

TERMPLUS Tonga Energy Road Map 2021-2035 TERMPLUS Status Update



Background



Tonga Energy Road Map (TERM) 2010-2020 was a 10-year plan:

- Reduce Vulnerability to Oil Price Shocks;
- Achieve an Increase in Quality Access to Modern Energy Services in an Environmentally-Sustainable Manner;
- The TERM (2010-2020) was a first of its kind, followed a *Least-Cost-Approach* and recommended a detailed program of activities to achieve its objectives.

The TERMPLUS (2021-2035) is a 15-year plan:

- Built around a *Consistent* Set of (quantifiable) *targets*;
- Identifying *Measures and Requirements* to achieve those targets;
- Alignment with targets set in other Official Documents and Laws;
- Includes Transportation, Data Collection, Gender and Resiliency
- New guiding document for development of Tonga's energy sector to continue from TERM; Building upon TERM Results & Experience from Past

Content and Structure



TERM 2010-2020:

- Policy, legal, regulatory and institutional
- Renewable Electricity
- Off-grid electricity
- Petroleum
- Energy efficiency
- Environmental considerations
- Phased approach: Phase 0, 1 and 2

TERMPLUS 2021-2035:

- Energy Supply
- Final consumption
- Renewable Electricity, T&D
- Transportation
- Action Plans 5-10-15-year
- Updated Energy efficiency
- Cross cutting issues
 - Policy, Regulations, Legal, Incentives
 - Data collection
 - Climate Change / Resilience
 - Gender-Inclusion

TERM and TERM*PLUS* Objectives



TERM objectives:

Reduced vulnerability to oil price shocks, reducing price and price fluctuation

Reduced dependence on fossil fuels

Increased share of electricity generated from renewable sources to 50%

Increased access to electricity

Increased conversion efficiency of fossil-fueled electricity generation

Reduced transmission and distribution losses to below 9%

Introduction of demand side energy efficiency measures

TERM*PLUS* objectives:

Reduce total amount of diesel imports in 2035 by 10% compared to 2015

Increase security of supply (e.g., days of storage capacity)

70-100% electricity generation from Renewable Resources

Limit growth in oil consumption to 1% per year on average for the period 2021-2035

Limit growth in grid-connected residential end-use of electricity to 1% per year on average for the period 2021-2035

Maintain line losses at under 8%

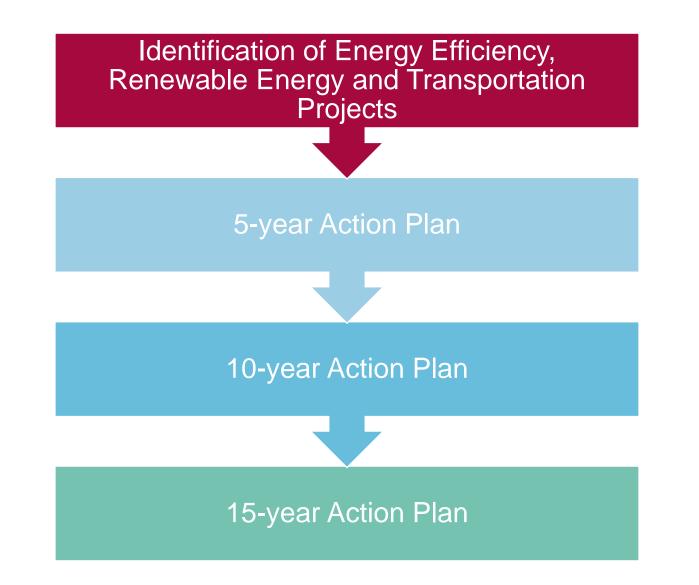
"New" areas introduced or given more prominence in TERMPLUS



- Transportation
- Energy Efficiency
- Data Collection & Dissemination
- Alignment with Tonga Policies & Laws
- Resilience to Climate Change
- Gender Inclusion
- Action Plans

