Pacific Power Utilities

Benchmarking Report

2021 Fiscal Year

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Pacific Power

Benchmarking

Summary Report

2021 Fiscal Year

Prepared by Pacific Power Association

December 2022

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1. Introduction

1.1 Benchmarking Overview

Twenty utilities out of the twenty-six utility members have provided data for the 2021 report, the same number that participated in 2010.

This exercise commenced in 2001 and recommenced in 2010 after a lapse of 9 years. The list of participating utilities during this period is shown in Table 1.1.

Table 1.1: Utility Participation in 2001 and from 2010 to 2021

Utility			Data Period												
			2001	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Acronym	Name	Country/ Territory	Year Data Collected												
			2002	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
ASPA	American Samoa Power Authority	Amercian Samoa	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×
CPUC	Chuuk Public Utility Corporation	Fed. Staes of Micronesia (FSM)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CUC	Commonwealth Utilities Corporation	Commonwealth of Northern Marianas	×	✓	✓	✓	✓	×	✓	×	✓	✓	✓	×	×
EDT	Electricite de Tahiti	French Polynesia	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	×	×
EEC	Electricite et Eau de Caledonia	New Caladonia	✓	×	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EEWF	Electricite et Eau de Wallis et Futuna	Wallis & Futuna	✓	×	×	×	×	×	×	×	×	×	×	×	×
ENERCAL	Societe Neo-Caledonnenne D'Energie	New Caladonia	✓	×	×	×	×	×	×	×	×	×	×	✓	✓
EPC	Electric Power Corporation	Samoa	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	×	✓	✓
EFL	Energy Fiji Limited	Fiji	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	×	✓
GPA	Guam Power Authority	Guam	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	×	✓	✓
KAJUR	Kwajalein Atoll Joint Utility Resources	Marshall Islands (RMI)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	×	×
KUA	Kosrae Utilities Authority	Fed. States of Micronesia (FSM)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MEC	Marshall Energy Company	Marshall Islands (RMI)	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	✓
NPC	Niue Power Corporation	Niue	✓	✓	×	×	×	×	×	×	×	×	×	×	×
NUC	Nauru Utilities Corporation	Nauru	×	✓	✓	✓	×	×	✓	✓	✓	✓	×	✓	✓
PPL	PNG Power ltd.	Papua New Guinea (PNG)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PPUC	Palau Public Utilities Corporation	Palau	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PUB	Public Utilities Board	Kiribati	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓
PUC	Pohnpei Utilities Corporation	Fed. States of Micronesia (FSM)	✓	×	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓
SCE	Southern California Edison	Santa Catalina Island												✓	✓
SP	Solomon Power	Solomon Islands	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TAU	Te Aponga Uira O Tunu-Te-Varovaro	Cook Islands	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TEC	Tuvalu Electricity Corporation	Tuvalu	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TPL	Tonga Power Limited	Tonga	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
UNELCO	UNELCO Vanuatu Ltd.	Vanuatu	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
YSPSC	Yap State Public Service Corporation	Fed. States of Micronesia (FSM)	×	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓
		Total	20	21	21	21	21	19	22	18	21	22	15	20	20

2. Governance

2.1 Key Governance Results

The governance data provided by utilities for previous reports and the 2020 report is shown in Table 2.1.

Table 2.1: Quality Standard and Regulatory Structures of Utilities

Utilities	Power Quality Standards	Self-Regulated or Externally regulated	Public/ Private Ownership	Accounting standards
ASPA	US	Self Regulated	Public	
CPUC	US	Self Regulated	Public	USGAP
CUC	US	Self Regulated	Public	
EDT	concession contract	Externally Regulated	Private	
EEC	EN50160	Externally Regulated	Private	
EEWF				
ENERCAL		Self Regulated		
EPC	AUS/NZ	Externally Regulated	Public	IFRS & IAS
EFL	AUS/NZ	Externally Regulated	Public/ Private	IFRS
GPA	AHRI & Energy Star	Externally Regulated		US GAP
KAJUR	self	Self Regulated	Public	
KUA	KUA	Self Regulated	Public	US GAP
MEC	MEC	Self Regulated	Public	US GAAP
NPC		Self Regulated	Public	
NUC	AUS/NZ	Self Regulated	Public	IFRS
PPL	AUS/NZ	Externally Regulated	Public	
PPUC	JIS, NEC	Externally Regulated	Public	GASB
PUB	Self	Self Regulated	Public	GAP
PUC	Self	Self Regulated	Public	GAP
SCE	US	Externally Regulated	Private	USGAAP
SP	Self	Self Regulated	Public	IAS/IFRS
TAU	AUS/NZ	Externally Regulated	Public	NZ IFRS
TEC	AUS/NZ	Self Regulated	Public	IAS
TPL	Self	Externally Regulated	Public	IFRS
UNELCO	Concession contract	Externally Regulated	Public/ Private	French GAAP & IFRS
YSPSC	NEC	Self Regulated	Public	GAAP

Note: The Solomon Islands and Kiribati are in the process of establishing an independent regulator.

