

## Unlocking MG for sustainable development:

**Suva, Fiji**

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**Ofa Sefana**

*Tonga*



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# 1. GOVERNMENT STRATEGIES



- \* **Renewable Energy targets (TERM PLUS)**

- \* 50% renewable energy generation by 2020
- \* 70% renewable energy generation by 2025
- \* 100% renewable energy generation by 2045

- \* **Energy Efficiency targets (TEEMP)**

- \* Maintain line loss at 8%
- \* 20% reduction in Vehicle Kilometer Travelled of light-duty vehicles (LDVs) through walking, biking, transit, rideshare, telecommute.
- \* 30% improvement in fuel economy for new LDVs through registration fees, import tariffs, or fuel economy standards
- \* 10% of new LDVs are electric by 2030.

- \* **2<sup>nd</sup> NDC**

- \* 70% renewable energy generation by 2030
- \* Mandatory vehicle standards and/or incentives through tax, fees, import tariffs
- \* Adoption of MEPSL

# GOVERNMENT STRATEGIES (con't)



- \* a more inclusive, sustainable and balanced urban and rural development across island groups
- \* a more inclusive, sustainable and empowering human development with gender equality
- \* a more inclusive, sustainable and successful provision and maintenance of infrastructure and technology



## 2. Mini-grid Electrification – COOPERATIVE SOCIETY

**Tonga**

Niuafo'ou  
**NIUA GROUP**

Tafahi  
Niuatoputapu

N  
Vava'u  
Group  
Fonualei  
Toku

★ **100% SOLAR - GCF  
FUNDED / COMMISSION  
DEC23**

Late Vava'u

**HAÁPAI GROUP**

★ **PV/DIESEL HYBRID - AUSAID  
COMMISSION BY DEC 23**

Kao  
Tafua  
Ha'ano  
Lifuka  
Uiha  
Nomuka

★ **100% PV - GCF BE COMMISSIONED IN  
DEC24**

**Pacific Ocean**

Nuku'alofa  
Tongatapu  
Group  
'Enu

'Ata

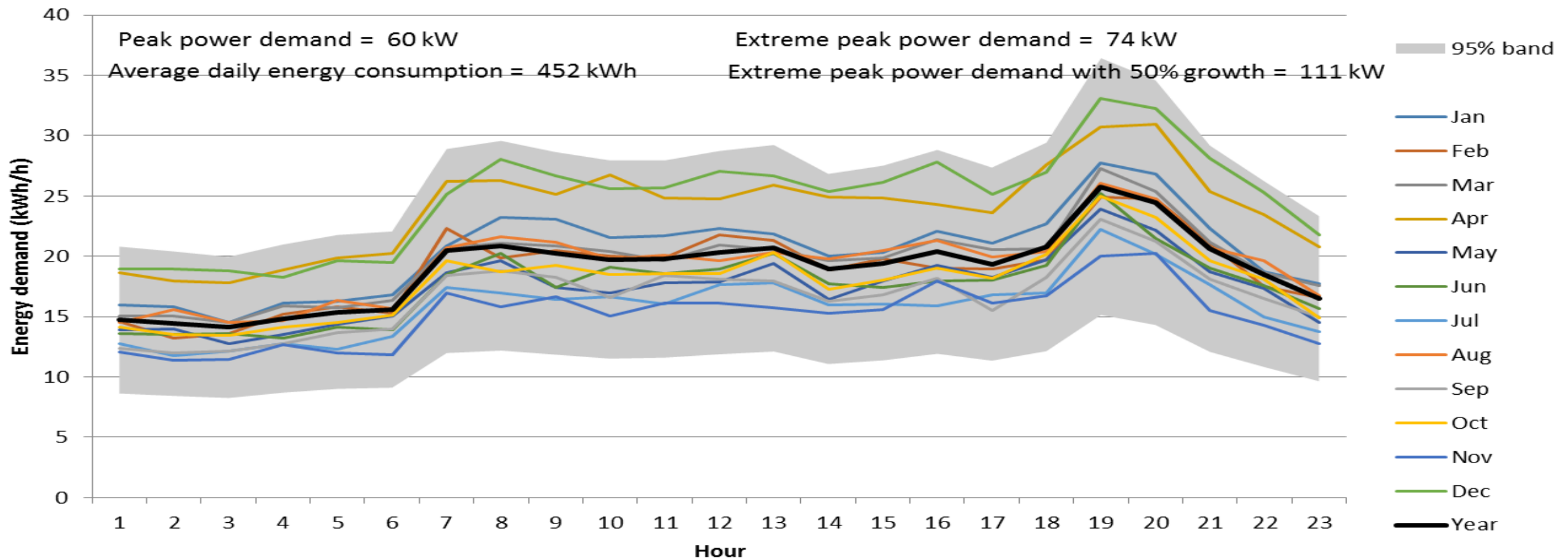
# Mini-Grid Electrification (con't) Investment/Tariff