Action Plans incorporate Energy Efficiency, Renewable Energy & Transportation Projects





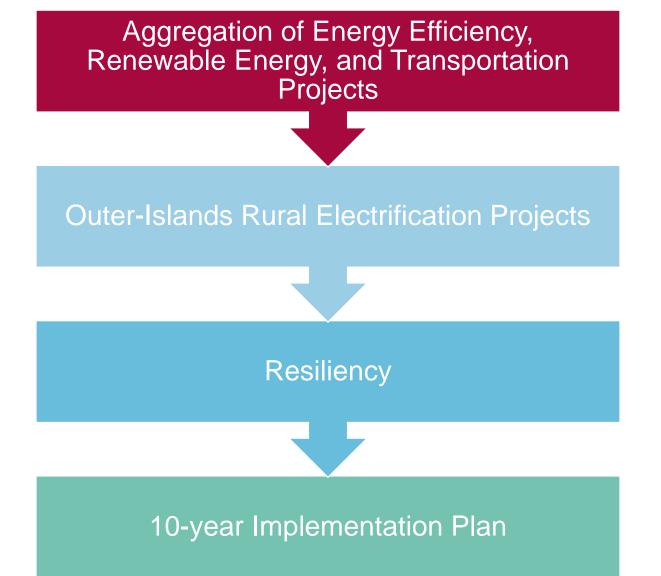


Resiliency

- Incorporate resilience into building codes
- Continue to harden T&D lines and power generation
- Diversify fuel choices
- Improve vehicle efficiency
- Optimize the use of appropriate vehicles

Rural Electrification and Resiliency







Approach - Project Criteria: Advocate & Innovate

- Quality of Life
- Return on Investment
- Economic Development
- Technical and Financial Soundness
- Cost-effective Public-Private-Partnerships

Light-Emitting-Diode (LED) Lamps





Wind Farms







On-Site Renewables



On-Site Renewables



- Efficient Buildings
- Photovoltaic Arrays + Battery
- 100% Renewable Government Centers
- Electric Vehicle Pilots
- Level 2 Chargers

Tonga 50% Renewable Pacific Island Country - Energy Leadership





- PV Tongatapu 14 MW
- BESS Tongatapu 1 MW
- PV Vava'u 1.87 MW
- Bess Vava'u 0.2 MW
- PV Ha'apai– 0.67 MW
- Bess Ha'apai 0.66 MW
- PV Eua 0.37 MW
- Wind Farm 1 1.3 MW
- Wind Farm 2 3.8 MW
- Wind Farm 3 2.0 MW
- Off-Grid Generation 0.20 MW

Tonga 70% Renewable Pacific Island Country - Energy Leader





- PV Tongatapu 14 MW
- BESS Tongatapu 1 MW
- Load-Shifting BESS 5 MW / 17.4 MWh
- Stability BESS 5 MW / 2.5 MWh
- Grid Improvements
 - Nomuku
 - Ha'ano
 - Uiha
 - Ha'afeua
- Biofuel Production Facility 1 MGY
- PV Vava'u 1.87 MW
- Bess Vava'u 0.2 MW
- PV Ha'apai- 0.67 MW
- Bess Ha'apai 0.66 MW
- PV Eua 0.37 MW

