



TONGA'S 50% RENEWABLE ENERGY SPRINT

TPL Projects

2020 & BEYOND



Presentation Outline

Topics to be Covered

TPL Background

Stock take of TERM Projects

GCF TREP Projects

Related Efforts & Strategic Summary

Ultimate Goal for Renewable Energy Technology



TPL Vision, Mission & Values

OUR VISION

"Powering the sustainable development for our Kingdom"

OUR MISSION

Providing safe, reliable, affordable and sustainable electricity services for Tonga, with at least 50% of electricity requirements through renewable sources by 2020 whilst remaining financially stable.



Quality Customer Service ✓

Excellent practice & embracing technology ✓

Transparency & Accountability ✓

✓ Creativity & Innovation

✓ Honesty & Integrity

✓ Run the business as if its your own

✓ Success as a unified team, success as a dedicated individual

Stocktake Highlights



Generation



Maama Mai 1.3MW

Matatoa 2MW

Mata 'o e La'a 1MW

La'a Lahi 420KW - Vava'u

Hulo 'o e La'a 200KW - 'Eua

Ha Masani Solar Farm 500KW - Ha'apai



Nakolo Windfarm 11KW

Ha'apai Windfarm 11KW

Distribution



TVNUP/NNUP



OIREP



Smart Metering
Project

Retail



Online Payment



PEEP

ERP/IT



Common Billing



New IT Network
Infrastructure



New ERP
System



Grid Code

BUSINESS ENVIRONMENT ANALYSIS

EVENT

His Majesty Statement to UNGA (UN General Assembly)



“ *Tonga believes it can achieve its 50% by 2020 Renewable Energy Target through more and stronger private public partnership arrangements* **”**



HOW CAN WE

get there?

STRATEGIC DECISION MAKING

Updated Strategic Objectives and Priority Initiatives



Where do we want to be?



17.5 MW OF RE



10MW/20MWh Energy Storage
added to Tongatapu system



Climate Resilient Networks



50% or more of electricity
generation from RE



Achievable- through significant donor and private sector investment and a dedicated implementation team

