	5.49	23.38	9.24
2033		0.41	1.69	-0.05	18.86	1.51	5.60	23.93	9.42
2034		0.41	1.69	-0.09	19.24	1.54	5.71	24.49	9.60
2035		0.41	1.69	-0.13	19.63	1.57	5.83	25.06	9.79
2036		0.41	1.69	-0.18	20.02	1.60	5.95	25.65	9.98
2037		0.41	1.69	-0.22	20.42	1.63	6.06	26.25	10.18
2038		0.41	1.69	-0.27	20.83	1.67	6.19	26.86	10.38
2039		0.41	1.69	-0.32	21.24	1.70	6.31	27.48	10.59
2040		0.41	1.69	-0.38	21.67	1.73	6.44	28.12	10.80
2041		0.41	1.69	-0.43	22.10	1.77	6.56	28.77	11.02
2042		0.41	1.69	-0.49	22.55	1.80	6.70	29.44	11.25
2043		0.41	1.69	-0.56	23.00	1.84	6.83	30.13	11.48
2044		0.41	1.69	-0.62	23.46	1.88	6.97	30.83	11.72
2045		0.41	1.69	-0.69	23.93	1.91	7.11	31.54	11.97
2046		0.41	1.69	-0.76	24.40	1.95	7.25	32.27	12.22
2047		0.41	1.69	-0.84	24.89	1.99	7.39	33.02	12.48
2048		0.41	1.69	-0.92	25.39	2.03	7.54	33.78	12.75
2049		0.41	1.69	-1.00	25.90	2.07	7.69	34.57	13.02
2050		0.41	1.69	-1.09	26.42	2.11	7.84	35.37	13.30
2051		0.41	1.69	-1.18	26.94	2.16	8.00	36.19	13.59
2052		0.41	1.69	-1.27	27.48	2.20	8.16	37.02	13.89
2053		0.41	1.69	-1.37	28.03	2.24	8.32	37.88	14.20
2054		0.41	1.69	-1.48	28.59	2.29	8.49	38.76	14.51
2055		0.41	1.69	-1.59	29.16	2.33	8.66	39.65	14.84
2056		0.41	1.69	-1.70	29.75	2.38	8.83	40.57	15.17
2057		0.41	1.69	-1.82	30.34	2.43	9.01	41.51	15.52
2058		0.41	1.69	-1.95	30.95	2.48	9.19	42.47	15.87
2059		0.41	1.69	-2.08	31.57	2.53	9.38	43.45	16.23
2060		0.41	1.69	-2.21	32.20	2.58	9.56	44.46	16.61
2061		0.41	1.69	-2.36	32.84	2.63	9.75	45.49	16.99
2062		0.41	1.69	-2.50	33.50	2.68	9.95	46.54	17.39
								EIRR	20.2%
								ENPV, NZDm	19.4

8.9 Sensitivity Analysis of the Project

Sensitivity analysis of the EIRR and the economic net present value (ENPV) for the overall Project was conducted under the following scenarios: (i) Investment costs up by 10% (ii) O&M cost up by 20%, (iii) Loss reduced down to only 8% (not 5%) (iv) Increase of expected additional consumptions less by 20%. The results of the analysis for the overall Project under the base case and scenarios defined for the sensitivity analysis are shown in Table 26.

Table 26. EIRRs and Sensitivity analysis for Subprojects

	Base Case	Investment costs up by 10%	O&M cost up by 20%	Loss reduced down to only 8% (not 5%)	Increase of consumptions less by 20%
EIRR	20.2%	17.9%	18.7%	19.4%	14.5%
ENPV, NZD m	19.4	15.7	16.6	17.8	8.3

Overall, the network upgrade project is economically viable, as its economic internal rates of return (EIRR) is higher than the benchmark of the economic opportunity cost of capital (EOCC=12%). Also, the Project is resilient to key risk factors as indicated by the results of the sensitivity.

Economic analysis for Subprojects

Similarly, the economic analysis was completed for all five Subprojects (Project Areas). The results of the economic analysis are presented in Table 27.

Table 27. EIRRs and Sensitivity analysis for Subprojects

	Base Case	Investment costs up by 10%	O&M cost up by 20%	Loss reduced down to only 8% (not 5%)	Increase of consumptions less by 20%
AREA 5					
EIRR5	12.3%	11.3%	11.8%	12.0%	11.1%
ENPV, NZD m	0.2	(0.5)	(0.1)	0.0	(0.6)
AREA 4					
EIRR4	15.5%	13.7%	14.4%	14.7%	12.2%
ENPV, NZD m	1.5	0.9	1.1	1.2	0.1
AREA 3					
EIRR3	22.7%	21.5%	22.6%	23.6%	19.0%
ENPV, NZD m	5.2	4.9	5.0	5.3	4.2
AREA 2					
EIRR2	22.3%	19.2%	20.6%	21.0%	14.5%
ENPV, NZD m	4.3	3.6	3.8	4.0	1.7
AREA 1					
EIRR1	40.2%	33.5%	38.5%	39.4%	17.3%
ENPV, NZD m	6.6	6.1	6.2	6.4	3.4

The Subprojects are individually economically viable and are resilient to key risk factors as indicated by the results of the sensitivity, except three sensitivity cases for Project Area 5 (Investment costs increase by 20%, O&M costs increase by 20%, and Expected increase of consumptions less by 20%). However, in all those cases EIRRs are higher than 11%, and taking into account other non-quantified benefits such as benefit from smart/pre-paid metering, the Subproject Area 5 is also considered to be economically viable.

8.10 Conclusion

The results of the economic analysis indicated that the overall EIRR for the Project is 20.2% and NPV is NZD 19.40 million meaning that the overall Project is economically viable, as its EIRR is higher than the benchmark of the economic opportunity cost of capital (EOCC=12%). Based on the results of the sensitivity analysis, the Project is resilient to key risk factors, as shown in Table 28.

Table 28. EIRRs and Sensitivity analysis for Subprojects

	Base Case	Investment costs up by 10%	O&M cost up by 20%	Loss reduced down to only 8% (not 5%)	Increase of consumptions less by 20%
EIRR	20.2%	17.9%	18.7%	19.4%	14.5%
ENPV, NZD m	19.4	15.7	16.6	17.8	8.3

The Subprojects are individually economically viable as shown in Table 29.

Table 29. Project and Subprojects EIRRs and ENPVs

Subprojects	EIRR	ENPV, NZD million
Area 1	40.2%	6.55
Area 2	22.3%	4.35
Area 3	22.7%	5.24
Area 4	15.5%	1.55
Area 5	12.3%	0.16
Overall Project	20.2%	19.40

The Subprojects are resilient to key risk factors based on the results of the sensitivity analysis, except three sensitivity cases for Project Area 5 (Investment costs increase by 20%, O&M costs increase by 20%, and Expected increase of consumptions less by 20%). However, in all those cases FIRRs are higher than 11%, and taking into account other non-quantified benefits such as benefit from smart / pre-paid metering, the Subproject Area 5 is also economically viable.

9.0 Financial Analysis of Network Upgrade

9.1 Introduction

This financial analysis was carried out as part of the due diligence of the proposed NNUP to determine the financial feasibility and sustainability of the proposed distribution network upgrade project, in accordance with ADB's Guidelines for the Economic Analysis of Projects (ADB, 1997). All financial costs and benefits are expressed in mid-2016 constant prices. Taxes and duties on capital expenditures for the subprojects are exempted by the government. Also, the Tonga's National Reserve Bank 3% charge to payments flowing through Government has been exempted.

9.2 Project financial costs

Project financial costs were presented in Table 20 and Project financial costs adjusted for the use of Additional equipment were presented in Table 22. Summary of the financial costs and adjusted financial costs are shown in Table 30. Some of the additional equipment (large vehicles) that will be purchased under this Project will have remaining values after the project implementation for other uses by TPL. Therefore, as explained above, for the sake of this analysis the costs of the subprojects were adjusted to include the cost of actual use of the additional equipment (vehicles and technical tools).

Table 30. Project/ Sub-projects financial costs

Subproject	Financial costs, NZD m	Financial costs adjusted for use of Additional equipment, NZD m
Area 1	10.90	11.20
Area 2	11.88	12.19
Area 3	10.86	11.16
Area 4	7.44	7.74
Area 5	8.86	9.17
Total	49.94	1.33

The remaining value of the Additional equipment was calculated and included in the Project cost streams accordingly.

9.3 Project financial benefits

The main financial benefits of the Project were identified as follows:

- Increased sales due to improved network capacity
- Increased sales due to new connections
- Reduced O&M costs and reduced CAPEX
- Loss reduction benefits (less generation costs and diesel)
- Cost savings from the installation of pre-pay meters.

The network will be upgraded due to the Project investment. Therefore, there will be less capital expenditure on capital replacements and upgrades compared to without Project case. Thus, TPL's regular CAPEX will be less with the Project.

The major benefits have been calculated based on similar methodology of projections of cost and benefit flows for "with" and "without" Project scenarios as described in the Economic analysis section above. The additional sales were valued at Tariff. Relatively small benefits (such as benefit of saving on disconnection costs due to pre-pay and smart metering, reduced penalties payments for non-compliance, etc.) were not quantified for the sake of efficiency of the analysis.

9.4 Weighted Average Cost of Capital

TPL's cost of borrowing is 6.3%⁵⁷. As a conservative approach, considering possibility of non-concessional financing of the Project the WACC for the Project was computed at 6.68% as shown in Table 31. This is based on the assumption that the debt ratio is 33% according to the TPL Business plan 2017-2020. The international inflation rate is assumed to be 1.8%³ and local inflation at 2%. The cost of equity has been assumed to be 10% that is being aimed by TPL from current actual 7% according to its business plan out to 2020.

Table 31. Weighted Average Cost of Capital (Option 1 - Non-concessional financing).

		Debt/ Non-concessional	TPL/Govt of Tonga	Total
A	Weighted	33%	67%	100%
B	Nominal Cost	6.30%	10.00%	
C	Tax rate	0.00%	0.00%	
D	Tax Adjusted Nominal Cost Bx(1-C)	6.30%	10.00%	
E	Inflation Rate	1.90%	2.00%	
F	Real Cost = $[(1+D)/(1+E)]-1$	4.32%	7.84%	
G	Weighted Compact, FxA	1.42%	5.25%	
WACC			6.68%	

However, considering also potential concessional and grant financing of the proposed Project, as was done with the Tonga Village Upgrade project, the WACC for the Project was computed at 3.02% as shown in Table 32. This is based on the assumption that the debt to equity financing ratio will be at 80% to 20%.

Table 32. Weighted Average Cost of Capital (Option 2 - Concessional financing).

		Debt/ Non-concessional	TPL/Govt of Tonga	Total
A	Weighted	80%	20%	100%
B	Nominal Cost	5.00%	10.00%	
C	Tax rate	25.00%	0.00%	
D	Tax Adjusted Nominal Cost Bx(1-C)	3.75%	10.00%	
E	Inflation Rate	1.90%	2.00%	
F	Real Cost = $[(1+D)/(1+E)]-1$	1.82%	7.84%	
G	Weighted Compact, FxA	1.45%	1.57%	
WACC			3.02%	

Potential Tariff decrease was assessed for both type of possible financing.

9.5 Cost-Benefit Analysis and Financial Internal Rate of Return

Similar to the economic assessments as described above, the financial evaluation is carried out using real (constant) prices for costs and benefits. Costs and prices estimates are done as at mid-2016. Then, a financial appraisal of each subproject (the five Project areas) was also undertaken using with- and without-project scenarios over the operational period. Financial flows were discounted over time using the WACC, which was calculated based on the after-tax real interest rate.

The financial modelling was set up in order to estimate financial effect (net benefits) of the investment Project by calculating Financial Internal Rate of Return (FIRR) and Financial Net Present Value (FNPV) of the Subprojects. The FIRR is the discount rate at which the financial net present value (FNPV) of each

⁵⁷ The World Bank projections.

subproject's net cash flow becomes zero. If the FIRR is equal to or greater than the WACC, a subproject is considered financially viable.

The results of the financial analysis indicated that the overall FIRR for the Project is 15.4% and NPV is NZD 45.02 million indicating that the overall Project is financially feasible. The details of the cost and benefit streams and calculated FIRR and Financial NPV for the Project are shown in in the Table 34 and Table 35.

Table 33 shows FIRR and FNPV of the Project, as well as those for the Subprojects that are analysed further below.

The details of the cost and benefit streams and calculated FIRR and Financial NPV for the Project are shown in in the Table 34 and Table 35.