Transportation Initiatives

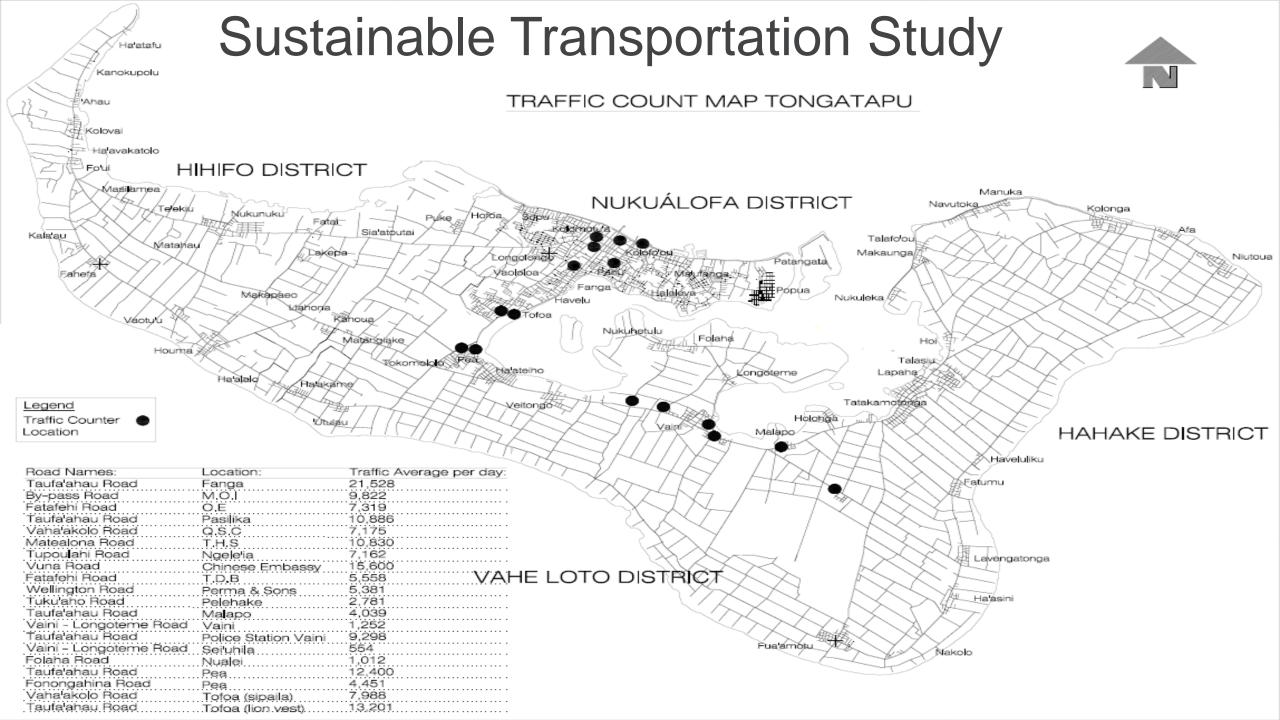


- Electric Vehicles Fleet Pilots 2021-2025
- Electric Vehicle (EV) Charging Stations 2022-2035
- Electric Buses (e-Bus) 2022-2035
- e-Bus Infrastructure and Depot 2024-2035
- Electric Mopeds, Bikes and Tricycles 2025-2035
- Biofuels for Buses 2025-2035
- Hydrogen for Transportation (Maritime Operations) – 2030-2035



Transportation - Electric Vehicles







Transportation: e-Bus



Approach: Resiliency / Preparedness



- <u>Water Generation</u> High-efficiency multi-fuel gen-sets to provide water pumping for a 3- to 7-day period
- <u>Emergency Operations</u> Optimal Geographic Locations

 <u>Shelters</u> - Designated for public with emergency backup generation

Accomplished & Future Energy Portfolio

2010-2020

- TERM
- Energy Department
- PV Projects Implemented
- Wind Projects Implemented
- Battery Projects Planned
- More PV + Wind Projects Planned
- Grid Improvements





- TERMPLUS
- PV + Wind + Battery + EV + MG
 Sites Implemented
- Electric Bus & Vehicle Fleets
- EV Charger Network
- LED Street & Interior Lights
- Biofuels
- Strategic-Partnerships

- Pacific Island Nation Leader in Renewable Trajectory to 100%
 - Renewable Energy to Innovative Storage & Grid Solutions
 - Excess Renewable Generation shifted to Transportation
 - Complete Solutions : PV + Wind + EV + Grid + Battery
 - Tonga Energy Research Center RD&D
 - Island EVs & Charger Network
 - Electric & Biofuel Buses