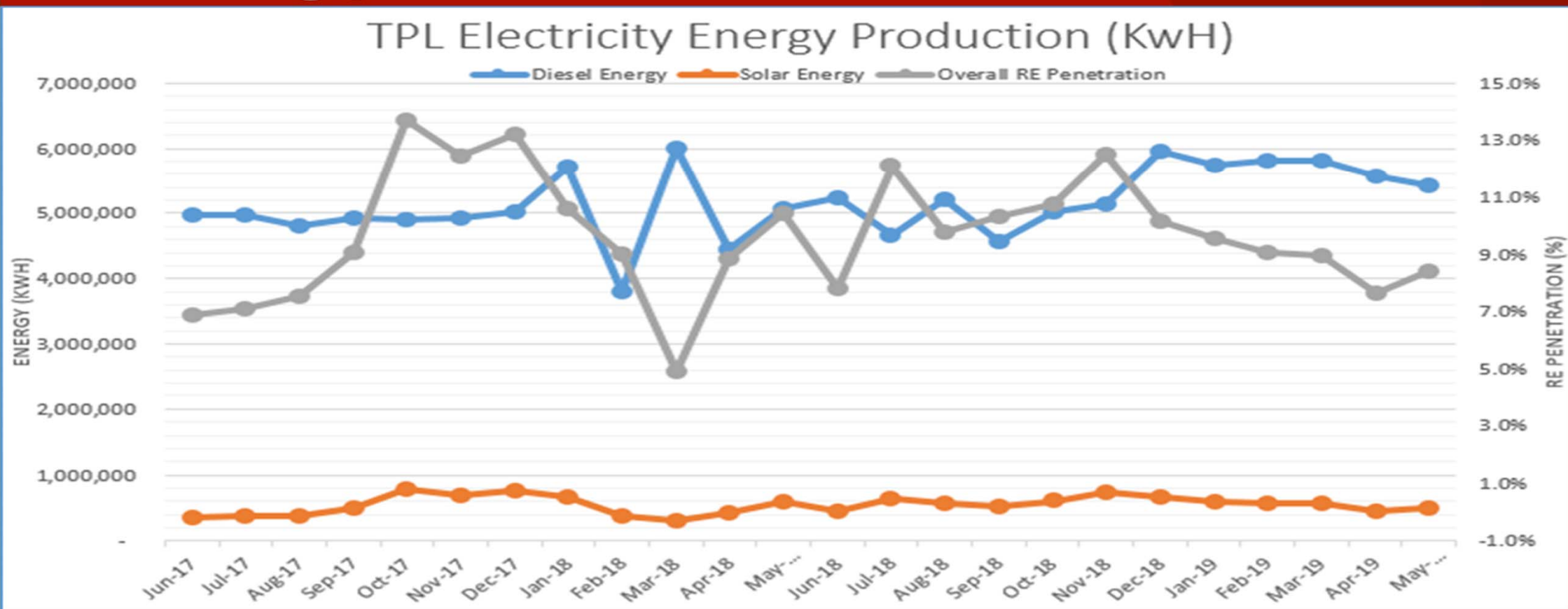


Relative: Socio-economic benefits through tariff stability & affordability due to less impact of oil price shocks.