Table 33. Project and Subprojects FIRRs and FNPVs

Subprojects	FIRR	NPV, NZD million
Area 1	27.0%	13.45
Area 2	15.9%	9.68
Area 3	16.4%	11.24
Area 4	12.0%	4.87
Area 5	9.6%	3.49
Overall Project	15.4%	45.02

Table 34. Overall FIRR - Without Project Incremental (NZD million)

	Current CAPEX	O&M	Revenues from Sales	Net benefit
2016	2.15	2.42	14.97	10.40
2017	2.15	2.42	15.27	10.70
2018	2.15	2.42	15.57	11.00
2019	2.15	2.42	15.89	11.31
2020	2.15	2.42	16.20	11.63
2021	2.15	2.42	16.53	11.96
2022	2.15	2.42	16.86	12.29
2023	13.00	2.42	17.20	1.77
2024	2.15	2.42	17.54	12.97
2025	2.15	2.42	17.89	13.32
2026	2.15	2.42	18.25	13.68
2027	2.15	2.42	18.61	14.04
2028	2.15	2.42	18.99	14.41
2029	2.15	2.42	19.36	14.79
2030	2.15	2.42	19.75	15.18
2031	2.15	2.42	20.15	15.58
2032	2.15	2.42	20.55	15.98
2033	2.15	2.42	20.96	16.39
2034	2.15	2.42	21.38	16.81
2035	2.15	2.42	21.81	17.24
2036	2.15	2.42	22.24	17.67
2037	2.15	2.42	22.69	18.12
2038	2.15	2.42	23.14	18.57
2039	2.15	2.42	23.61	19.03
2040	2.15	2.42	24.08	19.51
2041	2.15	2.42	24.56	19.99
2042	2.15	2.42	25.05	20.48
2043	2.15	2.42	25.55	20.98
2044	2.15	2.42	26.06	21.49
2045	2.15	2.42	26.58	22.01
2046	2.15	2.42	27.12	22.54
2047	2.15	2.42	27.66	23.09

**TA-8345 REG: Due Diligence of Tonga Nuku'alofa Distribution Network Upgrade Project
Due Diligence Report**

	Current CAPEX	O&M	Revenues from Sales	Net benefit
2048	2.15	2.42	28.21	23.64
2049	2.15	2.42	28.78	24.20
2050	2.15	2.42	29.35	24.78
2051	2.15	2.42	29.94	25.37
2052	2.15	2.42	30.54	25.96
2053	2.15	2.42	31.15	26.57
2054	2.15	2.42	31.77	27.20
2055	2.15	2.42	32.41	27.83
2056	2.15	2.42	33.05	28.48
2057	2.15	2.42	33.71	29.14
2058	2.15	2.42	34.39	29.82
2059	2.15	2.42	35.08	30.50
2060	2.15	2.42	35.78	31.21
2061	2.15	2.42	36.49	31.92
2062	2.15	2.42	37.22	32.65

Note: In without Project case, there will be replacement of MV conductor after 7 years (in 2023) as it reaches end of its life, thus there is a jump in CAPEX in 20123.

Table 35. Overall FIRR - Without Project Incremental (NZD million)

	Project Investment cost	Current CAPEX	O&M	Cost of additional Generation/Savings (1)	Base revenue from Sales	Additional sales due to improved network capacity	Additional sales due to new connections	Net benefit With Project	Net benefit Incremental
2016	0.00	2.15	2.42	0.00	14.97	0.00	0.00	10.40	0.00
2017	0.92	2.15	2.42	0.00	15.27	0.00	0.00	9.78	-0.92
2018	9.58	2.15	2.03	0.00	15.57	0.00	0.00	1.81	-9.20
2019	7.74	1.81	1.64	-0.01	15.89	0.16	0.29	5.15	-6.16
2020	11.16	1.46	1.26	-0.02	16.20	0.33	0.57	3.24	-8.39
2021	12.19	1.12	0.87	0.04	16.53	0.62	1.09	4.01	-7.94
2022	9.87	0.78	0.87	0.09	16.86	0.90	1.58	7.73	-4.56
2023	0.00	0.43	1.77	0.25	17.20	1.38	2.42	18.54	16.76
2024	0.00	0.43	1.77	0.23	17.54	1.40	2.47	18.98	6.01
2025	0.00	0.43	1.77	0.21	17.89	1.43	2.52	19.43	6.12
2026	0.00	0.43	1.77	0.18	18.25	1.46	2.57	19.90	6.22
2027	0.00	0.43	1.77	0.15	18.61	1.49	2.62	20.37	6.33
2028	0.00	0.43	1.77	0.12	18.99	1.52	2.67	20.85	6.44
2029	0.00	0.43	1.77	0.09	19.36	1.55	2.73	21.35	6.56
2030	0.00	0.43	1.77	0.06	19.75	1.58	2.78	21.85	6.67
2031	0.00	0.43	1.77	0.03	20.15	1.61	2.84	22.37	6.80
2032	0.00	0.43	1.77	-0.01	20.55	1.64	2.89	22.90	6.92
2033	0.00	0.43	1.77	-0.05	20.96	1.68	2.95	23.44	7.05
2034	0.00	0.43	1.77	-0.09	21.38	1.71	3.01	23.99	7.18
2035	0.00	0.43	1.77	-0.13	21.81	1.74	3.07	24.55	7.32
2036	0.00	0.43	1.77	-0.18	22.24	1.78	3.13	25.13	7.46
2037	0.00	0.43	1.77	-0.22	22.69	1.82	3.20	25.72	7.60
2038	0.00	0.43	1.77	-0.27	23.14	1.85	3.26	26.32	7.75
2039	0.00	0.43	1.77	-0.32	23.61	1.89	3.32	26.94	7.91
2040	0.00	0.43	1.77	-0.38	24.08	1.93	3.39	27.57	8.07
2041	0.00	0.43	1.77	-0.43	24.56	1.96	3.46	28.22	8.23

	Project Investment cost	Current CAPEX	O&M	Cost of additional Generation/Savings (1)	Base revenue from Sales	Additional sales due to improved network capacity	Additional sales due to new connections	Net benefit With Project	Net benefit Incremental
2042	0.00	0.43	1.77	-0.49	25.05	2.00	3.53	28.88	8.40
2043	0.00	0.43	1.77	-0.56	25.55	2.04	3.60	29.55	8.57
2044	0.00	0.43	1.77	-0.62	26.06	2.08	3.67	30.24	8.75
2045	0.00	0.43	1.77	-0.69	26.58	2.13	3.74	30.94	8.93
2046	0.00	0.43	1.77	-0.76	27.12	2.17	3.82	31.67	9.12
2047	0.00	0.43	1.77	-0.84	27.66	2.21	3.90	32.40	9.32
2048	0.00	0.43	1.77	-0.92	28.21	2.26	3.97	33.16	9.52
2049	0.00	0.43	1.77	-1.00	28.78	2.30	4.05	33.93	9.73
2050	0.00	0.43	1.77	-1.09	29.35	2.35	4.13	34.72	9.94
2051	0.00	0.43	1.77	-1.18	29.94	2.40	4.22	35.53	10.16
2052	0.00	0.43	1.77	-1.27	30.54	2.44	4.30	36.35	10.39
2053	0.00	0.43	1.77	-1.37	31.15	2.49	4.39	37.20	10.62
2054	0.00	0.43	1.77	-1.48	31.77	2.54	4.47	38.06	10.87
2055	0.00	0.43	1.77	-1.59	32.41	2.59	4.56	38.95	11.12
2056	0.00	0.43	1.77	-1.70	33.05	2.64	4.66	39.85	11.37
2057	0.00	0.43	1.77	-1.82	33.71	2.70	4.75	40.78	11.64
2058	0.00	0.43	1.77	-1.95	34.39	2.75	4.84	41.73	11.91
2059	0.00	0.43	1.77	-2.08	35.08	2.81	4.94	42.70	12.19
2060	0.00	0.43	1.77	-2.21	35.78	2.86	5.04	43.69	12.49
2061	0.00	0.43	1.77	-2.36	36.49	2.92	5.14	44.71	12.79
2062	0.00	0.43	1.77	-2.50	37.22	2.98	5.24	45.75	13.10
								FIRR	15.4%
								FNPV, NZD	\$45.0

Note 1: This takes into account Savings from Loss reduction.

9.6 Sensitivity analysis of the Project

Sensitivity analysis of the FIRR and the FNPV for the overall Project was conducted under the following scenarios: (i) Investment costs up by 10% (ii) O&M cost up by 20%, (iii) Loss reduced down to only 8% (not 5%) (iv) Increase of expected additional consumptions less by 20%. The results of the analysis for the overall Project under the base case and scenarios defined for the sensitivity analysis are shown in Table 36.

Table 36. FIRRs and Sensitivity analysis for Subprojects

	Base Case	Investment costs up by 10%	O&M cost up by 20%	Loss reduced down to only 8% (not 5%)	Increase of consumptions less by 20%
FIRR	15.4%	13.6%	14.1%	14.7%	13.9%
FNPV, NZD ('000s)	45.0	40.1	39.9	42.1	37.2

9.7 Financial Analyses for Subprojects

Similarly, the financial analysis was completed for all the Subprojects (Project areas). The results of the analysis are presented in Table 37.

Table 37. Results of Sensitivity analysis for Subprojects

AREA 5					
FIRR5	9.6%	9.5%	9.9%	10.2%	9.7%
FNPV, NZD ('000s)	3.5	3.5	3.6	3.9	3.3
AREA 4					
FIRR4	12.0%	10.8%	11.3%	11.6%	11.0%
FNPV, NZD ('000s)	4.9	4.2	4.3	4.6	3.9
AREA 3					
FIRR3	16.4%	14.5%	15.2%	16.5%	14.9%
FNPV, NZD ('000s)	11.2	10.2	10.2	11.0	9.4
AREA 2					
FIRR2	15.9%	13.8%	14.5%	14.9%	14.1%
FNPV, NZD ('000s)	9.7	8.6	8.7	9.0	7.9
AREA 1					
FIRR1	27.0%	20.9%	22.7%	23.3%	21.7%
FNPV, NZD ('000s)	13.4	12.4	12.2	12.6	11.3

The Subprojects are individually financially viable and are resilient to key risk factors as indicated by the results of the sensitivity.

9.8 Project Funding

The total Project cost, shown in Table 38, is about NZD 52.8 million and TPL's minimum contribution is about 6% of the total costs or NZD 3.0 million.

Table 38. Total Project costs (NZD)

	TOTAL	TPL Contribution	Donor/Loan/ Private co-financing
Project Management	2,093,709	815,773	1,277,936
Construction staff	3,660,482	0	3,660,482
Vehicles	2,685,000	0	2,685,000
Technical tools	186,000	0	186,000
Other Equipment	2,299,497	0	2,299,497
Materials	37,870,892	0	37,870,892
Project Works	2,197,518	2,197,518	0
Pre-pay metering	1,807,568	0	1,807,568
TOTAL PROJECT COSTS	52,800,666	3,013,291	49,787,375
	100%	6%	94%

It is worth noting that TPL and the Government are approaching their debt ceiling so may not be able necessarily take on more commercial loans at this point. Based on this financial analysis, the Project can be financed by non-concessional funding with no grant elements and including potential private co-financing.

Government and TPL need to seek potential private co-financing. It is important to note that the current tariff is at cost recovery level. This allows sound financial positions and long-run sustainability not only for TPL, but also positive return for involved private parties.

9.9 Tariff Affordability, Efficiency and Sustainability

The Government of Tonga currently maintains a uniform tariff policy and it is cost reflective on average, though the costs of supply vary significantly across the islands. The electricity tariff is regulated by the Electricity Act and administered by the Electricity Commission. The tariff adjustment is determined by a process set down in the Concession Agreement between TPL and the Electricity Commission. The

Competent Authority (Tongan Government Agency) sets the landed price of diesel that TPL uses for their power generation.

As around 90% of the electricity on the TPL grid is supplied from diesel generation, the price of diesel fuel is a big component of the electricity tariff. The new power tariff of 72.11 seniti/kWh was effective from 1 July 2016, an increase from 69.99 seniti/kWh set in March 2016. This is due to the increase in the diesel price from 87.34 seniti/litre in February 2016 to 103.38 seniti/litre in June 2016 (or by 18.4%).

The revised tariff rates approved by the Electricity Commission are shown in Table 39.

Table 39. Tariff in Tonga as at 1 July 2016

Island	Current Non-Fuel part	Current Fuel part	Current Tariff	Change in Fuel part (only)	% Change	New Tariff
Tongatapu	44.35	25.64	69.99	2.12	3.0%	72.11
Vava'u	44.35	25.64	69.99	2.12	3.0%	72.11
Ha'apai	44.35	25.64	69.99	2.12	3.0%	72.11
'Eua	44.35	25.64	69.99	2.12	3.0%	72.11

The new power tariff is still 18% lower than the power price of 87.79 seniti back in February 2015. Without the operation of the solar and wind projects the electricity tariff would be higher at 78.11 seniti/kWh instead of the 72.11 seniti/kWh today, according to TPL. There is also contribution from lower diesel prices and from reduced losses under the Tonga Village Network Upgrade programme.

Tariff affordability. Population of Tonga is paying the current tariffs. This level of tariff defines the current demand. If average tariff will decrease, demand will go up accordingly. Tariffs in Tonga are high in absolute terms because of the fuel costs, remoteness, low consumption per customer, and low load density. Tariffs are very high as a proportion of income considering low average incomes in Tonga. Feedback from all consumer groups is that most residential customers have difficulty paying the monthly electricity bill. Disconnections for non-payment are very frequent (approximately 7% of customers per month). The reconnection fee of TOP 30 is a significant burden. Several hundred customers remain disconnected from the network because they cannot afford to pay for electricity. Now TPL is considering reducing this fee. Smart or prepay meters will reduce costs of reconnection, that is about TOP 554,000⁵⁸ per year

Tariff efficiency. There are cross-islands subsidies. Greater scale and load density on Tongatapu reduces generator fixed costs, network costs and customer service costs per unit of energy distributed compared to other islands. For instance, non-fuel costs for Ha'apai and Vava'u is about twice of that of Tongatapu as shown in Table 40.