		Island Name	H'hold#	Year of Operation	CAPEX TOP	Generation Capacity			Proposed Levelized Tariff TOP (5yr)	Commissioning Date
		OIREP				Genset kW	PV kWp	BESS kWh		
	1	Uiha	197	2002	1,668,219.00	50	100	210	4.36-3.63	Sep-23
	2	Haáno	153	2002	1,719,616.00	50	100	210	2.43-2.04	Aug-23
	3	Haafeva	80	2002	1,165,664.00	30	60	110	1.71-1.40	Aug-23
	4	Nomuka	158	2002	1,574,948.00	50	100	210	2.33-1.91	Nov-23
	5	Niutoputapu	232	New	3,967,569.00	80	150	295	2.30-1.91	Jul-23
		TREP1								
	6	Oúa	31	New	1,317,655.00	Non	58	109	Not Decided	Dec-23
	7	Tungua	44	New	1,339,011.00	Non	84	160	Not Decided	Dec-23
	8	Kotu	46	New	1,341,998.00	Non	69	130	Not Decided	Dec-23
	9	Moungaóne	21	New	1,103,043.00	Non	35	66	Not Decided	Dec-23
	10	Niuafoóu	155	New	5,755,945.00	Non	250	404	Not Decided	
		TREP2								Nov-24
	11	Hunga	101	New	1,212,980.00	Non	110	350	Not Decided	Nov-24
	12	Otea	56	New	1,290,345.00	Non	80	190	Not Decided	Nov-24
	13	Ofu	49	New	1,192,982.00	Non	80	200	Not Decided	Nov-24
	14	Falevai	42	New	1,341,902.00	Non	80	200	Not Decided	Nov-24
			1365		5,038,209.00	260	1356	2844		



# Mini-Grid Load Profile (con't) – Load Profile



# Mini-Grid Electrification (con't) Individual Cost

OIREP CAPEX	TOP \$	PERCENTAGE
New Generator	1,079,696	11%
New Battery	2,093,030	21%
New Inverters	1,855,676	18%
New Solar Plant	1,519,939	15%
New Transformer	843,549	8%
New Switch gear	362,627	4%
New Cable	744,778	7%
	447,323	4%
New Refurbishment of old office and fence	712,596	7%
Extension to the old office	210,824	2%
New Power house	212,879	2%
Imporvement to the new Building	13,100	0%
TOTAL	10,096,017.00	100%