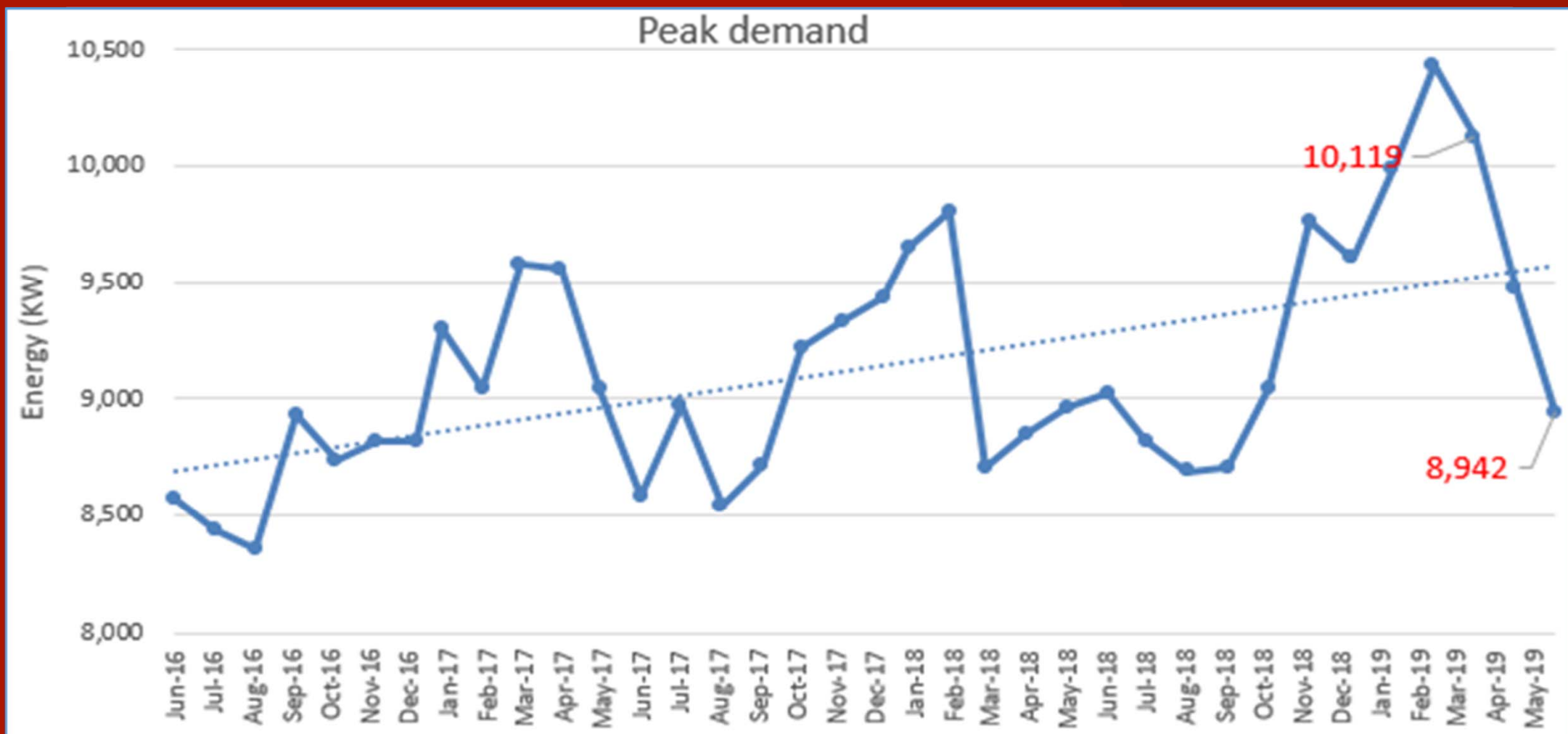


Time Bound - before the end of 2020

Tonga's Renewable Energy Penetration



Peak Demands



Tonga 50% RE Target by 2020

Phases to achieving 50%



Tonga's 50% Renewable Energy Target by 2020

Phase 1 (2014-2019)

Outer Island Renewable Energy Project [OIREP] (RE plants on 9 outer islands + power distribution network upgrades) funded by

- ADB Loan: \$2.50M
- ADB Grant: 11.44 M
- Government of Australia Grant: \$6.72 million
- European Union: \$3.57 million
- Second Danish Cooperation Fund for Renewable Energy and Energy Efficiency for Rural Areas: \$0.75M
- Global Environment Facility Grant: \$2.64 M
- Government of Tonga: \$1.57 million

Total: \$29.19 M

Phase 2 (2017-2019)

- 1 Solar IPP: ~ \$5.0 M
- 2 Wind Farms to be funded by JICA and Government of China : \$10-15M
- **Total: \$15~20 M**

Phase 3 (2018-2020)

Tonga renewable energy project (TREP):

- Green Climate Fund Grant: \$29.90M
- ADB Grant: \$12.20M
- Government of Australia Grant \$2.50M
- Tonga Power Limited: \$3.00 million
- Government of Tonga: \$5.60 million

Total: \$53.20 M

- ✓ 4MW Solar PV farms and 3.8MW wind farm to be developed by IPPs
- ✓ Potential contribution from Government of NZ for wind IPP (to be confirmed)
- ✓ Potential Biomass Plant _Funding sought

Tonga's Energy Efficiency Target (Reduction of Power Grid Losses to 9%) by 2020

Completed

1. Cyclone Ian Recovery Project to rehabilitate TPL's power grid on Haápai (completed in 2015).

- ADB Grant: \$ 2.0 M
- Tonga Power Limited: \$0.5M

2. Tongatapu – Tonga Village Network Upgrade Project (completed in 2015).

- Government of New Zealand Grant: \$ 35 M

Total: \$37.5 M

Ongoing

1. 'Eua – part of OIREP (to be completed in 2018).