Table 40. Cost of Supply across Islands

Island	Cost of Supply		
	Fuel (s/kWh)	Non-Fuel (s/kWh)	Total (s/kWh)
Tongatapu	42	33	75
'Eua	49	141	190
Vava'u	49	61	110
Ha'apai	51	99	150
Uniform Tariff	43	43	86

Source: Tonga: Review of Regulated Electricity Prices. Paul White, Sep 2013

Also, there are also cross-consumer group's subsidies. The current tariff (72.11 s/kWh) is variable and is poor as small customers make little contribution to fixed costs. The smallest half of customers by consumption recover less than 10% of system costs, so large customers subsidize small customers. Because large customers carry such a large proportion of fixed charges, it is often financially viable to install

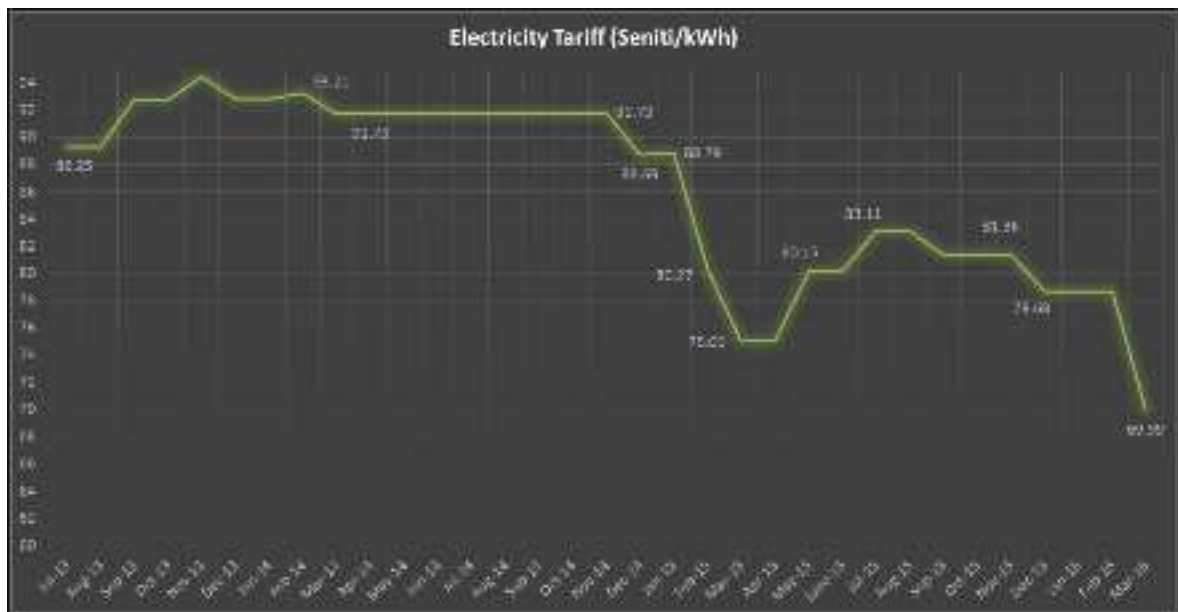
⁵⁸ 7% x 22000 customers x 30 TOP x 12 months = TOP 554,000.

their own generation and, in particular, rooftop solar. For each TOP 1.00 of revenue lost by TPL as large customers self-generate, only TOP 0.50 of system costs are avoided.⁵⁹ In the short run this impacts TPL's financial performance. In the long run, prices to all customers will increase, making self-generation attractive to more of the bigger customers. If TPL is not careful in tariff setting policies, potentially the viability of the network could collapse. Also, while self-generation might become financially attractive for large consumers, Government/Regulator/TPL could put a cap on the quantity of self-generation allowed on Tongatapu both to enable TPL to control their system better and for national benefit (particularly cross-subsidy for the poorest users).

Tariff sustainability: Economic efficiency is necessary to promote an allocation of resources and recovery of the cost of supply in a way that maximises the benefit to society as a whole. This can be achieved by setting the variable price equal to the long-run marginal cost (LRMC) of supply; and recovering the remaining allowed revenue in the way that least distorts customers' consumption decisions. The LRMC of supply is the cost of generating one additional unit of electricity including both variable costs (fuel, O&M costs, etc.) and required capital expenditures. If the variable part of the tariff is greater than the LRMC then this leads to inefficiency that some efficient commercial activity may be discouraged (potential profitable energy intensive businesses may become unprofitable if forced to pay a price greater than the LRMC of supply). Also, it may force customers to generate their own electricity at a cost lower than the tariff. If the variable part of the tariff is less than the LRMC then customers will use too much electricity.

Overall, the TPL tariff has reduced in the past three years as shown in in Figure 7.

Figure 7. Tariff Changes during 2013-2015



Source: TPL Annual report 2015

The political economy and political will: The political economy and political will with regard to the Project has been assessed by analysing sustainability of funding implications, tariff and affordability for the Government. It is shown that the Project can sustain non-concessional funding with no grant elements and including potential private co-financing.

NNUP contributes towards Government target of 50% RE by 2020, as without sound and reliable network with sufficient capacity it is impossible to provide RE to the population of Tonga.

It was calculated that the Project can reduce the levelised cost of energy (LCOE) supplied by TPL by 5 Seniti/kWh if the Project is financed with non-concessional loan at current TPL's financing costs of 6.3%; and can reduce LCOE by 9 Seniti/kWh if the Project is financed with concessional loans (assuming 80% to 20% of debt to equity ratio). The Government and TPL will get more potential for Tariff decrease in case of concessional funding with grant elements. If the non-TPL costs were 100% grant funded, the reduction in

⁵⁹ Tonga: Review of Regulated Electricity Prices, P. White, 2013.

LCOE would be by 15.2 Seniti/kWh. If the non-TPL costs were 50% grant funded and the remaining 50% were financed by concessional loan, the reduction in LCOE would be by about 12.5 Seniti/kWh. Potential funding sources include ADB, NZ Government, EIB and others.

As the current tariff is at cost recovery level, it allows sound financial positions and long-run sustainability for TPL. However, economic efficiency of Tariff shall be monitored accordingly as the existing cross subsidies cause some economic inefficiencies as discussed above. In particular, TPL should be aware at what level of tariff it becomes more economic for its big consumers to turn to their own generation.

Overall, when setting tariff it shall take into account the following three factors, as was discussed: (i) economic efficiency; (ii) customer equity (fairness); and (iii) government policy.

For efficiency purposes sophisticated tariff structure can be considered when TPL will have installed smart meters for all or most of its consumers. As of July 2016, there are around 16,500 active meters on Tongatapu. Under this Project around 7,000 active meters are to be replaced by smart meters and also around 1,400 new smart meters to be added (most of them are disconnected meters for various reasons) in the Nuku'alofa area. TPL, under its separate plan, has already installed 500 smart meters and will install 3,000 more in about 12 months' time, mostly in the village areas. TPL is considering replacing the remaining 4,500 meters by smart meters sooner after that.

The electricity price decreased in the past years, following diesel price fall, giving positive effect to the Tongan economy. The diesel price fell about 35% during FY2014/2015. This diesel reduction translated to about a 13% reduction in the electricity tariff in Tonga.

9.10 TPL Financial Performance and Projections

At this stage it was assumed that TPL will most likely act as executing and implementing agency for this NNUP Project. Therefore, TPL's financial performance were analysed based on the TPL's Annual report for 2015 that contains the TPL's financial data for 2010-2015. Also, TPL financial projections were analysed based on the data provided in the updated TPL's Business plan 2017-2020.

Key Financial Variances during the past year

- Cost of sales decreased by 11% to TOP 29 million due to reduction in diesel fuel price.
- Administrative and other expenses rose by 16% to TOP 6.7 million driven mainly by the increased depreciation expenses (TOP 1.3 million is depreciation on donated assets and is matched with the same amount by releasing of deferred income) and insurance (up by TOP 0.175 million due to the insurance purchased for donated assets to date).
- Distribution expenses decreased by 15% (from TOP 5.9 million to TOP 5.0 million) due to decrease in total repairs and maintenance as a result of implementation of the TVNUP. Repairs and maintenance decreased by 27% from \$3.9 million to \$2.8 million.
- Property and equipment balance increased by 40% to TOP 111.6 million due to addition of distribution and RE assets acquired during the year 2015.
- Depreciation expense rose by 2.4% during the year as a result of the increase in donated assets.
- Borrowings increased by about 50% due to increases in loan finances of the new MAK Generator (TOP 10 million) and acquisition of Tonga Gas Ltd (TOP 3 million). As a result, the gearing ratio (Debt/(Debt + Equity)) increased from 19% to 26%. However, TPL debts service obligations are adequately covered as reflected in the interest cover ratio.

Measures to improve the TPL's financial positions

TPL's major strategic objectives are to: (i) provide a safe, reliable, affordable and sustainable electricity supply throughout the Kingdom of Tonga, (ii) maximise shareholder value while maintaining prudent levels of exposure to operational and financial risks.

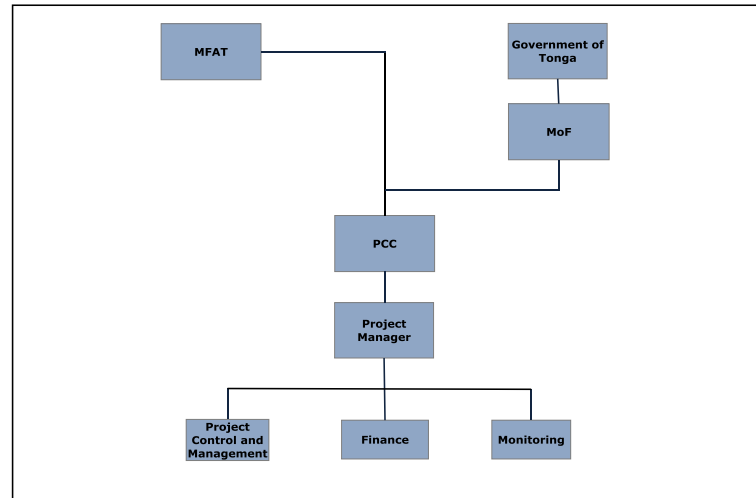
As at June 2015, TPL's labour force was 177 permanent staff and 30 casual/trainee staff (50 at TPL Head Office including 10 management staff, 68 - at the Distribution Office, and 24 at the Power Station). The system is semi-automated with SCADA monitoring.

Annual consumption in the Project area is 33.26 GWh according to the actual billing data from TPL Accounting (from April 2015 to May 2016).

As these benefits are relatively small compared to other benefits, it was not included in this analysis.

Management and governance arrangements and structure for the Project have not been defined yet.

Figure 8. TVUNP Governance Organisation



The on-going TVNUP has been governed through a Project Coordination Committee (PCC), which reported to the GoT, through MoF, and New Zealand’s MFAT. The PCC comprised: CEO of TPL, Representative of the TERM Implementation Unit (TERM-IU), Representative of MoF, Representative of MFAT, TPL Finance Manager, and The Project Manager. The governance organisation is shown in Figure 8. The lines show direct lines of governance and formal lines of communication. The PCC has served as broad oversight, leaving the Project Manager to be individually responsible for operational decisions. The PCC has overseen the overall direction of project implementation.

The financial performance of TPL (refer Table 41) for the past six years has been strong and sustainable.

Table 41. TPL Financial Performance 2010-15

30-Jun-15	2010	2011	2012	2013	2014	2015
Revenue	\$36,321,524	\$40,124,291	\$44,038,707	\$41,782,742	\$48,505,746	\$46,100,465
Expenses	\$31,915,137	\$35,172,632	\$40,782,045	\$38,844,083	\$44,991,917	\$43,554,963
Profit Before Tax	\$4,406,387	\$4,951,659	\$3,256,662	\$2,938,659	\$3,513,829	\$2,545,502
Tax Expense	\$1,524,510	\$1,237,915	\$780,314	\$713,692	\$878,457	\$636,376
Declared NPAT	\$2,881,877	\$3,713,744	\$2,476,348	\$2,224,967	\$2,635,372	\$1,909,126
Effective NPAT	\$2,881,877	\$3,713,744	\$2,476,348	\$2,224,967	\$2,635,372	\$3,800,000

During the last five years, TPL had paid an accumulated sum of TOP 8.8 million in dividend and income tax to the Government of Tonga.

Some financial performance targets were not achieved due to fuel hedging costs, which reduced NPAT from \$3.8 m to \$1.9 m. As a result, ROE fell to 3.5% compared to its target value of 10%. ROA and capital structure targets were not achieved due to an increase in the asset base and debt finance. Key performance indicators in the past six years were as shown in Table 42.

Table 42. TPL Key Performance Indicators 2010-15

KPIs	2015 (Targets)	2015 (Actuals)	2014 (Actuals)	2013 (Actuals)	2012 (Actuals)	2011 (Actuals)	2010 (Actuals)
Financial							
Profitability (Net Profit Margin)	4%	4.4%	5.7%	5.3%	5.6%	9.3%	7.9%
Return on Assets	4%	1.6%	3.3%	3.7%	4.2%	6.9%	5.6%
Return on Equity	10%	3.4%	4.7%	4.5%	5.2%	8.8%	7.5%
Return on Investment	8.5% (WACC)	2.5%	3.8%	3.8%	4.5%	7.5%	6.1%
Gearing Ratio	24%	25.9%	19.4%	15.4%	13.7%	14.6%	18.4%
Interest Time Cover	4.3	5.0	4.7	5.2	6.1	6.8	5.8
Dividend Yield		3.4%	2.8%	1.3%	1.6%	1.9%	2.0%
Current Ratio	1.5	0.9	1.7	1.8	1.0	0.8	0.9
Number of shares		1031	1031	1031	1031	1031	1031
Earnings Per Share		\$1,852	\$2,556	\$2,158	\$2,402	\$2,556	\$1,852
Dividend per Share		\$1,843	\$1,533	\$755	\$841	\$970	\$970
Non Financial							
Customer Service Levels (%)	100%	95%	95%	95%	95%	90%	90%
Generation Capacity (MW)	16	16.5	15.5	15	14	14	14
Load Factor (%)	62%	70%	65%	64%	68%	69%	73%
Line Losses (%)	12%	11.26%	12.30%	12.90%	14.60%	16.20%	17.70%
Fuel Efficiency (kWh/L)	4.15	4.11	4.06	3.99	4.08	3.95	4.13
SAIDI (Average Outage Time per Customer) (minutes)	1120	1125	1058	1138	2000	4765	3582
Number of HV Outages		445	430	265			
Low Voltage Complaints		200	300	354			
High Voltage Complaints		6	6				
Loss Time injuries (LTIs)	0	0	0	0	0	0	0

The objective of the TPL's Business Plan is to achieve the Government's core purpose to "reduce Tonga's vulnerability to oil price shocks by increasingly accessing to state-of-the art energy technologies in an affordable and environmentally sustainable manner". In order to achieve this objective, TPL must reduce its reliance on Diesel Generation and introduce a higher proportion of Renewable Energy (RE) generation. Over the past three years, TPL has achieved approx. 8% penetration of RE, leaving 92% of generation from diesel. The objective is to reach 50% penetration of RE by 2020, which is the target set by the Government. In order to achieve this objective, TPL will require 15.3 MW of RE (8.7 MW of Solar and 6.6 MW of Wind) and at least 20 MWh of storage capacity. As a result of this 50% RE penetration, up to 20 Seniti/kWh in tariff reduction can be achieved, according to the TPL's Business Plan.