2.2 Governance Assessment

The composite governance score introduced in the 2012 Fiscal Year Report has again been utilised in this years' power benchmarking exercise for the purpose of analysing if good governance mechanisms are delivering tangible benefits to utilities in the form of improved financial performance. The composite score is comprised of the same weighted indicators as the 2012 Fiscal Year Report, determined from relevant responses in the governance questionnaire using a governance scorecard (Table 2.2).

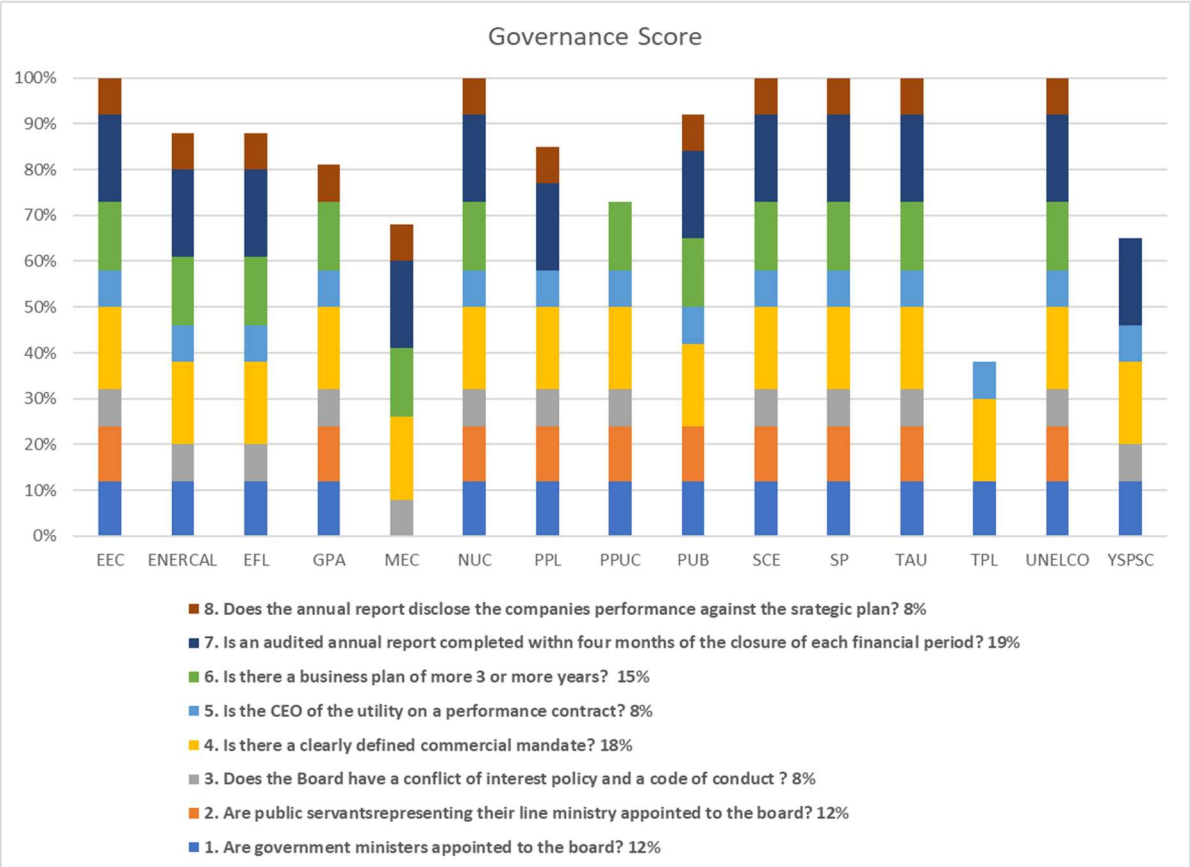
Table 2.2 Governance Score

Governance Indicator	Good Governance	Poor Governance	Score
Are Ministers appointed to the Board?	No	Yes	12%
Are Ministers/ public servants representing line/ sector Ministry appointed to the Board?	No	Yes	12%
Is a Code of Conduct in place and implemented?	Yes	No	8%
Is a commenrcial mandate in place and implemented?	Yes	No	19%
Is the CEO on a performance contract with annual reviews?	Yes	No	8%
Has a Strategic Plan (at least 3 years forecasts) been adopted and implemented?	Yes	No	15%
Is the Annual Report (audited) completed within four months of the end of the reporting year?	Yes	No	19%
Does the Annual Report disclose performance against Plan?	Yes	No	8%
Total Score			**100%**

Note: A good governance score results in full marks for each indicator, whilst a poor governance result receives a zero for each applicable indicator. In regard to the indicator on Annual Reports being completed within four months of the end of the reporting year, this has been used as a good practice standard, but it is acknowledged that several utilities have agreements with their regulators that allow for longer periods for production of Annual Reports.