2. Vava'u – part of OIREP (to be completed in 2019).

2. Tongatapu – Smart Metering Project (completed in 2018).

- Government of New Zealand Grant: \$ 0.6 M
- TPL: \$3.0M

Total: \$3.6 M

Planned (Beyond 2020)

1. Nukuálofa Network Upgrade Project

- ADB Grant: \$ 6.8 M
- Government of New Zealand: \$8.0M

2. Battery Energy Storage System - part of TREP

3. Energy Efficiency Programs for residential and commercial customers

- Tonga Power Limited: \$0.5M/yr

Total: \$14.8 M (excluding TPL's annual contribution)

TONGA RENEWABLE ENERGY ROADMAP (TREP)

TPL GRID



GREEN
CLIMATE
FUND

COMPONENTS

RE CAPACITY

BESS CAPACITY



Ha'utu Solar PV plant

2MW



Fualu Solar PV plant

2MW



Liukava/Kolovai PV plant

2MW



'Eua & Vava'u Islands PV plant

650KW

1.4MWh



JICA Wind Farm

1.3MW



Niutoua Wind PPA

3.8MW



Government of China

2.25MW



BESS #1

5.1MW/2.5MWh



BESS #2

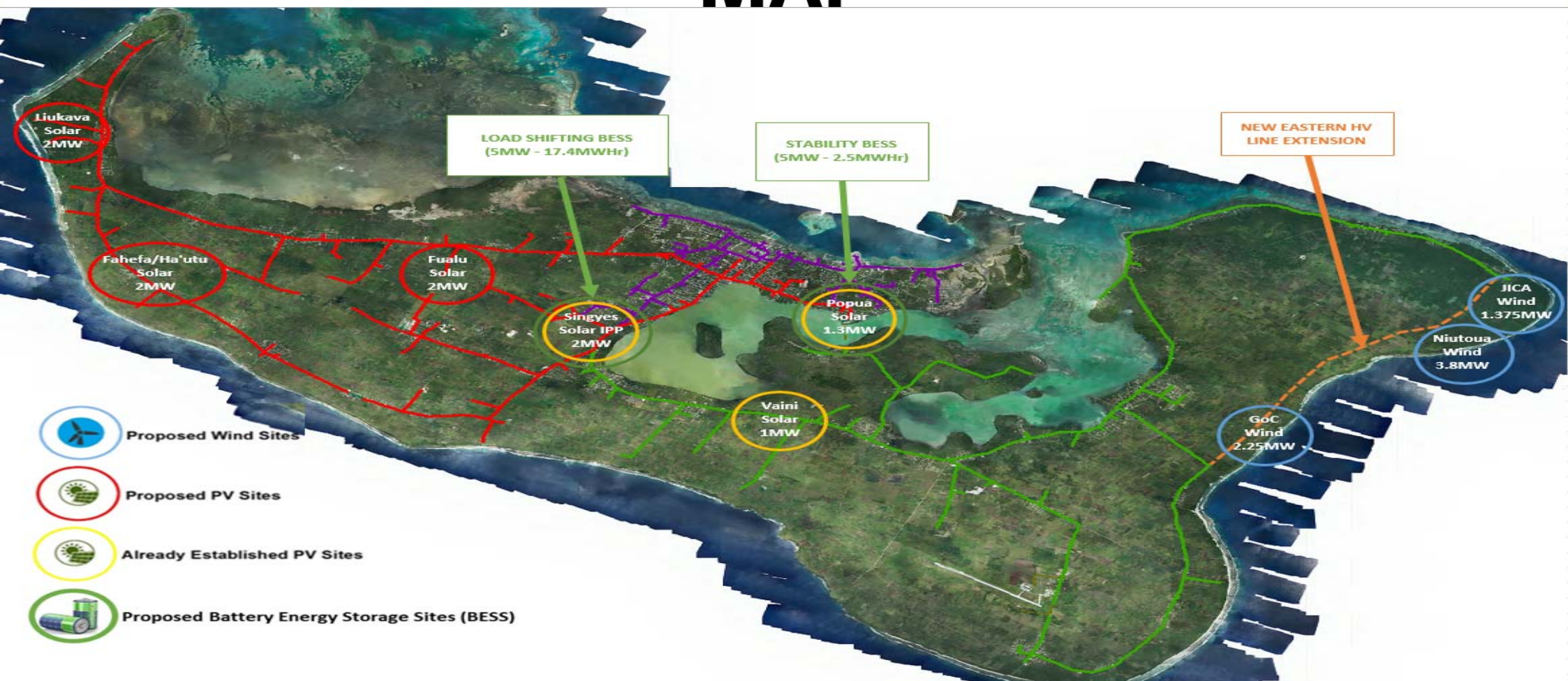
5.0MW/17.4MWh



'Eua & Vava'u Solar Energy Storage

1.3MW/1.4MWh

RENEWABLE ENERGY ROAD MAP



TONGA RENEWABLE ENERGY ROADMAP (TREP)