Balancing economy, environment, culture, costs, and quality of life





□ Vision from Tonga:

- Demonstrate 21st century technologies
- World Leader in Cost-Effective Renewable Energy
- Revive traditional "affluent subsistence"

□ <u>Partnership Vision</u>:

- Sector Integration: energy, water, food, health and education systems
- Sustainable Energy Sector: Integration & Harmonizing Supply & Demand
- > RE, EE, Transportation, Resiliency

□ <u>Vision from GGGI</u>:

- Sustainable Energy Systems
- Tonga Energy Road Map PLUS
- Pacific Island Demonstration Sites

TERMPLUS WORKPLAN & SCHEDULE



Tonga Energy Road Map 2021-2035 - TERMPLUS WorkPlan Outputs in Red	R = Responsible	S = Support	T = Transport	SO = Sign-off	Kry-Acalysis Planned Delivered Caput Schmidt	
PHASE 0	R		т		17.Mary 24.Mary 31.Mary 7.Jun 14.Jun 28.Jun 5.Jul 12.Jul 19.Jul 26.Jul 2.Aug 9.Aug 16.Aug 30.Aug 6.6ep 13.6ep 25.5ep 27.5ep 4.Oct 11.Oct 18.Oct 25.Oct 1.Nov 8.Nov 12.Nov 29.Nov	6-Dec 13-Dec 20-Dec 27-Dec 3-Jan
					vicchow de la constance de la consta	
Step 0: Agreement on November Deliverable: TERMPlus					/LANG SCHOOLS	
Kick off Email	WR					
Outline and Guidance Document	WR				24-May 25 200000000000000 Weekshep 2000000000000 15-Sep	
Update TERMPLUS Analyses Files on MS Teams	WR, JS	KS, MA			24May	
Provide Document Template	WR, JS	KS, MA			24 May KS- Workshop	
GGGI Internal Meeting - Brainstorming. Deliverables and Schedule	KS. MA. JS. WR				TANK Western Tank	
MS-Teams Organization, Regularly Scheduled Team Meetings with Agenda and Workplans	KS, MA, JS, WR	ML			25 May 17 Jun 15 Nov	
Meeting with Tonga DPE to Agree on Deliverables and Final Delivery	KS, MA, JS, WR			DPE	27/May 8-Jun 15/Hov	_///
PHASE 1: TERMPlus: Preparation						
Review and Reset: Desired Length of Document, Chapters with Delivery Dates	KS, MA, JS, WR	DM-S			27-May 25-Jun	
					Pre- Workby	
Questions to DPE: Energy Supply & Demand, Renewable Energy Projects, any other Questions, Follow-up on Outstanding Questions	MA, JS, WR	KS			11-May 12-3d d3 d3	
Questions for TPL on Renewable Energy and T&D Targets, Projected Cost of Electricity, Future Technologies, Transportation and Resiliency	MA, JS, WR	KS			12-had Montahap Cr	
Contact S. Bloomfield for Team Meeting on Energy Bill Insights	WR	MA, JS			Aug Verschap Cd	
Contact Other Govt Departments Necessary	WK.	MA, IS			18-Jun 2-Jul	
					Workshop Workshop	
Contact Private Entities (e.g. Oil Suppliers) and Other Releveant Entities Develop TOR for Transportation Consultant, post, interview and procure	WR	KS, MA, JS		GGGI-HQ	1 Skyn 22 Jul 25 7 Jul 44g (b) 0 2 Jul 25 7 Jul 45g (b) 0 2 Jul 45g (b)	
Develop TOR for Transportation Consultant, post, Interview and procure Update TERMPlus Draft Document	WR KS, MA, JS, WR	KS, MA, JS	1	aaal-HQ	Dur Life of second s	
PHASE 2: TERMPlus Implementation						
Document Chapter - Energy Supply (5 pages?)						
Overview, with oil products and renewables as the relevant fuels	JS	MA, WR			18 Jun 19 Jul	
Targets, including reduction of oil imports and increased security of supply	15	MA, WR				
Measures by fuel to achieve targets, including gender considerations	15 15	MA, WR				
Enabling environment, including policy, legal and regulatory reform - Deliver Chapter Document Chapter - Energy Consumption (and Efficiency) (7 pages?)	15	MA, WR			1944 - 1944 - 1944 - 1944 - 1944 - 1944 - 1944 - 1944 - 1944 - 1944 - 1944 - 1944 - 1944 - 1944 - 1944 - 1944 -	
Overview, with transport, commerce and public services, and households as the main sectors for final energy consumption	MA	JS. WR	т		25-bun T-9-bul 2.Aug	
Targets on reduction of oil consumption and limiting growth of electricity consumption thru energy efficiency and conservation	MA	JS, WR	т			
Measures by sector to achieve targets incl. gender considerations -10 selected priority actions developed in a template	MA	JS, WR	т			