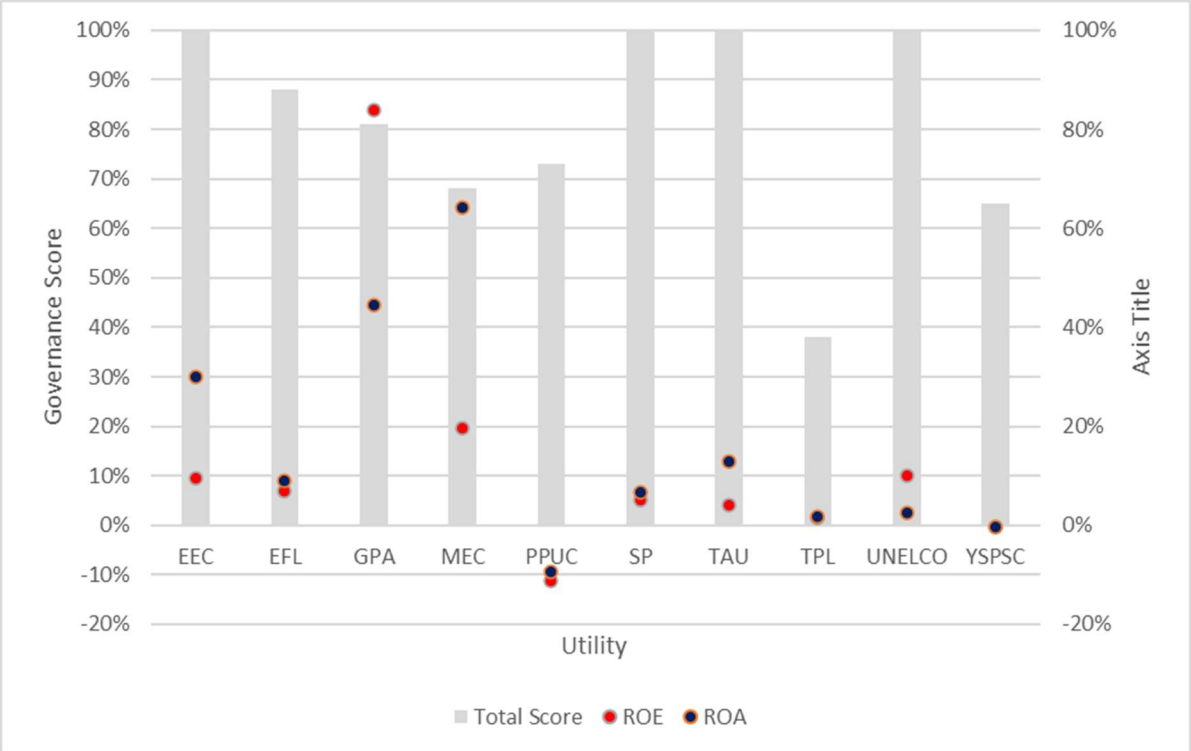
The composite Governance Score for utilities which provided sufficient responses to enable scores to be determined are presented in Figure 2.1.

Figure 2.1: Composite Governance Score for 2021 FY



The Comparison of Governance Score to the Return on Total Assets and Return on Equity is shown in Figure 2.2.

Figure 2.2: Composite Governance Score compared with ROA and ROE



3. Gender

Of the 20 utilities that reported, 17 utilities provided sufficient data on the gender profile of their workforce. The utilities That provided data are CPUC, EEC, EPC, EFL, GPA, KUA, MEC, NUC, PPL, PUB, PUC, SP, TAU, TEC, TPL, UNELCO and YEPSC.

The gender make-up of the Pacific Island utilities in presented in Table 3.1.

Table 3.1: Gender Make up of Utility Workforce

Workforce Gender Profile	
Total Number of Employees	3,476
% of Male Employees	81%
% of Female Employees	19%
Number of Male CEOs	16 out of 17
Number of Male 2nd in Command	9 out of 12
Number of Executive Staff	115
% Male Executive Staff	80%
% Female Executive Staff	27%

Divisions	Technical	Finance	Procurement	HR	PR/Customer Service/Communications	Administration	Other
Total Number of Staff	1,880	278	102	110	338	105	519
% Male Staff	82%	44%	45%	32%	32%	41%	
% Female Staff	18%	56%	55%	68%	68%	59%	

Female employees make up 19% of the total workforce. In 2018, 2019 and 2020 this stood at 18.2%, 19% and 19.7% respectively.

4. Data Reliability

Figure 4.2 presents the data reliability category as assess by the utilities that responded.

These are translated into aggregate reliability scores submitted by each of the utilities in order to rank the relative reliability of the data that was submitted. These aggregate scores have furthermore been utilised as a weighting in this reporting in calculating the Composite Indicator for the 2021 FY.