Non TPL - GRID

Solar/Battery Hybrid + New Mini-grid



GREEN
CLIMATE
FUND

COMPONENTS	RE CAPACITY	BESS CAPACITY
 O'ua	58KW	109KWH
 Tungua	84KW	160KWH
 Kotu	69KW	130KWH
 Mo'unga'one	35KW	66KWH
 Niuafu'ou	0.25MW	0.404MWH

Anticipated Impact of Each Phase to Renewable Energy Penetration

	Phase	TPL Grid				Non TPL Grid	TOTAL	%
		Tongatapu	'Eua	Vava'u	Ha'apai	Outer Islands		
Phase 1	Grand Total Consumption (kwh)	54,215,438	1,791.133	6,148,000	1,533,085	2,292,344	66,000,000	100%
	Conventional (kwh)	23,549,038	978,333	5,000,000	699,435	252,297	30,479,103	46%
	OIREP RE + BESS (kwh)	-	301,800	-	837,650	747,596	1,887,046	3%
	Existing RE + BESS (kwh)	4,000,000	-	710,000	16,000	550,946	5,276,946	8%
Phase 2	Ongoing and Upcoming RE + BESS (kwh)	10,840,000	-	-	-	15,885	10,855,885	16%
Phase 3	TREP RE + BESS including IPPs (kwh)	15,826,400	511,000	438,000	-	725,620	17,501,020	27%
Total	Total RE + BESS (kwh)	30,666,400	812,800	1,148,000	853,650	2,040,047	35,520,897	-
	RE Penetration (%) per Island	57%	45%	19%	55%	89%	54%	-

RENEWABLE ENERGY ROAD MAP



	Plant	Capacity (AC)	Installed	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025 Future
Existing	6 x Caterpillar (CAT-1750kVA-50Hz-CP_C)	9.6	2004											Phase out	
	2 x MAK 2.88 6CM32	5.6	2014											Maintain	
	Solar PV (Maama Mai)	1.3	2014											25 year (Refurb 2039)	
	Solar PV (Vaini)	1	2015											25 year (Refurb 2040)	
	Solar PV (Villa)	2	2017											25 year (Refurb 2042)	
	Solar PV (distributed rooftop)	0.5	2015-											Ongoing	
Under construction	Wind (JICA - Niutoua)	1.37											20 year (refurb 2038)		
Proposed	BESS (TREP)		2019	TREP Subproject 3										25 year (replace cells 2031)	
Proposed - dependent on BESS	Solar PV (TREP - Matafonua)	2	2019	TREP Subproject 1										25 year (refurb 2046)	
	Solar PV (TREP - Fahefa)	2	2019	TREP Subproject 1										25 year (refurb 2046)	
	Wind (TREP - Niutoua)	3.8	2020	TREP Subproject 2										20 year (refurb 2040)	
	Wind (GoC)	2	2020											20 year (refurb 2040)	
	Solar PV (Future)	2	2020											25 year (refurb 2047)	
	Solar PV (Future)	2	2020											25 year (refurb 2047)	
	Wind (2020->2030)	5.3	2021												
	Solar PV (2020->2030)	See ->	See ->						4	4	4	4	4 +2MW/year for growth		
Totals	Cumulative Wind				1.3					1.3	7.1	12.4	12.4	12.4	12.4
	Cumulative Solar PV				1.3	2.8	2.8	4.8	4.8	8.8	12.8	16.8	20.8	24.8	28.8