Funding could be a challenging task, as TPL will need to raise about TOP 166 million to fund these projects. Funds will need to be raised either from Development Partners, International Financial Institutions, private investors and others. TPL will require strong Government support to meet the objectives outlined in its Business Plan out to 2020.

So, TPL will need to find funding for and contribute from its own capital to this Network Upgrade Project in addition to the above RE projects.

As a necessary step to keep and further improve its financial positions and ability to finance required investments, including the NNUP, TPL needs to closely monitor its major risks as indicated below.

Major risks

Foreign exchange risk arises from recognised assets and liabilities that are denominated in foreign currencies, primarily with respect to NZD and USD. As a measure, prompt settlement of liabilities should be exercised by management to minimise the exposure to foreign exchange losses. As an additional measure, TPL could negotiate competitive rates with its bankers to minimise losses and maximise gains when receipts and payments become due. To determine company's sensitivity to foreign exchange risk, an implied volatility in exchange rates is calculated based on the maximum variation of month end spot rates from the average exchange rate in the year. Minimal asset and liability balances are maintained in overseas currencies, hence, there has been little sensitivity to movements in the NZD and USD.

Interest rate risk. As the company's interest bearing assets are small relative to its operations, its cash flows are substantially independent of changes in market interest rates. Also, the company's interest bearing borrowings are in the form of long-term borrowing and at a fixed interest rate. Given the fixed nature of interest rates there is a high level of certainty over the impact on cash flows arising from interest income and expenses.

Credit risk is the risk of financial loss to TPL if its financial counterpart fails to meet its contractual obligations and arises principally from the company's account receivables. TPL has a credit policy in place

and the exposure to credit risk is monitored on an ongoing basis. Credit risk on financial assets is minimised by dealing with recognised monetary institutions with accepted credit ratings. TPL ensures that sales of products and services are made to customers with an appropriate credit history.

Capital risk management. TPL's objective is to provide shareholders with a consistent level of returns. Capital is monitored on the basis of the gearing ratio. This ratio is calculated as net debt divided by total capital. Net debt is calculated as total borrowings (including 'current and non-current borrowings' as shown in the statement of financial position) less cash and cash equivalents. Total capital is calculated as 'equity', as shown in the statement of financial position, plus net debt. During the past year the Company secured (1) additional loan of TOP 1.2 m to cover costs for the final stages of installation of new MAK Diesel Generator. The loan is repayable at a rate of TOP 97,000 (including interest and principal) per month, over a period of 13 years and attracts an interest rate of 4.25% per annum, (2) additional loan of TOP 3.2 m for the acquisition of Tonga Gas Limited. The loan is repayable at a rate of TOP 20,000 (including interest and principal) per month, over a period of 7 years and attracts an interest rate of 4.25% per annum, and (3) new loan of TOP 7 m to finance the purchase and installation of Prepaid Smart Metering.

Table 43. TPL Revenues and Operating costs 2014-15

	Consolidated		Company	
	2015	2014	2015	2014
	\$	\$	\$	\$
REVENUE				
<u>Regulated Revenue</u>				
Fuel	20,565,953	24,262,107	20,574,656	24,265,580
Non-fuel	21,192,666	19,907,530	21,192,666	19,907,530
Gas	5,961,589	6,038,789	-	-
	<u>47,720,208</u>	<u>50,208,426</u>	<u>41,767,322</u>	<u>44,173,110</u>
<u>Non-regulated Revenue</u>				
Fees	310,030	308,002	310,030	308,002
Customer reconnections/disconnections	374,137	431,822	374,137	431,822
Upgrade and repairs	858,333	1,065,176	858,333	1,065,176
	<u>1,542,500</u>	<u>1,805,000</u>	<u>1,542,500</u>	<u>1,805,000</u>
	<u>\$ 49,262,708</u>	<u>\$ 52,013,426</u>	<u>\$ 43,309,822</u>	<u>\$ 45,978,110</u>
	Consolidated		Company	
	2015	2014	2015	2014
	\$	\$	\$	\$
PROFIT BEFORE INCOME TAX				
Profit before income tax has been determined after charging as expenses:				
	<u>\$ 2,597,805</u>	<u>\$ 3,540,764</u>	<u>\$ 2,545,502</u>	<u>\$ 3,513,829</u>
(a) Cost of sales				
Fuel cost	19,768,369	23,583,014	19,768,369	23,583,014
Gas cost	4,802,393	5,438,876	-	-
Salaries & wages	2,625,683	2,731,465	2,625,683	2,731,465
Superannuation contribution	120,719	97,828	120,719	97,828
Third party costs	1,740,156	776,563	1,740,156	776,563
Maintenance costs	2,091,879	2,441,163	2,091,879	2,441,163
Supplies & consumables	244,458	215,134	244,458	215,134
Rent/ lease expenses	190,669	239,342	190,669	239,342
Other repairs	117,353	73,728	117,353	73,728
Depreciation of generation equipment	987,249	1,263,631	987,249	1,263,631
Other expenses	923,112	962,470	923,112	962,470
	<u>\$ 33,612,040</u>	<u>\$ 37,823,214</u>	<u>\$ 28,809,647</u>	<u>\$ 32,384,338</u>
(b) Selling and distribution expenses				
Media announcements	165,637	121,263	68,729	73,994
Loss on disposal	-	1,478,671	-	1,478,671
Repairs and maintenance	809,475	1,551,794	800,705	1,551,794
Depreciation of the distribution network	4,155,748	2,853,113	4,155,748	2,853,113
	<u>\$ 5,130,860</u>	<u>\$ 6,004,841</u>	<u>\$ 5,025,182</u>	<u>\$ 5,957,572</u>

(c) Administrative and other expenses				
Auditor's remuneration - audit services	62,030	54,060	41,500	39,560
Bad and doubtful debts expense	(4,102)	58,673	37,258	30,030
Bank charges	152,583	85,598	152,583	85,598
Depreciation of property, plant & equipment	1,094,403	1,054,098	949,087	983,668
Amortisation expense of intangible assets	109,681	108,797	108,798	108,797
Electricity Commission fees	531,389	517,536	531,389	517,536
Insurance	902,688	678,214	835,058	658,217
Directors' emoluments (Note 26)	153,021	157,011	117,931	134,046
Legal and professional fees	445,068	806,945	411,669	768,270
Recruitment costs	182,142	68,591	182,142	56,636
Repairs and maintenance	122,033	44,172	62,738	32,217
Salaries and wages	2,254,736	1,802,047	1,914,561	1,518,229
Superannuation contribution	54,345	39,584	43,146	32,168
Other expenses	1,374,460	837,393	1,327,883	818,202
	\$ 7,434,477	\$ 6,312,719	\$ 6,715,743	\$ 5,783,174

TPL's revenues and costs for the past two years were as shown in Table 43.

TPL's financial projections are provided in the updated TPL's Business plan 2017-2020. Summary of Financial Projections are shown in Table 44.

Table 44. Summary of Financial Projections for TPL

	2017	2018	2019	2020	2021
	1 Jul-30 Jun	1 Jul-30 Jun	1 Jul-30 Jun	1 Jul-30 Jun	1 Jul-30 Jun
Total Revenue	36,807,700	37,186,916	36,715,303	37,601,288	38,508,378
Total Expenses	24,051,917	24,007,977	23,210,258	23,691,183	24,048,992
EBITA	12,755,783	13,178,938	13,505,045	13,910,105	14,459,386
Depreciation	6,930,372	7,382,128	7,882,324	8,188,636	8,688,978
Interest	1,175,630	1,231,731	1,152,080	1,083,492	875,976
Income Tax	1,162,445	1,141,270	1,117,660	1,159,494	1,223,608
NPAT	3,487,336	3,423,809	3,352,980	3,478,482	3,670,824
Variance		-1.8%	-2.1%	3.7%	5.5%

TPL is expecting to achieve a net profit after tax of about TOP 3.5 million at the end of the 2017 financial year. Profitability level of the company is stabilised as it is projected that the company will continue to be profitable in the years to follow. Furthermore, TPL is expected yield 10% Return on Shareholder's Fund at the end 2017 financial year. Total revenue is forecasted to be at TOP 36.8 million at the end of 2017 and is expected to increase steadily by 1% from 2018 onward. Total expenses is expected to remain generally stable at 24 million from 2017 to 2021.

Even though TPL is proposing a dividend of 35% of its Net Profit after Tax (NPAT), the final amount will always be negotiated between the TPL Board and the Minister at end of each financial year. The estimated dividend for 2017 financial year will be TOP 1.2 million. The previous year's dividend was 105% of NPAT which was equated to TOP 1,318 pay out for each ordinary share issued.

Based on TPL current financial position and cost recovery and sustainability of the tariff these projections seem to be reasonable.

9.11 Conclusion

The results of the financial analysis indicated that the overall FIRR for the Project is 15.4% and NPV is NZD 45.02 million meaning that the overall Project is financially feasible, as shown in Table 45.

Table 45. FIRRs and Sensitivity analysis for Subprojects

	Base Case	Investment costs up by 10%	O&M cost up by 20%	Loss reduced down to only 8% (not 5%)	Increase of consumptions less by 20%
FIRR	15.4%	13.6%	14.1%	14.7%	13.9%
FNPV, NZD ('000s)	45.0	40.1	39.9	42.1	37.2

The Subprojects are individually financially viable and are resilient to key risk factors based on the results of the sensitivity analysis, as shown in Table 46.

Table 46. Project and Subprojects FIRRs and FNPVs

Subprojects	FIRR	FNPV, NZD million
Area 1	27.0%	13.45
Area 2	15.9%	9.68
Area 3	16.4%	11.24
Area 4	12.0%	4.87
Area 5	9.6%	3.49
Overall Project	15.4%	45.02

The total Project cost is about NZD 52.8 million and TPL's minimum contribution is about 6% of the total costs or NZD 3.0 million, as shown in Table 47.

Table 47. Total Project costs (NZD)

	TOTAL	TPL Contribution	Donor/Loan/Private co-financing
Project Management	2,093,709	815,773	1,277,936
Construction staff	3,660,482	0	3,660,482
Vehicles	2,685,000	0	2,685,000
Technical tools	186,000	0	186,000
Other Equipment	2,299,497	0	2,299,497
Materials	37,870,892	0	37,870,892
Project Works	2,197,518	2,197,518	0
Pre-pay metering	1,807,568	0	1,807,568
TOTAL PROJECT COSTS	52,800,666	3,013,291	49,787,375
	100%	6%	94%

It is worth noting that TPL and the Government are approaching their debt ceiling so may not be able necessarily take on more commercial loans at this point. Based on the financial analysis, the Project can be financed by non-concessional funding with no grant elements and including potential private co-financing.

Government and TPL need to seek potential private co-financing. It is important to note that the current tariff is at cost recovery level. This allows sound financial positions and long-run sustainability not only for TPL, but also positive return for involved private parties.

The political economy and political will with regard to the Project has been assessed by analysing sustainability of funding implications, tariff and affordability for the Government. Also, NNUP contributes towards Government target of 50% RE by 2020, as without sound and reliable network with sufficient capacity it is impossible to provide RE to the population of Tonga.

It was calculated that the Project can reduce the LCOE supplied by TPL by 5 Seniti/kWh if the Project is financed with non-concessional loan at current TPL's financing costs of 6.3%; and can reduce LCOE by 9 Seniti/kWh if the Project is financed with concessional loans (assuming 80% to 20% of debt to equity ratio). The Government and TPL will get more potential for Tariff decrease in case of concessional funding with grant elements become available. Potential funding sources include ADB, NZ Government, EIB and others.

Economic efficiency of Tariff shall be monitored accordingly as the existing cross subsidies cause some economic inefficiencies as discussed above. In particular, TPL should be aware at what level of tariff it

becomes more economic for its big consumers to turn to their own generation. While self-generation might become financially attractive for large consumers, Government / Regulator / TPL could put a cap on the quantity of self-generation allowed on Tongatapu both to enable TPL to control their system better and for national benefit (particularly cross-subsidy for the poorest users).

For efficiency purposes sophisticated tariff structure can be considered when TPL will have installed smart meters for all or most of its consumers. Under this Project around 7,000 active meters are to be replaced by smart meters (out of total 16,500 active meters on Tongatapu) and also around 1,400 new smart meters to be added.