Figure 4.2: Data Reliability Chart

	Utility	EEC	ENERCAL	EFL	MEC	NUC	SCE	TAU
	Question							
i.	How is fuel consumption calculated or derived?	A	A	A	B	A	B	A
ii.	How are generation quantities calculated or derived?	A	B	A	B	A	A	A
iii.	How are customer outage impacts calculated or derived?	A	B	A	B	A	B	A
iv.	How are network demands and capacity utilisation calculated or derived?	A	A	A	C	A	B	A
v.	How are the number of connections or customers calculated?	A	B	A	A	A	A	B
vi.	Where is financial information sourced from?	A	B	A	A	A	A	B

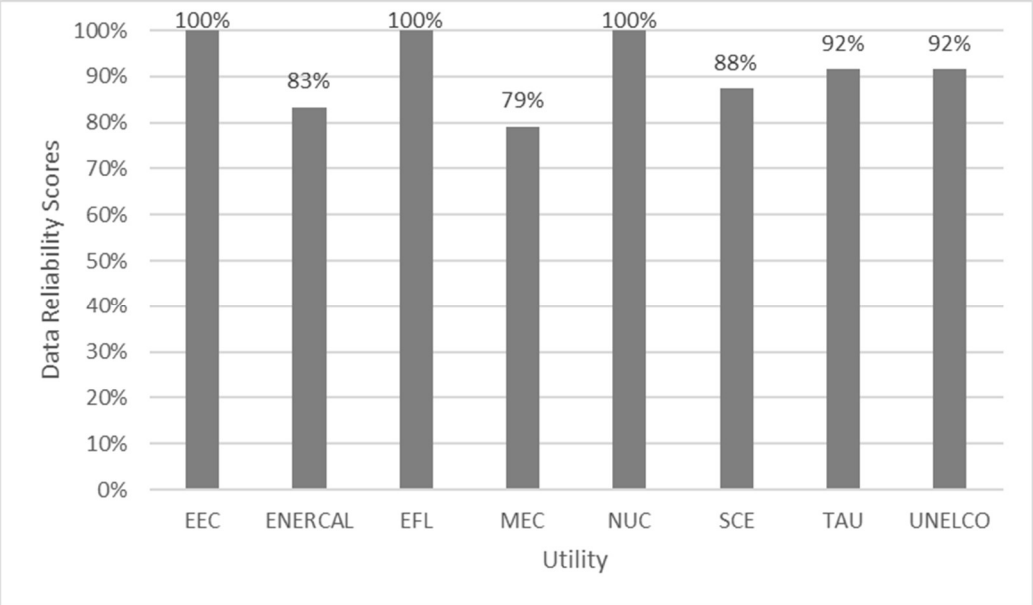
The reliability grade are:

A Highly Reliable

B Reliable

C Unreliable

D Highly Unreliable



5. KPI Results

5.1 Introduction

This section provides performance results for the 20 (2021 FY) and 20 (20120 FY) utilities that participated in the relevant reporting year. The results from 2019 FY have also been included for further comparison. The results are comprised of 46 KPIs, with each indicator graphically presented with both the regional average (arithmetic mean) and median (middle) values.

An indication of utility size is also provided via a colour coding of red, orange, or green as determined by utility size in accordance with the PPA's membership level categorisations: green indicates an annual peak load of less than 5MW (small); orange indicates an annual peak load of between 5MW and 30MW (medium); and red indicates an annual peak load of 30MW or greater (large). In order to facilitate comparison of results by size, all graphs are shown in the order of minimum to maximum demand. Table 5.1.1 furthermore provides an overview of some key characteristics of the participating utilities, including the applicable colour coding.

Table 5.1.1: Utility Key Characteristics

Utilities	Peak Demand (for Largest Grid)	Size Category	Smaller Grids Serviced	Total Annual Energy (MWH)	Renewable Energy Contribution
ASPA		Medium	Yes	-	-
CPUC	2.50	Small	Yes	16,499.00	5%
CUC		Medium	Yes	-	-
EDT		Large	Yes	-	-
EEC	81.49	Large	Yes	480,410.27	0.14
EEWF		Small	Yes	-	-
ENERCAL	135.00	Large	Yes	1,977,146.42	30%
EPC	28.20	Medium	Yes	171,252.20	45%
EFL	166.37	Large	Yes	931,558.08	65%
GPA	258.00	Large	Yes	1,684,613.78	2%
KAJUR		Small	No	-	-
KUA	1.20	Small	No	6,573.55	3%
MEC	9.80	Medium	Yes	63,857.00	1%
NPC		Small	No	-	-
NUC	5.65	Medium	No	42,802.59	9%
PPL	133.10	Large	Yes	2,111,119.00	48%
PPUC	11.92	Medium	Yes	82,309.79	2%
PUB	-	Medium	No	31,419.00	7%
PUC	5.96	Medium	Yes	56,371.00	3%
SCE- Catalina	5.60	Medium	No	28,209.72	-
SP	16.08	Medium	Yes	98,415.76	2%
TAU	5.53	Medium	No	30,014.11	16%
TEC	0.60	Small	Yes	10,000.00	19%
TPL	10.18	Medium	Yes	76,946.98	11%
UNELCO	11.47	Medium	No	59,817.00	10%
YSPSC	1.75	Small	Yes	10,471.00	15%

Note:

1. The Peak demand is for the largest grid operated by the utility, while the energy demand is aggregate for all the grids operated by the utility.

2. The data for ASPA, CUC, EDT, KAJUR, EEWF and NPC was not provided.

5.2 Presentation of Indicators:

Where appropriate the performance indicator is presented for each electricity grid, while for overall performance the performance indicator is presented for each utility.