Past, present (as at 2018) and proposed generation for Tongatapu

Related Efforts



Network Enabling

- 4th Feeder
- Easter/Western Ring
- Differential Protection
- Synchronous Condenser or Diesel UPS (3-4Mvar)



6MW Solar IPP

- Land Acquisition
- Permitting



Grid Code

- Combined Control Centre Communication System for distributed Renewable Energy
- Renewable Energy Forecasting
- Weekly Generation Dispatch





50% RENEWABLE by 2020

Achieving 50% diesel fuel savings from Renewable Energy generation by 2020 in order to achieve the government TERM target and realistic tariff reductions.

YEAR 1

-  6MW IPP
-  CHINA WIND
-  WIND IPP 3.8MW (JUNE 2020 - DEC 2020)
-  300 KW VAVA'U
-  300KW 'EUA

YEAR 2

-  WIND IPP 3.8MW (JUNE 2020 - DEC 2020)
-  300 KW VAVA'U
-  300KW 'EUA

YEAR 3 and beyond







-  BIOMASS
-  HEAT & RECOVERY
-  COCONUT
-  TIDAL
-  WAVE
-  GEOTHERMAL
-  SDG's (Customer Owned)



ADOPTING NEW TECHNOLOGIES

Adopting technologies to manage the complexities arising from a digitized and decentralized renewable future

YEAR 1

-  BESS #1
-  BESS #2
-  BESS VAVA'U
-  BESS 'EUA
-  COMBINED CONTROL CENTRE
-  SYNCHRONOUS CONDENSER (3-4Mvar)

YEAR 2

-  BESS VAVA'U
-  BESS 'EUA
-  REPORTING, DATA ANALYTICS & BUSINESS INTELLIGENCE (In House)

YEAR 3 and beyond

-  More Reclosers & Sectionalisers
-  EV as a for BESS



IMPROVING THE NETWORK

Improving the network by replacing ageing assets to improve safety, efficiency and reliability of supply

YEAR 1



OVERHAUL/OVERDUE



REFURB CAT 2



UPDATE AMP'S



NNUP AREA 1 & 2

YEAR 2



REFURB CAT 3



NNUP AREA 3

YEAR 3 and beyond



REFURB CAT 4,5,6



RE O&M



Proactive Maintenance



HV Upgrades for Outside Nuku'alofa (Underground)



Vehicle/Plant Improvement Plan






Streetlights






IMPROVING OUR BUSINESS PROCESS

Improving our business processes to enhance customer/employee satisfaction while supporting a healthy and competent team.





YEAR 1

-  HR-ERP SYSTEM
-  WEBSITE UPGRADE
-  TPL SMARTPHONE APP
-  POLICY TRAINING
-  BILL PAYMENT OPTIONS POLICY
-  SOCIAL MEDIA PLATFORM
-  TRAINING REGISTER
-  FORMAL SUCCESSION PLAN
-  GENERATION & DISTRIBUTION MASTER PLAN

YEAR 2

-  ENERGY EFFICIENCY CAMPAIGN
-  RENEWABLE ENERGY GENERATION FORECAST
-  GRID INTEGRATION STUDIES
-  WEEKLY GENERATION DISPATCH

YEAR 3 and beyond

-  E-FILLING
-  EMAIL MARKETING
-  RESERVE MANAGEMENT TOOL
-  BUSINESS INTELLIGENCE SYSTEM INTEGRATION



MANAGEMENT OF FUNDS

Manage all external funding and internal financing sources successfully in order to increase shareholder value

YEAR 1



ERP INTEGRATED BUDGETS



FUNDING FOR NNUP & OIEEP PROJECTS



TARIFF SUBSIDIES-GRP/DIVIDENDS

YEAR 2



NEW PROFIT FORMULA (service fees)