Some financial performance targets of TPL were not achieved due to fuel hedging costs, which reduced NPAT from \$3.8 m to \$1.9 m. As a result, ROE fell to 3.5% compared to its target value of 10%. ROA and capital structure targets were not achieved due to an increase in the asset base and debt finance.

Appendix 1 Terms of Reference

TA 8345-REG: Establishment of the Pacific Region Infrastructure Facility Coordination Office (46500-001)

Terms of Reference

Due Diligence of Tonga Nuku'alofa Network Upgrade Project - DD NNUP

1 Background

The Pacific Regional Infrastructure Facility (PRIF) is a multi-agency coordination mechanism aimed at improving the delivery of development assistance from donors and development partners to the infrastructure sector in the Pacific region. Current PRIF partners are Asian Development Bank (ADB), Australian Department of Foreign Affairs and Trade (DFAT), New Zealand Ministry of Foreign Affairs and Trade (NZMFAT), World Bank Group (WBG), including the International Finance Corporation (IFC), European Commission (EC), European Investment Bank (EIB), and the Japan International Cooperation Agency (JICA).

PRIF supports infrastructure development and maintenance in Pacific Island Countries (PICs) through investment coordination, research and technical assistance.

Tonga is highly dependent on imported fuels to meet its overall energy requirements. Tonga's total fuel imports account for about 25% of all imports and about 10% of GDP⁶⁰. All grid-supplied electricity - over 98% of electricity used in Tonga - is based on diesel generation, which has exposed the Tongan economy and electricity consumers to high and volatile electricity prices linked to oil prices over the last ten years. Having realized the situation and aiming at reducing the vulnerability of the country to future oil price shocks, the Government of Tonga embarked on a process to develop the Tonga Energy Road Map 2010-2020 (TERM), which, with assistance of PRIF, was finalized in June 2010.

The objective of the TERM is to lay out a least cost approach and implementation plan to reduce Tonga's vulnerability to oil price shocks and achieve an increase in quality access to modern energy services in a financially and environmentally sustainable manner.

The drive for change and reducing Tonga's reliance on imported fossil fuels has been embraced by Tonga Power Limited (TPL)⁶¹ and has resulted in the formulation of its overarching strategy which aims to deliver the goals of the TERM. Central to this strategy is an efficient and 'smart' electricity distribution system where the benefits of renewable energy generation can be effectively delivered to the consumers of electricity. Ultimately this will result in the significant socio-economic benefits that the TERM represents and strives for being realized. TPL's overarching strategy also recognizes the need for sustainability of the utility in the midst of the transformation that is taking place in the industry.

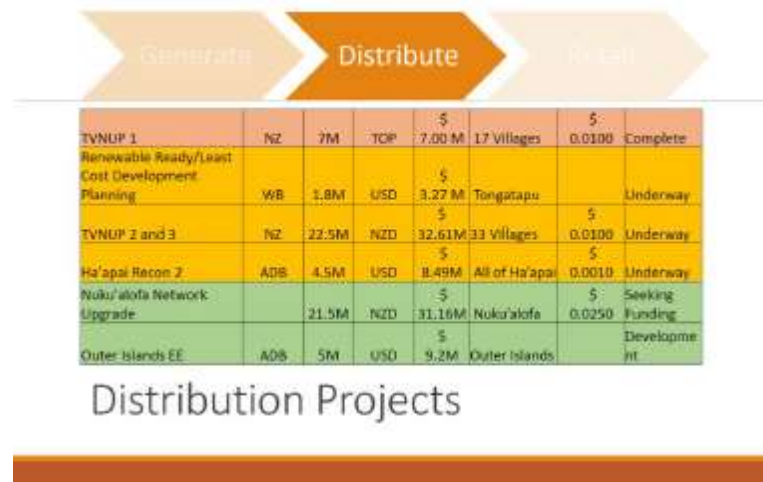
TPL's strategy in line with the TERM and the Government of Tonga has resulted in numerous project proposals that range from renewable energy generation through natural resources such as solar, wind and biomass, to network upgrades and advanced and prepayment metering. In terms of distribution, TPL has developed 6 projects aimed at distributing electricity safely, effectively and efficiently. Most of these projects have found favour with development partners, with one project completed, three underway and two projects under development, as per the table below:

One of the projects identified by TPL and prioritized in the Tonga National Infrastructure Investment Plan 2013⁶², is the Nuku'alofa Network Upgrade Project (NNUP), which affects the most densely populated area of Tonga (approximately 21% of the population) including the CBD of the main island Tongatapu where the majority of the daily economic activity and 60% of electricity consumption in Tonga as whole occurs.

⁶⁰ Source: Tonga Statistics Department

⁶¹ Tonga Power Ltd (TPL) is a state owned enterprise that supplies electricity to four main Islands in Tonga (Vava'u, Ha'apai, 'Eua, and Tongatapu).

⁶² With the assistance of PRIF.



The Government of Tonga reached out to Development Partners (DP) for funding of the estimated USD 20 m Nuku'alofa Network Upgrade Project and there are discussions for a potential joint collaboration within EIB and NZMFAT. In that light, the PRIF Coordination Office (PCO) has been requested to undertake a due diligence exercise to assess the merits and level of prioritization of this project vis-a-vis other investment allocations in Tonga and to ensure it meets specified technical, financial, procurement and safeguards criteria. The due diligence would benefit PRIF partners who are considering supporting the Nuku'alofa Network Upgrade Project and will support their efforts to streamline and expedite subsequent approval, if they decide in favor of supporting the project financially. The due diligence may also be useful in potentially attracting private co-financing.

2 Objective and scope of work

The objective is to conduct a due diligence of the Nuku'alofa Distribution Network Upgrade Project and submit a Due Diligence Report. The report will include technical, economic, financial, implementing agency, procurement, as well as environmental and social safeguard analysis including risk assessment, as follows:

Technical Analysis will include:

- i. Assessment of technical aspects of the proposed network upgrade, including the appropriateness of technology, features and efficiency characteristics, risks, efficiency of the existing and proposed distribution network.
- ii. Assessment of compatibility with local conditions such as local capacity for operation and maintenance.
- iii. Analysis to determine if proposed network upgrade is technically sound, otherwise make further recommendations.

The technical analysis will include suggestions on project improvements and/or other project options that could enhance the efficiency of the Nuku'alofa distribution network.

Economic and Financial Analysis will include:

- i. Assessment of economic viability and sustainability of the project.
- ii. Cost-benefit analysis (including sensitivity and risk analysis) presented both in an aggregate form for the whole upgrade, and in suitable disaggregated form e.g. by feeder, suburb/village, etc.
- iii. Assessment of the financial viability and sustainability of the project (including the impact on connection fees and tariffs and associated affordability and willingness-to-pay issues).
- iv. Assessment of different financing structures combining different shares of grant and credit sources (terms and tenors of DPs financing sources for Tonga will be provided by relevant DPs) and TPL's counterpart financing.
- v. Determine possible financing plans including grant and concessional loans as well as other potential sources such as private co-financing.

- vi. Determine minimum amount of grant needed to reach financial closure - combined with other sources.
- vii. Assessment of the political economy and political will with regard to the project by analysing if the scope and implications for funding and tariff are sustainable and also affordable for the Government. Assess government's and TPL's ability to resource maintenance of the infrastructure in the medium-term.
- viii. Executing agency and implementing agencies' financial performance and projections to be reviewed and analysed (TPL will most likely act as executing and implementing agency of the NNUP project). Measures to improve the executing agency and implementing agencies' financial positions will be proposed.

The Due Diligence report will clearly indicate the benefits and the costs to both consumers and government. Previous economic analysis of similar projects in Tonga will be made available to be considered during the assessment.

Procurement Assessment will include:

- i. Assessment of national and TPL's procurement policies and procedures potentially to apply to the project.
- ii. Outline possible risks and shortfalls that demonstrate deficiencies of national procurement processes and capacities, with special attention to complaints mechanism and practices in place, and building on previous procurement assessments conducted by PRIF partners.

Implementing Agency Assessment will include:

Conduct a full risk assessments of TPL as the likely executing and implementing agency for the project as well as the operator and maintainer of the upgraded distribution network. Propose possible approaches to risk mitigation.

Environmental and Social Safeguard Assessment will include:

Environmental impact assessment, social impact assessment including gender analysis, involuntary resettlement and indigenous peoples' and other safeguards policies to be assessed in accordance with Safeguard Policies of NZMFAT and EIB. Review national regulations and standards.

3 Implementation Arrangements

The study will be carried out under the PCO Technical Assistance Programme and will be managed by a project manager from the PCO. PCO is administered by the ADB on behalf of the PRIF partners. It follows procurement and financial management procedures of the ADB.

PCO will establish a Steering Group for the TA, which will comprise EIB, NZFMAT and PCO. The steering group will guide the project team, review and approve the project deliverables.

The Government of Tonga will establish a small working group, which is anticipated to be led by the TERM. The members of the Working Group are expected to facilitate consultations, provide support and information and guide the consultants while in Tonga. The working group will contribute to the review of the project deliverables, although the firm will be responsible for preparing the project reports. TERM, through TLP, will provide office space and local support to the team of consultants while in country.

4 Output/Reporting Requirements

Inception Report: The inception report will include the approach and methodology for conducting the technical, economic, financial, implementing agency (including risk assessment), procurement, environmental and social safeguards analyses. The Inception Report will also include a detailed work plan and time schedule to achieve the project outcomes on time and within budget. The Inception Report will be submitted within 1 week of project commencement. The Report will be limited to 5 pages for each assessment, excluding annexes.

Draft Due Diligence Report: The Draft Due Diligence Report will include research, analysis and conclusions/recommendations on each assessment of the due diligence exercise, including technical,

economic, financial, procurement, implementing agency (including risk assessments), environmental and social safeguards. The Draft Due Diligence Report will be submitted no later than 1 week after the in-country mission. The Draft Due Diligence Report will be submitted to PCO for distribution to Government stakeholders and PRIF partners for comments and review.

Final Due Diligence Report: The Final Due Diligence will address the comments from the PRIF partners and the Government, and will be submitted two weeks after receiving the comments.

5 Qualifications

The firm will have extensive experience conducting due diligence and/or pre-feasibility studies of energy projects following PRIF partner processes and policies (NZMFAT and/or EIB is desirable), preferably in the Pacific Region. Details and proof of firm's previous experience must be included in the EOI.

The firm will propose a team of highly-qualified consultants to undertake the due diligence tasks. As an indication, the team may consist of an Energy Specialist / Team Leader (with experience in procurement assessments), an Energy Financial and Economic Specialist, a Social Development Specialist, and an Environmental Specialist.

The firm is encouraged to propose a team structure that will best suit the skills and qualifications of their proposed team, ensuring that all technical aspects of the due diligence are covered. The EOI should demonstrate value for money in terms team structure, work plan and staffing time schedule. Appropriate level of in-country presence is required.

The team of consultants will each have:

- (i) relevant tertiary qualification,
- (ii) at least 10 years of general professional experience,
- (iii) at least 7 years of experience in their relevant fields,
- (iv) demonstrated analytical skills in their area of expertise,
- (v) strong interpersonal and communication skills,
- (vi) be fluent in written and spoken English, and
- (vii) experience in the Pacific region (desirable).

6 Timing

The due diligence is proposed to be carried out over 3 months, commencing in the second quarter of 2016. The final report is expected by 1 August 2016 the latest.

The mission starts with the arrival of the team in Tonga.

7 Outcome Indicators

The team of consultants will be required to report monthly to the PCO Project Manager on progress with implementation, emerging issues/risks and how they were/will be managed, and relationship management.

The performance indicators for the project are:

- achievement of outputs on time and to budget
- engagement of relevant organisations in project
- satisfaction of key stakeholders with the quality of the Due Diligence report and approach used by the team, and
- level of adherence to partner's project appraisal processes.