The Pacific Island Country and Territory (PICT), Utility and the electricity grids they operate is matched in Table 4.

Table 4: PICT, Power Utility and Electricity Grid

PICT	Utilities	Grid
American Samoa	ASPA	ASPA
Chuuk, FSM	CPUC	Weno
CMNI	CUC	CUC
Tahiti	EDT	EDT
New Caledonia	EEC	N=NOUMEA-DUMBEA-MONTDORE
	EEC	B=BOURAIL
	EEC	K=KOUMAC-KAALAGOMEN
	EEC	L=LIFOU
Wallis & Futuna	EEWF	EEWF
New Caledonia	ENERCAL	Grande Terre
	ENERCAL	Iles Loyautés
Samoa	EPC	Upolu
	EPC	Savaii
	EPC	Apolima
Fiji	EFL	Viti Levu
	EFL	Labasa
	EFL	Savusavu
	EFL	Ovalau
	EFL	Taveuni
Guam	GPA	GUAM
Marshall Islands	KAJUR	Ebeye
Kosrae, FSM	KUA	Kosrae
Marshall Islands	MEC	Majuro
Nuie	NPC	Nuie
Nauru	NUC	Nauru
Papua New Guinea	PPL	PORT MORESBY
	PPL	RAMU
	PPL	GAZELLE
	PPL	ISOLATED
Palau	PPUC	KB
Kiribati	PUB	South Tarawa
Pohnpei, FSM	PUC	NPPPUC
St. Catalina Island*	SCE	St. Catalina
Solomon Power	SP	Honiara

	SP	Noro-Munda
	SP	Auki
	SP	Others
Cook Islands	TAU	Raratoga
Tuvalu	TEC	Fogafale
	TEC	Vaitupu
	TEC	Central, South
	TEC	Northern
Tonga	TPL	Tongatapu
	TPL	Vava'u
	TPL	Ha'apai
	TPL	Eua
Vanuatu	UNELCO	Efate
Yap, FSM	YSPSC	Yap Proper

5.2 Generation

5.2.1 Load Factor

The Load Factor (LF) is the average load demand divided by the peak demand over a period. In this report the period is the fiscal year and the LF is given for each electricity grid operated by the utility.

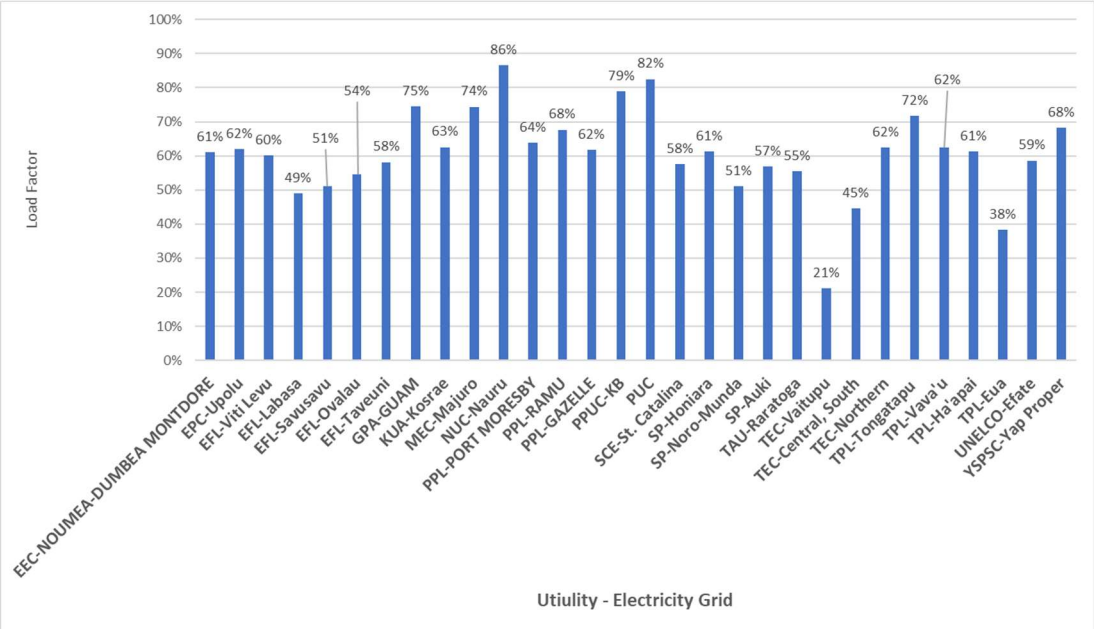
The LF is an indicator of the utilization of production capacity. Production capacity is maintained to provide for peak demand. A lower LF indicates a load profile with a greater peak compared to the average load and a lower utilization of production capacity.

A high LF implies a relatively flat demand profile and higher capacity utilization. This generally indicates an efficient use of production resources. However, a high LF could result from limiting peak demand by regular load shedding due to insufficient reliable production capacity. In this instance the high LF does not indicate an improved performance but is rather a symptom of insufficient reliable production capacity to meet the demand.

The minimum LF deemed acceptable is 50% while a benchmark of 80% is set for Pacific Island Utilities.