# MINI-GRID ELECTRIFICATION (con't) Cost Recovery

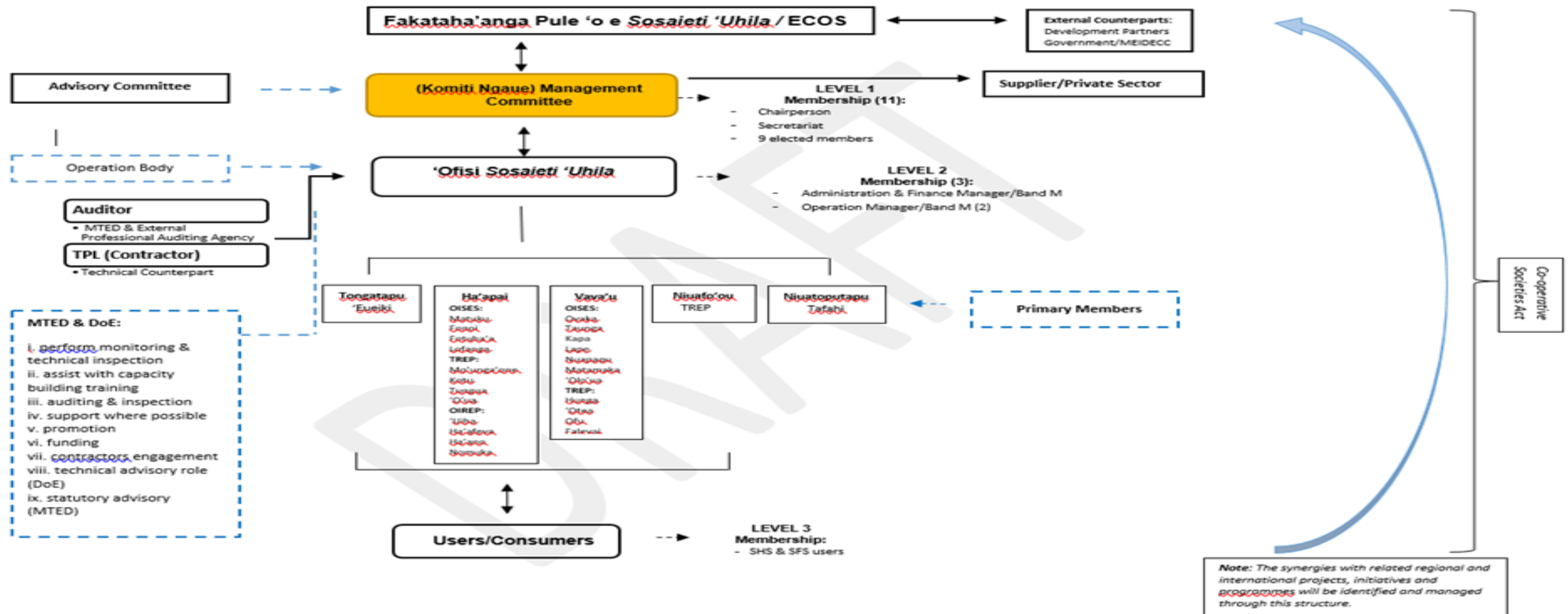


PROPOSED REGULATED  
TARIFF

Islands	CAPEX TARIFF	OPEX TARIFF	TOTAL TARIFF	Markup	REGULATED TARIFF	CAPEX %	OPEX %	Profit/BO NUS
Nomuka	1.17	0.52	1.68	0.07	1.75	66.59	29.44	3.97
Uiha	0.75	0.41	1.16	0.07	1.23	60.84	33.53	5.63
Ha'ano	1.38	0.53	1.91	0.07	1.98	69.65	26.85	3.50
Ha'afeva	1.69	1.02	2.71	0.07	2.78	60.82	36.68	2.50
Niutoputapu	1.88	0.37	2.25 <sup>9</sup>	0.07	2.32	80.95	16.06	2.99

# MINI-GRID ELECTRIFICATION (con't) Institutional

## PROPOSAL - TONGA ELECTRICITY CO-OPERATIVE SOCIETY LTD (FAKATAHA LAHI)





# Mini-grid Electrification (con't) GHG Reduction



## Sub-projects

Avoided emissions (2.68 kgCO<sub>2</sub>/l)  
Usable generation

Avoided emissions  
Unusable generation

2020 (tonnes)	2030 (tonnes)	Lifetime (tonnes)	2020 (tonnes)
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### Input 1: Tongatapu grid

1	Fahefa solar PV plant		1,869	1,117	30,176	2,331
	Matafonua solar PV plant		1,869	1,117	30,176	2,331
2	Niutoua wind farm		6,355	3,797	95,637	7,925
3	3 units of BESS					
	Additional generation to achieve 50%2020 and 70%2030 targets		7,572	26,568	629,126	9,250

### Input 2: 'Eua and 'Vava'u grids

4	Solar PV Farm with BESS in 'Eua		380	400	9,720	406
5	Solar PV Farm with BESS in Vava'u		319	285	6,977	349

### Input 3: Outer Island mini-grids

6	Centralized PV/Diesel/Battery hybrid systems and mini-grids on 4 outer islands of Ha'apai	O'ua	27	27	664	70
		Tungua	33	33	813	84
		Kotu	33	33	835	84
		Mo'unga'one	22	22	550	59
7	Centralized PV/Diesel/Battery hybrid systems and mini-grids on Niuafo'ou		128	128	3,210	294






**TOTAL**

<b>18,608</b>	<b>33,526</b>	<b>807,882</b>	<b>23,180</b>
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# 3. Experiences and challenges



## Experiences of **MINI-GRID** Electrification Project

-  Communities are willing to manage (Own+Run)
-  Cooperative Model for Institutional Management
-  Policy to be fully enforced by Management
-  Quarterly Regular Monitoring/Visit **MUST** be Carried out
-  **MUST** be managed under existing regulations







## 4. EXPERIENCES AND CHALLENGES



This shows the typical electricity supply to a household and the street lighting on Ha'ano island, Ha'apai group. The OIREP Phase 4 scope shall replace the household wiring along with the street lighting. This will drastically increase public safety.



# EXPERIENCES AND CHALLENGES



This shows the typical house wiring on and village transformers on 'Uiha island, Ha'apai group. The OIREP Phase 4 scope shall replace the metering boxes, house wiring and have them approved by the national Electricity Commission along with all the village transformers. This will drastically increase household safety.

# Experiences and challenges



## Issues of **MINI-GRID** Electrification Project



Lack of O&M experiences. Lack of technical expertise



No supervision of asset condition and O&M - Lack of clarity about rates, interconnection standards, safety requirements, as well as the roles of the minigrid operators



Institutional, technical & administrative for O&M were inadequate



Financial management/ records are not audited



Wages not attractive



## 5. LESSON LEARN

- a. Community-based Management *must* be managed under existing legislation/regulations
- b. Government Lime *Ministries active Participation* is essential
- c. To reach the real long-term generation costs, there should be no compromise on the *quality of system* components as well as *operational procedures*.
- d. Fully *diesel-fuelled mini-grids are more expensive* on a lifetime basis than hybrid ones, such as solar photovoltaic.
- e. Mandatory *standards & good practices must be in place*

# MALO!