Appendix 2 Glossary

Date	Document	Publisher
Jun 16	TPL Business Plan 2017-2020	TPL
Jun 16	TA-8345 Due Diligence of Tonga Nuku'alofa Distribution Network Upgrade Project - Inception Report	SMEC
May 16	Environment Management (Litter and Waste Control)	Kingdom of Tonga,
May 16	Tonga Village Network Upgrade Project Stage 2-3 - Progress Report for period 01 Oct 15 to 31 Mar 16	TPL
Jan 16	Renewable Energy & Energy Efficiency Plan - Assessment Report	AETS Consortium
Jan 16	Tonga Utility Climate Proofing Feasibility Report	Risk Frontiers
— 15	Renewable Energy & Energy Efficiency Plan II - Monitoring and Evaluation Framework 2016-20	TERM
Nov 15	Customer Service Agreement	TPL
Nov 15	TPL Annual Report 2104-2015	TPL
Jun 15	TPL Business Plan 2016-2020	TPL
Sep 15	Environmental Management Plan, Upgrade of Grid in Preparation for Renewables (Tongatapu)	TPL
Sep 15	The Second Electricity Concession Contract between TPL, the Electricity Commission and the Kingdom of Tonga	TPL/EC
Aug 15	Tonga Energy Road Map (TERM) Review/ Implementation Report 2010-2014	TERM
Jul 15	Tonga National Infrastructure Investment Plan - Annual Monitoring Report 2015	Philippe Bergeron
May 15	Tonga Strategic Development Framework 2015-2025	MoFNP
May 15	Upgrade of Grids and Preparing the Utility for Operations with Renewable Energy Plants Stage 2 - Modelling of Renewable Energy Penetration Scenarios	Aecom NZ
Dec 14	Environmental Impact Assessment Proposed Biomass Power Generation Plant at 'Eua	Nailasikau Halatuituia
Nov 14	TPL Regulatory Annual Report 2103-2014	TPL
Jul 14	Nuku'alofa Network Upgrade Project (NNUP): Project Paper	TPL
May 14	TPL 2014. Environmental Impact Assessment (EIA) and Impact Management Plan For the Tongan Village Network Upgrade Project Stage 2 & 3	TPL
May 14	Upgrade of Grids and Preparing the Utility for Operations with Renewable Energy Plants - Synchronous Modelling Report	Aecom NZ
Apr 14	Tonga Village Network Upgrade Project - Results Framework	Wedgewood White
Dec 13	Environment, Climate and Social Office, Environment and Social Handbook, Version 9.0	EIB
Oct 13	TPL Generation and Network Development Plan 2013-2018	TPL
May 13	Tonga: Review of Regulated Electricity Prices	Wedgewood White
May 13	Tonga Village Network Upgrade Project - Stages 2 & 3 - Activity Design Document	Wedgewood White
Feb 13	Environmental, Health and Safety Guidelines: Electric Power Transmission and Distribution.	IFC
May 12	IEE Outer Island Renewable Energy Project - Phase 1 (200 kWp 'Eua Solar Power Plant)	TPL
Nov 11	Current and Future Climate of Tonga	Pacific Climate Change Science Programme (PCCSP)
Oct 10	Environmental Impact Assessment Regulation of 2010	Kingdom of Tonga
Aug 10	Environmental Management Act of 2010	Kingdom of Tonga
Jun 10	Tonga Energy Road Map 2010 - 2020	TERM
Sep 09	The EIB Statement of Environmental and Social Principles and Standards	EIB
Sep 03	Environmental Impact Assessment Act of 2003	Kingdom of Tonga

This page blank for double siding

Appendix 3 Project Villages

Area 1	Kolomotu'a and Kolofo'ou
Area 2	Mataki'eua, Tofoa to Fanga
Area 3	Fasi, Halaleva to Ma'ufanga
Area 4	Anana, Touliki to Popua
Area 5	West to Sopu

Table 48. Project Villages

Area	Village or Locality	11 kV Lines km	Totals	Area	Village or Locality	11 kV Lines km	Totals
1	Kolomotu'a	4	11.5	3	Ma'ufanga	3.2	5.1
	Kolofo'ou	2.1			Pili	0.7	
	Longolongo	0.7			Tuimatamoana	2.5	
	Teufaiva				QS Wharf		
	Mailetaha	1.8			Kinikinilau		
	Fatafehi	0.4			Faua Wharf		
	Maiteialona	1			Ahohinapolo		
	Nuku'alofa				SIC		
	'Atenisi				Ha'amoko		
	Telekava				Touliki	0.8	
	Kapetá	1.5			Anana	0.6	
	Siu'ilikutapu				Umisi	0.6	
	Havelu	1.4			Houmakelikao	2.3	
Fanga	5	Fangaloto	1.8				
Tofoa	4.8	Popua	1.2				
2	Lavengamāile	0.7	17.7	4	Vae Popua		8.0
	Poutaha	2.3			Papiloa		
	Mataki'eua	2			Montfort		
	Tupoulahi				Fokololo		
	Tongamai	1.5			Patangata	0.7	
	Vaololoa				Sia'atoutai	5.6	
	Havelu Tokelau				Sopu	2	
	Vaiola				Hofoa	1.8	
3	Fasi	1.7	12.3	5	Isileli	0.9	12.3
	Ngele'ia	0.2			Maui	0.5	
	Pahu	1.1			Halavave	0	
	Mataika	1.3			Kopulu	0	
	Halaleva	0.8			Tu'atakilangi	1.5	
Total 11 kV km						54.6	54.6

Source: TPL

This page blank for double siding

Appendix 4 Project Risk Assessment

Table 49. Project Risk Assessment

Risk Category and Description	Potential Impact	Likelihood	Consequence	Risk Profile	Proposed Risk Management	Responsibility
Political						
Customer satisfaction	Lack of confidence in TPL	Unlikely	Harms objectives	Low	TPL has a 24/7 faults call centre and all customer calls are logged. TPL does need to improve some areas	TPL
Opposition from local people or political players	Project delayed	Unlikely	Harms objectives	Low	Effective public relations and positive promotion of the project	TPL
Changes in GoT policies affect TPL commercial operation	Project curtailed	Unlikely	Prevents objectives	Low	Effective consultation and briefing of GoT Ministers	TPL
Project not in accordance with GoT policies	Project curtailed	Unlikely	Prevents objectives	Low	Effective consultation with relevant GoT Ministries	TPL
Organisational						
Project designs technically flawed	Poor delivery	Very unlikely	Prevents objectives	Low	Quality assurance processes implemented to provide peer reviews and confirm technical adequacy of the project designs.	TPL
Delay in delivery of project goods will affect project implementation	Project delayed	Possible	Delays objectives; damages reputation of PF	Medium	Apply forward planning techniques to evaluate and monitor the project's critical path	TPL
Quality of project construction below acceptable international standards	Poor delivery	Very unlikely	Prevents objectives	Low	Quality assurance processes implemented to ensure installation follows specifications as well as compliance with relevant regulations	TPL
Competency of TPL project staff	Poor delivery	Unlikely	Prevents objectives	Low	Ensure appropriate training and regular refresher courses are held following NZ industry codes	TPL
Competence of TPL staff to operate the network	Poor delivery	Unlikely	Prevents objectives	Low	TPL has a strong sound culture of staff training and maintaining or improving staff competency, generally following NZ best practice.	TPL
Inadequate generation capacity to meet increased	Poor delivery	Possible	Delays objectives	Medium	Update TPL's power planning Master Plan to identify short term and long term power	TPL

TA-8345 REG: Due Diligence of Tonga Nuku'alofa Distribution Network Upgrade Project
Due Diligence Report

Risk Category and Description	Potential Impact	Likelihood	Consequence	Risk Profile	Proposed Risk Management	Responsibility
power demand during project implementation Poor reliability of the network	Poor delivery	Unlikely	Prevents objectives	Low	requirements and implement additions in a timely manner TPL has an on-going programme to address any issues identified in the network integrity	TPL
Safeguards Environmental and or social issues encountered during implementation Consumers being injured or killed because of electrical accidents	Poor delivery Lack of confidence in TPL	Unlikely Possible	Prevents objectives Harms objectives	Low Medium	Safeguard monitoring process implemented and any identified issues addressed in an appropriate manner Introduce residual current device (RCD) protection in households; promote safe electricity education campaigns in schools and public forums	TPL TPL
Perceived adverse impact on environment	Project delayed	Unlikely	Harms objectives	Low	Effective public relations and positive promotion of the project	TPL
Dispute over siting of project equipment on private or public land	Project delayed	Unlikely	Harms objectives	Low	TPL survey team to ensure all equipment is sited on public land and in consultation with village leaders	TPL
Financial						
TPL's financial situation unable to ensure adequate project cash flow	Project curtailed	Unlikely	Prevents objectives	Low	Review and monitor financial status of project on an on-going monthly basis	TPL, GoT, PF
Project costs exceed estimates	Project cost overrun	Unlikely	Delays objectives	Low	ICB procurement to ensure best prices obtained; Cost estimates reviewed on a monthly basis	TPL, PF
Corruption in TPL organisation or project team	Project delayed due to insufficient funds	Unlikely	Harms objectives	Rare	Regular monitoring of cash flows and monthly reviews by TPL	TPL, PF

TPL = Tonga Power Ltd; GoT = Government of Tonga; PF = project financier;

Appendix 5 Work Programme

Indicative Activities	2016				2017				2018				2019				2020				2021				2022				2023			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
Project Detailed Design																																
Finalise detailed design			■	■	■																											
Finalise BoQ					■																											
Loan Formalised & Project Start				◆																												
Finalise Bidding Documents					■																											
Approval of Bidding Documents						■																										
Advertise Bidding Documents							■																									
ICB Bidding Process																																
Bidding Period								■																								
Evaluation and Approvals									■																							
Negotiations and Contract Award										■																						
ICB Procurement																																
Manufacture and Delivery of Goods										■	■		■	■		■	■		■	■		■	■									
Factory Acceptance Tests											■	■		■	■		■	■		■	■		■	■								
Delivery											■	■		■	■		■	■		■	■		■	■								
Implementation																																
Installation Works																																
Subproject 1: Kolomotu'a and Kolofo'ou 13 months																																
Subproject 2: Matakī'eua, Tofoa to Fanga 13 months																																
Subproject 3: Fasi, Halaleva to Maufanga 12 months																																
Subproject 4: Anana, Toulīki to Popua 9 months																																
Subproject 5: West to Sopa 10 months																																
Testing and Commissioning																																
Safeguards Monitoring																																
Capacity Building																																
On-the-job training for TPL staff																																
Reporting																																
NDUP Annual Review																																
Completion Report																																

This page blank for double siding

Appendix 6 Results Framework

Table 50. Project Results Measurement Table

Results	Indicators	Baseline and Targets	Methodology and Data Sources
Output: on completion Each subproject completed All five subprojects completed	<ul style="list-style-type: none"> 56 villages upgraded to new network 8,500 connections upgraded 	Baseline: 2016 data Targets: 8,500 customers supplied by upgraded distribution network	Results measured for each subproject area using TPL monthly statistics and monthly billing system
Short-term Outcome: 1 to 2 years Improved power supply	<ul style="list-style-type: none"> Improved power supply with less outages and better quality of supply Reduction in losses (both technical and non-technical); piggy-backing of customers supplying neighbours eliminated Previously disconnected customers reconnected; better access to a reliable supply Less damage during cyclones with more resilient network 	Baseline: 2016 data Targets: improved SAIDI and SAIFI indicators 2016 losses reduced by 5% >50% of disconnected customers in area now reconnected >70% of households in project area connected to TPL network	Results measured for each subproject area using TPL monthly statistics and monthly billing system
Medium-term Outcome: 2 to 5 years Improved power supply	<ul style="list-style-type: none"> Short-term outcomes continue Reduced number of non-payment disconnections 	Baseline: 2016 data Targets: improved SAIDI and SAIFI indicators 2016 losses reduced by 10% >75% of disconnected customers in area now reconnected >85% of households in project area connected to TPL network	Results measured each year using TPL Annual Statistics
Long-term Outcome: 5 to 10 years Improved power supply	<ul style="list-style-type: none"> Medium-term outcomes continue Improved electrical safety 	Baseline: 2016 data Targets: improved SAIDI and SAIFI indicators 2016 losses reduced by 15% 100% of households in project area connected to TPL network No deaths due to electrical incidents	Results measured each year using TPL Annual Statistics



**TA-8345 REG: Due Diligence of Tonga Nuku'alofa Distribution Network Upgrade Project
Due Diligence Report**

This page blank for double siding

Appendix 7 Environmental Assessment

A. Determination of Category of Assessment

FORM 1: DETERMINATION OF CATEGORY OF ASSESSMENT		
<p>Name: Address:</p> <p>Contact Officers of the Proponent: Proponent Company: <i>(Official Use Only)</i> Project ID No.:</p>		
Requirement:	Minor Assessment (Form 2)	Major Assessment (Form 3)
<p>The following information is to be included in the proposal to be submitted for assessment:</p> <ol style="list-style-type: none"> 1. full description of the proposed activity/development and its costs. 2. location of the proposed activity and of any associated developments. 3. full description of the existing environment of the sites and their relationship to existing adjoining uses or habitation; in particular details of any significant physical, biological, social or cultural heritage items which may be affected by the proposed development or activity. 4. timing of design, construction and operation of the development. 5. estimated type, source and volume of any materials to be used in the construction and operation of the development; and proposed demand for utility services. 6. any plant or animal species to be introduced which are not native to Tonga. 7. any likely solid, liquid or gaseous emissions from the activity/development, whether or not totally contained upon site. 8. likely noise generated by the development, and assessment of likely increases in traffic flow. 9. employment likely to be generated by the activity/development, and contribution (if any) to the local or national economy. 10. assessment of anticipated environmental risks and impacts, and measures to be taken by the proponent to mitigate the same. <p style="text-align: center;"><i>Please attach proposal to this form.</i></p>		

B. Protected Wildlife Fauna

PROTECTED BIRDS

(Act No. 13 of 1934, G. 118/31, 29/33)

Local Name	English Name	Scientific Name	Period for which protected
1. Pekepeka	Edible Swiftlet	<i>Collocalia francica</i> (Gmel.)	1st January to 31st December
2. Fuleheu	Land Bird	—	
3. Henga	Samoa blue Lory	<i>Vini Australis</i> (Gmel.)	
4. Kaka	Parrot (peculiar to 'Eua)	—	
5. Kaleva	Small Land Bird	<i>Ptilopus</i>	
6. Kulukulu	Purple crowned Dove	<i>porphyraceus</i> (Forster)	
7. Malau	Megapod	—	1st May to 31st January
8. Misi	Savage Island Starling	<i>Aplonis Tabuensis</i> (Gmel.)	
9. Moho	Tongan Rail	<i>Porzana Tabuensis</i>	
10. Tu	Land Bird	-	
11. Lupe	Wild Pigeon	-	

SECOND SCHEDULE

PROTECTED FISH AND TURTLE

(Replaced by Act 24 of 1974.)