Enabling environment, including policy, legal, market desing and regulatory reform - Deliver Chapter	MA	JS, WR	т		304	
Document Chapter - Electricity Generation and Distribution (10 pages?)	WR. MA	JS, KS				
Overview of the electricity sector, including an assessment of existing and future generation options Targets, including increased electricity generation from renewable sources	WR, MA WR, MA	JS, KS JS. KS			18-Jun and a second	
Targets, including increased electricity generation nom renewable sources. Measures, including renewable energy (to achieve targets), these will be 10 selected priority actions developed in a template	WR, MA	15, KS				
Requirements including estimation of renewable energy potential, assessment of grid capacity for intermittent electricity	WR, MA	JS, KS				
Enabling environment, including policy, legal, market design and regulatory reform	WR, MA	JS, KS				
Requirements for the measures to be effective including gender considerations - Deliver Chapter	WR, MA	JS, KS				
Document Chapter - Transportation (5 pages?) Transportation Kick-off Meeting	WR	JS. MA. KS	т			
Pransportation KICK-off Meeting Overview of the transportation sector, including an assessment of existing and future transportation options	т	JS, MA, KS WR, MA, JS				
Measures, these will be 10 selected Transportation priority actions developed in a template	т	WR, MA, JS				
Enabling environment, including policy, legal, market design and regulatory reform - Deliver Chapter	т	WR, MA, JS				
Document Chapter - Action Plan ST, MT, LT (5 pages?)						
S-year Action Plan (ST)	WR	MA, JS			26 Aug	
10-year (MT), 15-year Action Plan (LT) Deliver Chapter	WR WR	MA, JS MA, JS			3.5ap	
Deswer Chapter Document Chapter - Gender Inclusion (2 pages?)	wh.	MH, 15				
Overview of Gender Policies that can increase Inclusion	KS	WR			23-kag 20-5sp	////
Guidance on next steps for Gender Inclusion - Deliver Chapter	KS	WR				
Document Chapter - Data Collection and Dissemination (4 pages?)						
Overview of the existing data collection procedures, including identification of relevant gaps	15 15	JS, MA, T	T		23 Aug 13 Gap	
Guidance on data collection, sharing and dissemination (to address existing gaps) - Deliver Chapter Document Chapter - Adaptation to Climate Change and Resiliency (5 pages?)	15	WR, MA, T				
Expected impact of climate change on supply, demand and electricity generation.	JS	WR, MA	т		10 Aug 27 Sep	
Adaptation options to cope with the adverse impact of climate change - Deliver Chapter	15	WR, MA	т			////
Document Chapter - Annexes (Separate Document up to 30 pages?)						
Annexes with relevant technical analysis - Deliver Annexes	WR, MA, JS	KS	т		18-bun 27-5ep 23-0423-04	
Executive Summary (1-2 pages) Compile Chapters, Annexes, Executive Summary and Final Draft Review Internally and send final Draft to DPE	KS, WR KS. MA. JS. WR	MA, JS	T	DPF		
Compile Chapters, Annexes, Executive Summary and Final Draft Review Internally and send final Draft to DPE Validation Workshops to receive Comments at Mid-Term and for Final received from DPE. Stakeholders and Development Partners	KS, MA, JS, WR KS, MA, JS, WR		т	UPE		
Validation workshops to receive comments at whomen and for Phan received from DPC, stateholders and Development Partners Final Changes and Print	KS, MA, JS, WR		T			
PHASE 3: TERMPLUS: Delivery						
GGGI Final Output: Deliver TERMPLUS to DPE	WR	KS, MA, JS, T	т	DPE	29-0ct	
External Output:Tonga DPE Meeting with Cabinet	DPE	GGGI		CABINET	Tongo	TERMPLUS LAUNCH
Follow-up Email and Schedule for Launch of TERMPLUS and Initiation of TERMPLUS Investment Plan	WR	KS, MA, JS, T		DPE	1 May 12 May Electrons	KICKOFF TERMPLUS INVESTMENT PLAN
HAPPY HOLIDAYS - CHRISTMAS (+ OTHER INTERNATIONAL HOLIDAYS)					Glosgow COP 26 XXXXXXX	**********