Demand side management strategies, time of use tariffs, peak lopping and demand shifting strategies can be adopted to limit the peak demand and improve the LF. This is expected to be an increasingly important activity in Pacific power sector policies."[1]

Figure 5.2.1: Load Factor (%)



Higher is better provided peak demand is not being limited by insufficient production capacity.

5.2.2 Capacity Factor

Capacity factor (CF) is also an indicator of effectiveness in relation to the use of generation resources. It is a similar measure to LF. Where LF measures average power as a percentage of maximum demand, CF measures average power demand as a percentage of installed firm capacity. The lower the CF the greater the production reserve capacity available to provide for demand when production units are taken out of service for maintenance

[1] PPA ADB, Pacific Power Utilities, pp. 5-1.

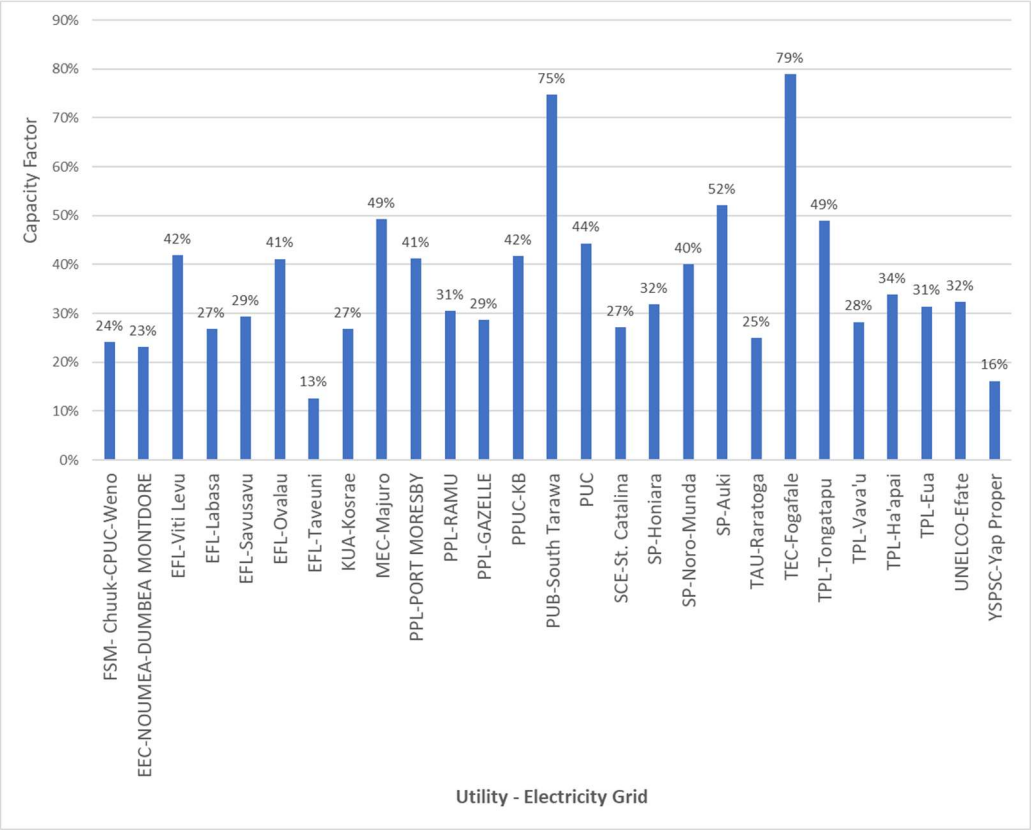
purposes or for repairs due to faults. It also may suggest over investment in production capacity which situation is best avoided.

A higher CF indicates a peak demand that approaches available production capacity. This may cause difficulties in scheduling maintenance for the generating plants and may result in load shedding during peak load periods when generators are taken out of service due to faults.

The investment in production capacity is determine by the power security policy adopted by the utility. Utilities may adopt a security policy of N-1 or N-2. N-1 production capacity is the maintenance of sufficient production capacity to cater for the loss of the generating unit with the largest capacity in the fleet. Likewise, N-2 caters for the loss of the two largest units in the fleet.

The minimum production capacity is determined by the power security policy adopted based on experience concerning reliability, the cost of investment and expectations regarding the lifespan of the firm production equipment. Installing more capacity than required would be an inefficient way of utilising a utilities financial resources, while, underinvesting may compromise the reliability of power supply.

Figure 5.2.2: Capacity Factor



Too high a CF, risk having insufficient capacity to meet demand at all times

A low CF indicates over investment in capacity.

Pacific Benchmark >40%

5.2.3 Availability Factor The availability factor (AF) is an indicator of how well a power plant is operated and maintained. It is determined by the actual hours the unit is available for production divided by the maximum available hours for the period. Because power plants need to be taken out of service for routine maintenance an AF of 100% is not achievable. The type of power plant and its mode of operation may affect the AF. For a base load diesel power plant,

with higher running hours more routine maintenance would be required and subsequently resulting in a lower AF. For such power plant an AF between 90% and 95% is expected. For a plant that is operated less frequently the AF should be a little higher.