Local Name	English Name	Scientific Name	Period for which protected
1. 'Ava 'i Ano	Turtle (except Leatherback)		1st January to 31st December
2. Fono (except the species known as Leatherback)	Leatherback Turtle	<i>Dermochelys coriacea</i>	1st November to 31st January
3. Leatherback Turtle			1st January to 31st December

C. Examples of Activities and their Classification

NZMFAT Environmental and Social Impact Guideline

Example Activities: Category A

- Large-scale infrastructure involving land use change
- Large-scale wind and solar farms
- Medium and large-scale bioenergy development
- New airstrips, ports, and related transport infrastructure
- Activities taken place within or immediately adjacent to nationally or internationally designated area of conservation or heritage
- Large-scale industrial or agricultural Activity
- Large-scale land reclamation or coastal development
- Large-scale commercial fishing and logging
- Large-scale afforestation/reforestation, including logging operations
- Large-scale aquaculture/mariculture
- Use of mangroves or wetlands
- Dams or other large-scale water impoundments
- Water drainage, abstraction, or irrigation schemes of medium- or large-scale

Example Activities: Category B

- Maintenance or rehabilitation of roads, airstrips and other infrastructure
- Construction of new minor roads and medium-scale infrastructure such as public utilities
- Agro-industry projects of small and medium-scale
- Small-scale coastal developments
- Small-scale dams and water impoundment, irrigation and drainage schemes
- Small and medium-scale aquaculture and mariculture
- Small and medium-scale wind and solar farms
- Small-scale bioenergy development
- Small and medium-scale commercial fishing and logging

Example Activities: Category C

- Scholarships
- Technical assistance
- Workshops and meetings
- Research and extension in natural resources
- Replacement small-scale infrastructure (e.g. new electricity pylons) and maintenance of existing installations
- Capacity and institutional strengthening
- Health and education programmes that do not include infrastructure
- Business mentoring

D. Environmental and Social Screening Checklist

NZMFAT Environmental and Social Impacts Guideline

Questions	Yes (sig)	Yes	No	Comments
	A	B	C	
Will the Activity lead to adverse environmental, ecological, or public health impacts?				
Is the Activity taking place adjacent to or within an environmentally or culturally sensitive area? The following is a non-exhaustive list of examples: <ul style="list-style-type: none"> • Cultural heritage site • Designated protected or conservation area • Wetland, mangrove, coral reef, coastline 			<input type="radio"/> <input type="radio"/> <input type="radio"/>	
Will the Activity lead to any of the following? <ul style="list-style-type: none"> • Alteration, conversion, or degradation in the quality or quantity of critical habitats • Introduction of non-indigenous species • Decrease in land value (economic or amenity) due to noise, traffic congestion, degradation of environmental aesthetics etc. • Noise or vibration disturbances • Soil or coastal erosion • Water quality deterioration • Loss of agricultural productivity • Increase in levels of pollution, whether point-source (e.g. sea outfall) or diffuse (e.g. fertilizers contaminating ground or surface water) • Occupational health and safety risks due to physical, chemical, or biological hazards • Increased exposure to communicable disease • Increased access to tobacco, alcohol, and recreational drugs • Decreased access to nutrition 		<input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	
Will the Activity lead to unsustainable extraction, use, or management of living resources?				
Will the Activity involve an increase in the capacity or intensity of fishing, agriculture, or forestry?		<input type="radio"/>		
Will the Activity lead to a direct or indirect change in management practice from traditional to non-traditional with unknown consequences for sustainability of living resources?			<input type="radio"/>	
Is the Activity likely to trigger or exacerbate unresolved tenure conflicts concerning access rights or alternative uses of natural resources?			<input type="radio"/>	
Will the Activity reduce resilience to climate change, climate variability, or natural hazards?				
Is the Activity taking place in an area subject to extreme events such as earthquakes, floods, landslides, tropical cyclones, storm surges, tsunamis?			<input type="radio"/>	
Could short or longer term changes in the climate (e.g. rainfall, air temperature, salinity) adversely impact the sustainability of the Activity?			<input type="radio"/>	
Are there demographic or socio-economic aspects of the area which are already vulnerable? e.g. high incidence of marginalized populations, informal settlements, urban poor			<input type="radio"/>	

Questions	Yes (sig)	Yes	No	Comments
	A	B	C	
Will the Activity contravene applicable environmental, labour or human rights laws, conventions or regulations?				
Having identified potential adverse impacts associated with the Activity, will one or more of these contravene any of the following? <ul style="list-style-type: none"> • international laws or conventions the Partner Government or New Zealand is signatory to • relevant national laws or regulations • local customary practice 			<input type="radio"/> <input type="radio"/> <input type="radio"/>	
Will the Activity lead to social harm, including societal divisions, corruption, loss of livelihoods, violent conflict, forced relocation, or political instability?				
Will the Activity lead to any of the following? <ul style="list-style-type: none"> • Dislocation or involuntary resettlement of people • Disproportionate impacts on the poor, women, children, people with disabilities, and other vulnerable groups • Social conflicts if workers from other regions or countries are hired • Creation of slum communities • Accidental disruption of utilities • Increased burden on social infrastructure and services • Exacerbation of discrimination against ethnic/cultural minorities and other groups vulnerable to discrimination • Exploitative labour practices, e.g. dangerous health and safety, poverty wages, child labour • Loss of access to resources for livelihood opportunities 		<input type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	
If the Activity is being implemented by a Partner, do they have a child protection policy?			<input type="radio"/>	
Will this activity involve a worker directly employed by MFAT, under the aid programme, having regular or overnight contact with any child (other than a co-worker), without the presence of their parent or guardian? NO If yes refer to guidance on Vulnerable Children Act for legally enforced vetting requirements.				

E. Category B Report Structure
NZMFAT Environmental and Social Practice Handbook

The report structure for category B activities follows the same format for category A but focusses on the specific adverse impacts expected from the project and measures to mitigate these. It is a less comprehensive and more targeted assessment compared to category A, and only considers alternatives to project elements causing adverse impacts.

Category B Activities

1. Summary
2. Policy, legal and administrative framework
3. Description of project elements with adverse environmental and/or social impacts, and any alternatives
4. Description of impacts and mitigation measures
5. Results of public consultations (where relevant)
6. Impact management plan

F. Screening Checklist at PIN Stage
Table C: Checklist for the E&S screening at PIN stage¹⁶

Environmental and Social Issues	Yes ✓	No or Not Sure X	Initial level of Risk (High, Medium or Low)
E&S Policy, Legislation and Standards			
<u>EU policy:</u> • Is the project/operation consistent with EU environmental and social policy?		✗	
<u>Legal context and compliance:</u> • Is the project/operation likely to be consistent with EU/national/international environmental and social legal frameworks (i.e. international conventions ratified by the host country)?		✗	
<u>Consultation and disclosure under the EIA process?</u> • Has the screening decision been disclosed to the public? • Has the NTS been disclosed to the public and consultation under the EIA process been carried out?		✗	
<u>EIB E&S principles and standards:</u> • Is the project/operation likely to be consistent with EIB E&S principles and standards?		✗	No, if based on existing EIA Law
<u>IFI E&S standards, safeguards and operational policies:</u> • Is the project/operation likely to be consistent with IFI E&S standards or safeguards and operational policies?		✗	No, if based on existing EIA Law

Environment, Biodiversity, Climate Change			
<u>Environmental impacts:</u> <ul style="list-style-type: none"> Will the project have an impact on air, soil, water through emissions or similar? 		✘	
<u>Transboundary impacts:</u> <ul style="list-style-type: none"> Will the project impact a cross-border region (river, canal, lake, seas, forest, mountain range, etc.) which forms a boundary between or runs through 2 or more sovereign states in any way? 		✘	
<u>Protected areas:</u> <ul style="list-style-type: none"> Does the project include activities within or adjacent to protected and environmentally sensitive areas? 		✘	
<u>Critical Habitats:</u> <ul style="list-style-type: none"> Does the project involve significant conversion or degradation of critical habitats? Does the project impact on an area of critical habitat? 		✘	Note: the project may be precluded from financing if the impacts on critical habitats are too significant as per EIB E&S Statement.
<u>Biodiversity:</u> <ul style="list-style-type: none"> Will the project impact an area high in biodiversity or impact on a vulnerable, endangered or critically endangered species? 		✘	Note: the project may be precluded from financing as per EIB E&S Statement
<u>Forestry:</u> Does the project involve: <ul style="list-style-type: none"> the financing of commercial forestry? logging operations in tropical moist forest the purchase of logging equipment for use in tropical moist forest? 		✘	Note: the project may be precluded from financing as per EIB Forestry Policy
<u>Cultural heritage:</u> <ul style="list-style-type: none"> Will the project adversely impact non-replicable cultural property (e.g. archaeological, historical or religious sites), sites with unique natural values or intangible cultural heritage (e.g. social practices, rituals and festive events)? 		✘	
<u>Vulnerability to climate change:</u> <ul style="list-style-type: none"> Will the outcome of the project and/or impact of the project on environment, communities or ecosystems be significantly affected by climate change projections? Do the projects for climate change in the lifetime of the project significantly increase the risks above (e.g. to the environment, biodiversity, forestry)? 		✘	
<u>Climate change mitigation:</u> <ul style="list-style-type: none"> Will the project have significant absolute or relative GHG emissions? 		✘	
Social			
<u>Social assessment:</u> <ul style="list-style-type: none"> Will the project/operation have significant adverse social impacts and risks? 		✘	
<u>Involuntary resettlement:</u> <ul style="list-style-type: none"> Will the project have any involuntary resettlement, either or both physical or economic? Will the project result in livelihood changes that can increase the pressure on available natural resources? 		✘	

<p>Vulnerable groups and Indigenous Peoples (IPs):</p> <ul style="list-style-type: none"> Does the project impact on indigenous peoples and, if so, have the particular rights of indigenous groups been considered (e.g. rights to lands, territories and resources, rights to FPIC, etc...) Will the project have adverse impacts on vulnerable groups? Have vulnerable groups amongst impacted stakeholders been identified and included in project planning and consultation and engagement activities? 				✗	
<p>Labour Standards:</p> <ul style="list-style-type: none"> Are there risks of forced or child labour? Is there any indication of child or forced labour in the supply chain? 				✗	Project may be precluded from EIB financing as per EIB E&S Statement
<p>Occupational and public health, safety and security:</p> <ul style="list-style-type: none"> Will the project have an impact (direct /indirect) on occupational and public health and safety? 			✗		The upgrade will enhance public safety¶
<p>Stakeholder engagement:</p> <ul style="list-style-type: none"> Has the project engaged adequately with project-affected stakeholders? Has a project grievance mechanism been established? Is an adequate accountability reporting in place? 				✗	Stakeholder engagement and GRM will be established during DD stage¶
Other E&S Issues					
<p>Project boundaries:</p> <ul style="list-style-type: none"> Are the project's ancillary/associated facilities/infrastructure and area of influence likely to pose any significant E&S impacts and risks? 				✗	

<p>Environmental and social management:</p> <ul style="list-style-type: none"> Is the environmental and social capacity/performance of the promoter to manage E&S issues satisfactory? Does the promoter have an appropriate and effective management system in place? 					Capability enhancement of TPL will be included in EMP¶
<p>Supply chain:</p> <ul style="list-style-type: none"> Are there any risks of adverse environmental and social impacts of the project's supply chain? 			✗		Sourcing of wooden poles¶
Reputational Risk					
<p>Stakeholder interests:</p> <ul style="list-style-type: none"> Are there any major stakeholder interests in the project/operation? 				✗	
<p>Risks:</p> <ul style="list-style-type: none"> Is the project/operation likely to pose significant risks from an environmental, climate or social point of view? Is the EIB likely to be exposed to any reputational risk? 				✗	

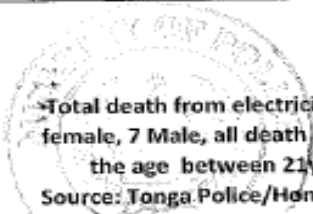
Note: All environmental and social issues must be screened; if in doubt, the analyst should err on the side of caution and include the issue under the heading "No or Not Sure". Where an issue then falls under "No or Not Sure", the environmental and social due diligence should focus on these matters. The Team should follow the precautionary principle as detailed in Article 191 of Treaty.

G. Electrocution Statistics

Death from electrocution is significant social cost (not quantified). Cases of death from electrocution in the past years (2008-2015)

TOTAL DEATH FROM ELECTRICITY FOR THE WHOLE KINGDOM AS FROM 2008-2015 (Jan-Oct)

2008=2				
S/NO.	GENDER	AGE OF DECEASED	LOCATION	NATURE OF THE INCIDENT RESULTED DEATH
1	Male	29yrs	Sia'atoutai/ Tongatapu	Answering phone at home.
2	Male	17yrs	Saineha High School/Vava'u	Build up door for coronation at school and he stand at the top of the door and touch the electricity wire.
2009=2				
1	Male	34yrs	Longomapu/ Vava'u	Cut the breadfruit tree by knife ,then he cut the wire.
2	Male	21yrs	Folaha/ Tongatapu	He works at Shoreline Company , try to cut trees from electricity wire at the main road.
2010-2012 ALL NIL				
2013=2				
1	Male	27yrs	Malaekula/Kolofo'ou/Tongatapu	Touch the wire while on the ground
2	Male	22yrs	Ha'avakatolo/ Tongatapu	Doing washing with his old oval washing machine.
2014- NIL				
2015=2				
1	Female	38yrs	Kolomotu'a/ Tongatapu	Human faces near the metre wire at her house.
2	Male	3yrs	Longoteme/ Tongatapu	Try to push mobile charger from the main electricity wire hook on the main plug.



Total death from electricity for whole kingdom 2008-2015 file in this office is 8, 1 female, 7 Male, all death happen at the Tongatapu and the rest from Vava'u. And the age between 21yrs-30yrs was the most age of death from electricity.
 Source: Tonga Police/Homicide Register

SOURCE: Police department of the Kingdom of Tonga.

This page blank for double siding

Appendix 8 Social Development Assessment

A. Line of Questioning

What are we seeking to find out?