TERMPLUS Workplan 27-May to 30-August



27-May

Tonga Energy Road Map 2021-2035 - TERMPLUS WorkPlan

Outputs in Red

PHASE 0

Step 0: Agreement on November Deliverable with Tonga MEIDECC – Department of Energy: TERMPLUS

PHASE 1: TERMPlus: Preparation

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Questions for TPL on Renewable Energy and T&D Targets, Projected Cost of Electricity, Future Technologies, Transportation and Resiliency

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Contact Private Entities (e.g. Oil Suppliers) and Other Releveant Entities

PHASE 2: TERMPlus Implementation

Document Chapter - Energy Supply (5 pages?)

Overview, with oil products and renewables as the relevant fuels

Targets, including reduction of oil imports and increased security of supply

Enabling environment, including policy, legal and regulatory reform - Deliver Chapter

Document Chapter - Energy Consumption (and Efficiency) (7 pages?)

Overview, with transport, commerce and public services, and households as the main sectors for final energy consumption

Targets on reduction of oil consumption and limiting growth of electricity consumption thru energy efficiency and conservation

TERMPLUS Workplan 27-May to 29-October

Document Chapter - Electricity Generation and Distribution (10 pages?)				<u> </u>
Overview of the electricity sector, including an assessment of existing and future generation options				
Targets, including increased electricity generation from renewable sources				
Requirements including estimation of renewable energy potential, assessment of grid capacity for intermittent electricity				
Document Chapter - Transportation (5 pages?)				
Document Chapter - Action Plan ST, MT, LT (5 pages?)				
5-year Action Plan (ST)				
10-year (MT), 15-year Action Plan (LT)				
Document Chapter - Gender Inclusion (2 pages?)				
Document Chapter - Data Collection and Dissemination (4 pages?)				
Document Chapter - Adaptation to Climate Change and Resiliency (5 pages?)				
Document Chapter - Annexes (Separate Document up to 30 pages?)				
Executive Summary (1-2 pages) 24-25-	26-27-			
Validation Workshops: receive Comments Aug	Oct			
PHASE 3: TERMPLUS: Delivery				
GGGI Final Output: Deliver TERMPLUS to DPE	<mark>29-Oct</mark>			
			Tong	a
		1-Nov 12-Nov	v Electic	ons
	l	Glasgow COP		
		26		xxxxxx
		TERMPLUS Launch		



Kick-off TERMPLUS Investment Plan

Thank You





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