A higher-than-expected AF may mean the plant is not being sufficiently maintained and this could lead to more frequent breakdown in the near future. A lower AF indicates more frequent breakdowns and outages for repairs as a result of poor maintenance and operation protocols.

Of the 37 grids reported upon 31 reported an AF of 100%. Five report an AF of between 95% and 99%.

Solomon Power reported an AF of 85% for the Honiara grid. This is the only data point that appears to be accurately reported.

It appears the underlying reasons for this reporting inaccuracy is a misunderstanding of the performance indicator and the lack of the underlying reports necessary to capture the data required.

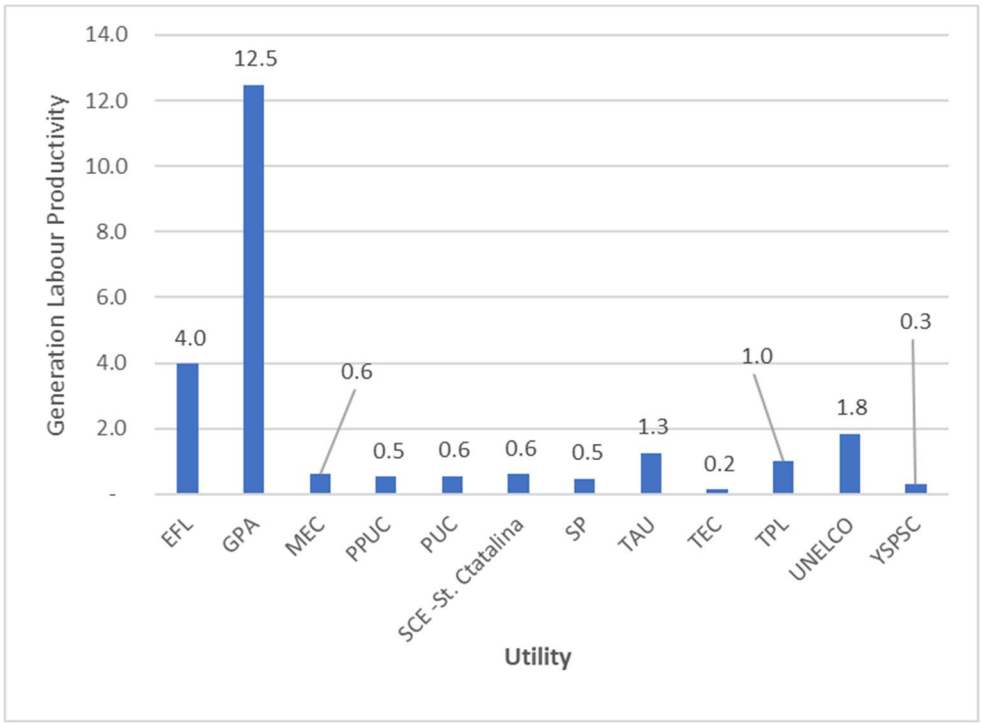
Figure 5.2.3: Availability Factor (%) ***(Graph is not presented due to unreliable data)***

5.2.4 Generation Labour Productivity

Generation Labour Productivity (GPL) is a measure of the total energy produced per full-time equivalent (FTE_G). Benchmarking of GPL for comparable utilities in size, demand and generation asset types would indicate whether the utility production team is right sized.

The average GPL for 2021 is 1.89 GWH. For 2020 the average was 1.3 GWH. The GLP for 2020 and 2021 is not comparable for the 2020 data did not include the GLP for GPA and EFL. GPA and EFL are the larger utilities in the PPA and as expected they have a higher GLP than the smaller utilities and so have lifted up the average.