PPP Policy

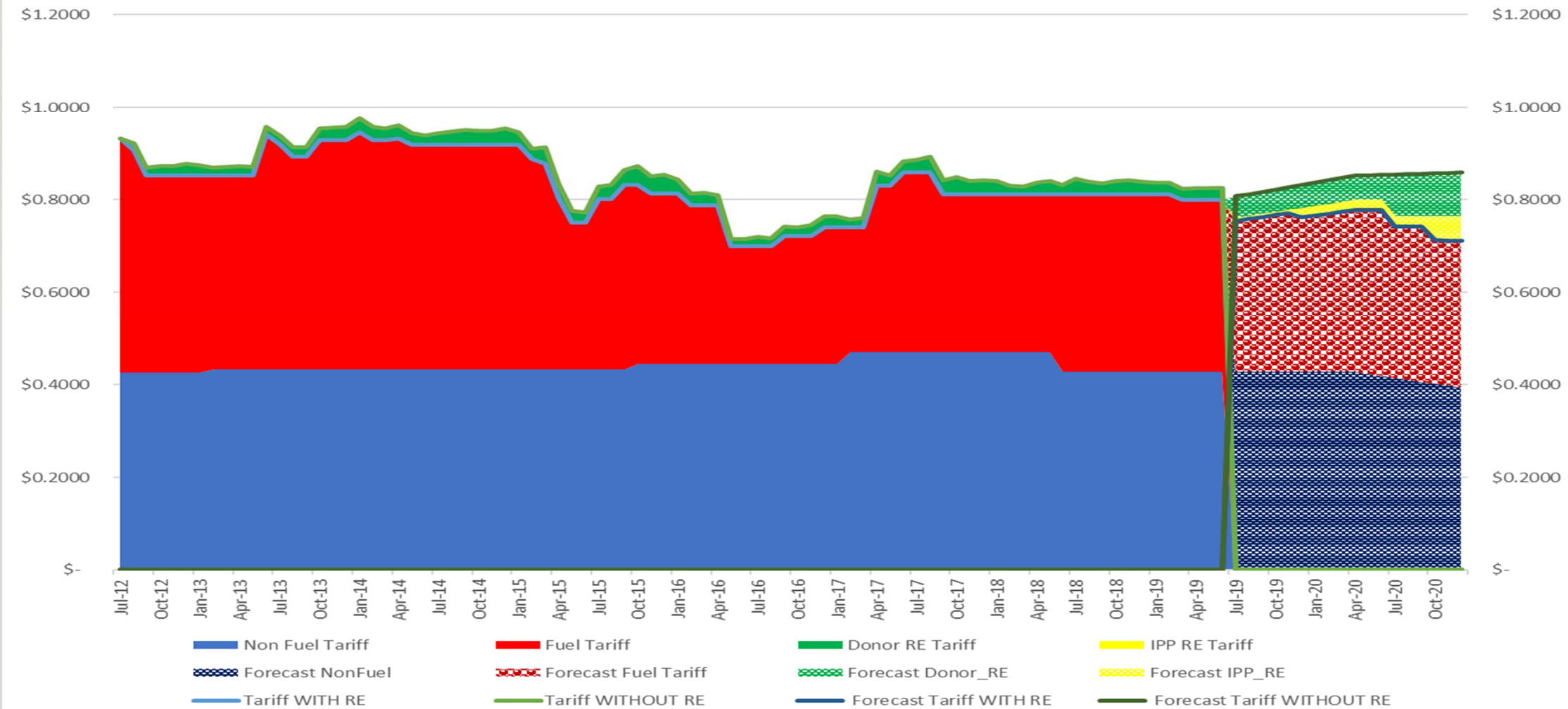


INTEGRATE OFF-GRID POWER

YEAR 3 and beyond

Ultimate Goal for Renewable Energy Technology

Impact of RE on Power Tariff July 2012 - June 2020



50kWhr Consumption (2018)