Tonga Power Ltd recognises that Nuku'alofa communities should have a safe, reliable, consistent energy source which contributes towards improving the social and economic needs of communities and businesses as well as supporting the integrity of the environmental landscape. Upgrades in the electricity sector therefore must involve communities actively in any development programme. They can do this through providing an insight into their lifestyles, related concerns that may be a result of electricity fluctuations and safety concerns, as well as opportunities that can be pursued from a more reliable and consistent supply of electricity. To do this effectively we seek to understand your current experience with your electricity supply

How will the Tonga Power Ltd use this Due Diligence Report?

Tonga Power Ltd is committed to providing a safe and quality service to all their clients across Tonga. Should there be discrepancies in service or product provision they will work with businesses and communities to improve the supply to meet client needs.

Tonga Power Ltd intends to use the Due Diligence Report to:

- Examine the impacts of the current power supply on the lifestyles and economic development of the Nuku'alofa community
- Identify issues with the current electricity system that may be constraining social and economic development opportunities
- Nurture the growing relationship between Tonga Power and their clients in Nuku'alofa in order to better meet their energy needs.

This will help Tonga Power Ltd to contribute socially and economically to the urban growth and development of the Nuku'alofa community. Your input and contribution to this discussion is extremely valuable to provide an accurate picture of the various social and economic attributes, characteristics and activities.

All responses are confidential and will be treated anonymously. Furthermore, all responses are voluntary and you do not have to answer any question that you are not comfortable with.

Tonga Power Due Diligence - Guiding Questions

Demographic

1. Village of residence
2. Men/Women attending the Focus Group?
3. Nature of the community - i.e. mainly businesses or mainly households?
4. Approximately how many people live in the village?
5. What proportion of the community is?
 - Children (under the age of 15) Youth (16-30 y/o).....
 - Adults (31-60 y/o)..... Seniors (over 60 y/o).....

Social and Cultural Organisation

6. What are the social and cultural priorities in this community?
7. What changes have you seen to the culture in recent years?
 - Has any of these changes been affected by the access to power?
 - Has the availability of power helped to celebrate the culture?
8. What government services are there in the community?

Communication

9. Is there internet in the community?
 - If not, has this to do with access to electricity?

- *If yes, how many people in the community have internet access?*

Water and Sanitation

10. Status of water and sanitation in communities?

- *What is the water supply to the community?*
- *Are there concerns regarding water supply?*
- *How waste is disposed - sewerage/septics?*
- *Is power required to provide these services?*

Housing

11. Is overcrowding an issue?

Energy

12. What do most households in this community cook with?

- *Gas* *Electricity*
- *Firewood* *Other (e.g. solar, kerosene)*
- *Mixed methods*

13. If gas is it affordable? How much is a tank of gas?

14. What are the benefits of the method/s used for cooking?

15. What are the issues faced using this energy source for cooking?

Electricity

16. Does your house/business have electricity?

- *If not, what are the reasons that you don't have electricity?*
- *What proportion of households do not have access to electricity?*
- *What proportion of business do not have access to electricity?*

17. Do you receive bills from Tonga Power Limited (TPL)?

If you do, how do you rate the cost of the service?

18. Compared to other utility services (e.g. water, rubbish collection, telephone) how do you rate the quality of the power service provided by TPL?

19. Compared to other utility services (e.g. water, rubbish collection, telephone) how do you rate the cost of the power service provided by TPL?

20. How do you rate the cost of setting the household/business connection to the Tonga Power network?

21. Approximately how many hours a day do you use electricity and for what purposes?

22. Compared to 12 months ago do you use

- *More Electricity* *Less Electricity*
- *Same* *Uncertain*

23. How much (TOP\$) do most households/business pay for electricity each month?

24. How much electricity (kWh) do most households/business consume per month?

25. Is it more or less affordable than five years ago?

26. Where do most households/business get the money to pay for electricity?

- *Paid work*
- *Selling products (such as fish, handicrafts)*
- *Family*

27. Has your electricity ever been cut off due to late payment in the past 12 months?

28. Considering the time taken to reconnect your electricity, how do you rate the reconnection service?

29. What is the current source of lighting in your household?

- Electricity from TPL Generator
- Solar Kerosene
- Coconut oil

30. Would the community use more electrical appliances if the price were lower?

31. Have you had any electricity outages in the last 12 months?

32. How often do outages occur?

- Weekly - how many days per week?
- Monthly - how many days per month?
- Less often - how many days per year?

33. How long do electricity outages last?

34. Have outages or spikes in the power supply damaged household/business equipment?

35. What alternatives do you use for lighting when there is an outage?

36. How efficient is TPL in responding to power outages?

37. How friendly are the TPL staff when dealing with issues and complaints?

38. Who mainly uses electricity in the household?

- Women Men Same

Safety

39. Has there been any safety issues with the TPL's electricity supply?

40. What is the general condition of the electricity system in your community?

41. What is the general condition of the electricity connection to your house/business?

42. How efficient and effective is the maintenance undertaken by Tonga Power?

43. Do you know what the risks are from power lines or from electricity in the house?

Environment

44. Are there environmental issues which arise from your energy source?

- If so what are these issues?

Energy awareness raising

45. Are there any training courses available to you and your community related to energy use and sustainability?

46. If there is training or other information available? If so, what type of training is available?

- Safety
- To use appliances
- To manage supply
- To manage usage to improve efficiency and minimise costs
- Use of technology.

47. What training or information would be useful to you to better manage your energy use?

48. Do you think that improved access to a reliable energy supply will improve your lifestyle?

49. If so in what ways?

50. Have you heard of the 'Smart' Prepaid meters?

51. Do you understand what the proposed 'smart' meter system will mean for your household?

52. Do you think that this meter system will benefit households and businesses?

53. If prepay 'Smart' power meters are made available, would you consider having one to help you managing your power consumption and bills?

Economy

54. Average household Income and expenditure?

55. What is the main form of employment in the community?

- *What jobs do women do?*
- *What jobs do men do?*

56. If you work do you use an appliance that uses an energy source for the work?

57. What small businesses operate in your community?

58. Would an increase in access to electricity promote new businesses in this Village/Community?

59. What constraints are there to small business development in the village?

Malo 'aupito

B. Stakeholders Consulted

Stakeholder consultation and issues covered

Stakeholder	Issues covered	Key feedback received
TPL Nuku'alofa Office, 28 June 2016		
TPL Team Leader Senior TPL staff	<ul style="list-style-type: none"> • History of Electricity and upgrades in the Nuku'alofa area • Land ownership upon which TPL assets are housed and extend. 	<ul style="list-style-type: none"> • Land is owned by the State. • No legacy issues. • Tonga Institute Science have 3-4 year linesman course →4 trainees with TPL for practical experience - none of which are women currently
Ministry of MEIDECC		
Hon. DPM Siaosi Sovaleni Mr Paula Ma'u - CEO Mr Inoke Vala - Director TERM Principal Officer	<ul style="list-style-type: none"> • Tonga Energy Road Map • Proposed Development of an Energy Act • Strengthening Legal Framework for Renewable Energy • To encourage private investment in energy - however the sale of energy can only be through TPL. 	<ul style="list-style-type: none"> • Sets the proposed NNUP within the broader national energy framework and improvements context • Need to reduce line losses from ~20%
Lands Department		
Seli Taufa	<ul style="list-style-type: none"> • Land ownership confirmed with government 	<ul style="list-style-type: none"> • Poles on government side not land owners
Department of Statistics		
Viliami Fifita	<ul style="list-style-type: none"> • Census to be commenced 2016 • Laws changed re confidentiality and FOI 	<ul style="list-style-type: none"> • Household - where people 'eat' together • Boundaries - Census blocks - 50 households
Chamber of Commerce		
John Paul Chapman	<ul style="list-style-type: none"> • Chamber covers 140 businesses • Electricity quite reliable - occasional blackouts 	<ul style="list-style-type: none"> • Cost is a factor for most businesses • Good service - linesmen come fast

Stakeholder	Issues covered	Key feedback received
	<ul style="list-style-type: none"> Most businesses pay bills physically - although aware can pay online Appliance imports should be monitored - could be a TPL role. 	<ul style="list-style-type: none"> Need for more training for businesses regarding energy management and OHS aspects.
Popua Handicrafts and handicraft makers		
6 - 5 men, one woman	<ul style="list-style-type: none"> Safety and energy efficiency not well understood Planned outages last ~ 3 hours Waste and power bill combined Power can fluctuate if windy weather Not aware of Contract of agreement with TPL 	<ul style="list-style-type: none"> Electricity more affordable now and is reliable - no surges Expensive for handicraft making - use of lathes, etc. Brother fixed low lying wire Main appliances - fridge, tv, telephone, lights, iron, computer → \$100-150/month - paid through salary and remittances Disconnections ~ 3 times a year
Sopu Business		
4 men	<ul style="list-style-type: none"> Fix electrical equipment - often they have poor earthing, broken wires or appliances There is a lot of electricity leakages Waste is with electricity bill - prefer it separate Need better complaints process - process too long and ineffective. 	<ul style="list-style-type: none"> Electricity bill - \$200 plus a month - generally affordable. Do not always believe the bill issued is correct ~ 3 disconnections a year - \$20 reconnection fee affordable but if connect after 12 midday reconnect next day or pay extra \$20 for same day connection Sometimes not enough cashiers in TPL front office - if a long queue - these tend to be people needing reconnection Like the idea of pre-paid meter Need various training for energy efficiency and safety - need brochures Use fridge, welding machine Consider that they have no option but to pay the bill even if disagree - takes too much time and not sure how to lodge complaint as rarely effective - 'go around in circles'
Tofoa Business		
	<ul style="list-style-type: none"> Electricity services have improved over last 5 years - use of certified electricians and TPL - this is important Business have back up power generator More training re appliances needed 	<ul style="list-style-type: none"> Electricity never affordable for businesses Rare power fluctuations - usually planned Home area of Fangaloto (near NZ High Commission) have quite a number of power fluctuations → affect appliances - despite this these power connections are underground.
Popua Community		
3 men, 4 women	<ul style="list-style-type: none"> Most people have come from outer islands Lots of changes over the years - thought reconnection fee is \$50 Disconnections from: <ul style="list-style-type: none"> Forget to pay Given wrong bill Family issues take priority Financial issues Bills more affordable now although costs similar - although one lady perceived the opposite - if more affordable will use more appliances Bill needs to be better broken down - do not understand how the price is made. Do not trust the meter reader Difficult and costly putting in poles to connect to grid 	

Stakeholder	Issues covered	Key feedback received
	<ul style="list-style-type: none"> • Do not get enough information from front desk - need a 'complaints; community' officer → one department to deal with issues • Increased outages this year - 3 times a month planned and unplanned - this can affect fridge when power spikes • TPL have a rapid response and fix outages and issues • A perception that TPL staff favour their relatives over the general public for reconnections and managing issues - even tamper with meters. • Older houses need updating electricity - need advice on how to do this and what is TPLs responsibility • Prepaid meters - see advantages in these • Tonga Trust have run energy efficiency training → TPL need to come to community to carry these out - would like more training • Incomes ~\$400 plus a month - some have no income; business can earn much more (fishing if a good harvest) • Women do not usually weave at night 	
Ma'ufanga Community		
29 men, 18 ladies - inc Town /District Officer and Member of Parliament	<ul style="list-style-type: none"> • Some houses have no electricity -cost of putting in power poles; some buildings too old • Affordable but still expensive • Concern re generator - pumping warm water to lagoon to cool - concerned may destroy lagoon • Want more information on technical aspects of renewable energy • Perception that tariffs differ between business and household • Reconnection can be expensive - especially where people have to first pay arrears • Concern regarding some electrical contractors 	
Kolomotu'a Community		
12 ladies, 2 men	<ul style="list-style-type: none"> • Kolomotu'a have 1140 households - there can be 3-4 houses in a household • Approximately 50 houses with no power <ul style="list-style-type: none"> ○ Connection to power too costly ○ Some have no wages ○ Lots of family obligations ○ Power not always prioritised • People have no idea on how to use power → plug everything in then complain about cost. Some turn off fridge at night • Some use appliances from US - not always compatible with NZ/Australian appliances • Want training on electricity use, budgeting and safety • Bill process - prefer to check with meter reader • No agreement with TPL for old customers - only recent ones • Electricity perceived as very expensive - ie fridge, radio, lights and tv is \$70/month • Want to trial prepaid meter • Reconnection - expensive and can be slow • Service varies - e.g. pole fallen come fast; leaves on wire not seen a priority by TPL • Unplanned outages about 2 times a month • Complaints process need improving - too many numbers to ring - sometimes no response on emergence number or is busy • Had a bad spike 3 years ago - transformer overloaded - no regulation then • One house connects and several 'piggy back' • Many people live on less than \$500/month - and electricity on average around \$100/month 	
Tofoa community		
4 ladies, 7 men	<ul style="list-style-type: none"> • Households without electricity <ul style="list-style-type: none"> ○ 30-50 new households - community growing ○ 10-15 houses disconnected for a long time - bill too high 	

Stakeholder	Issues covered	Key feedback received
	<ul style="list-style-type: none"> • Average electricity bill \$120-150/month or approximately 20-30% household income. Remittances not used for electrical bill these are for church and family obligations • Very slow and expensive to reconnect - fast to disconnect • Two unplanned outages in current month - lasted 3-4 hours and ruined several electrical appliances - ?? caused by issue with 3 phase meter • TPL service is now improved from before - need licensed contractors • Want training in electricity budgeting and safety • A TPL linesman electrocuted about 2 years ago • Request to get TPL staff to indicate where household connection is if it is underground in NNUP 	

C. How to Save Money on your Electricity Bill