Figure 5.2.4: Generation Labour Productivity



Average GLP for 2021 is 1.89 GWH/FTE_G

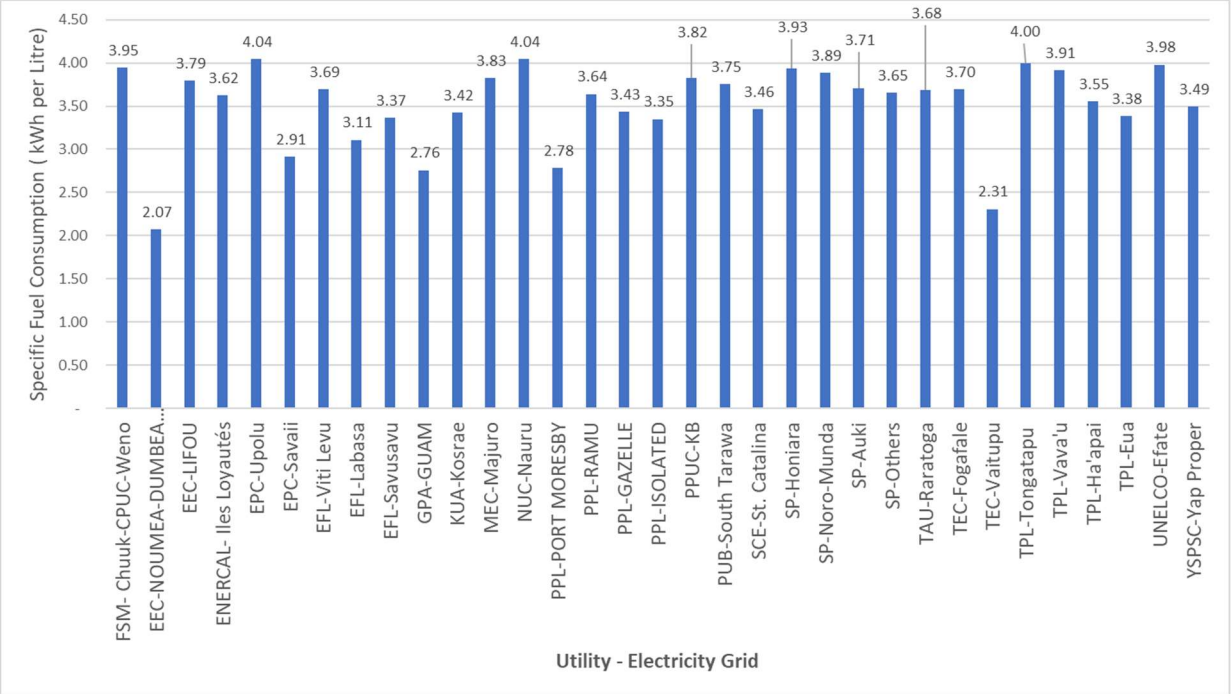
Higher is better

5.2.5 Specific Fuel Consumption DFO (kwh/Litre)

Specific fuel consumption (SFC) is a measure of the efficiency of fuel used for power generation utilizing diesel fired power generators, and is often reported in kWh/litre, kg/kWh or kWh/gallon. It is a critical performance indicator because fuel costs accounts for the bulk of generation expenses in a typical diesel-based power utility. Importantly, SFC refers to the efficiency of utility fossil fuel generation only – it does not include purchased energy from Independent Power Producers (IPPs). Furthermore, non-diesel generation is not factored into this indicator.

As power utilities transition away from fossil fuel-based production of power to renewable resources, and more IPPs are engaged in the production of energy, the impact of fossil fuel will factor less in the overall efficiency and costs of energy production.

Figure 5.2.5: Specific Fuel Consumption 2021

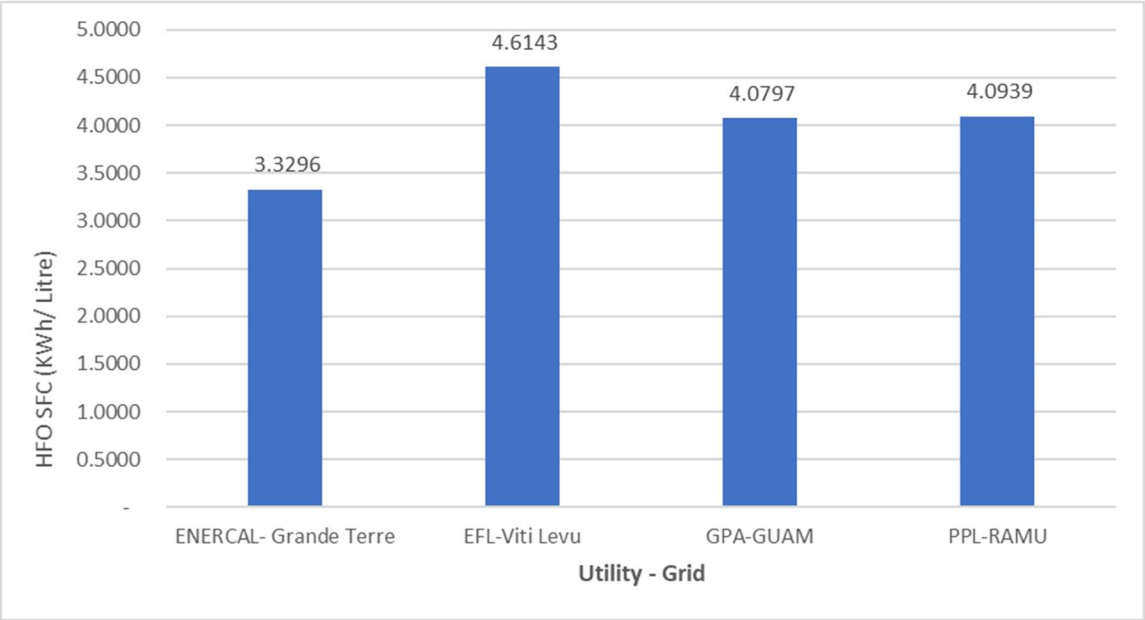


The Benchmark for SFC is 4 kWh per litre. The lower the indicator the less efficient the operation of the diesel generator.

5.2.6 Specific Fuel Consumption HFO (kWh/L)

This indicator reflects the efficiency of energy generation using heavy fuel oil. The only utilities that utilize heavy fuel oil for power generation are GPA, PPL, EFL and ENERCAL.

Figure 5.2.6: Specific Fuel Consumption HFO (kWh/L) 2021

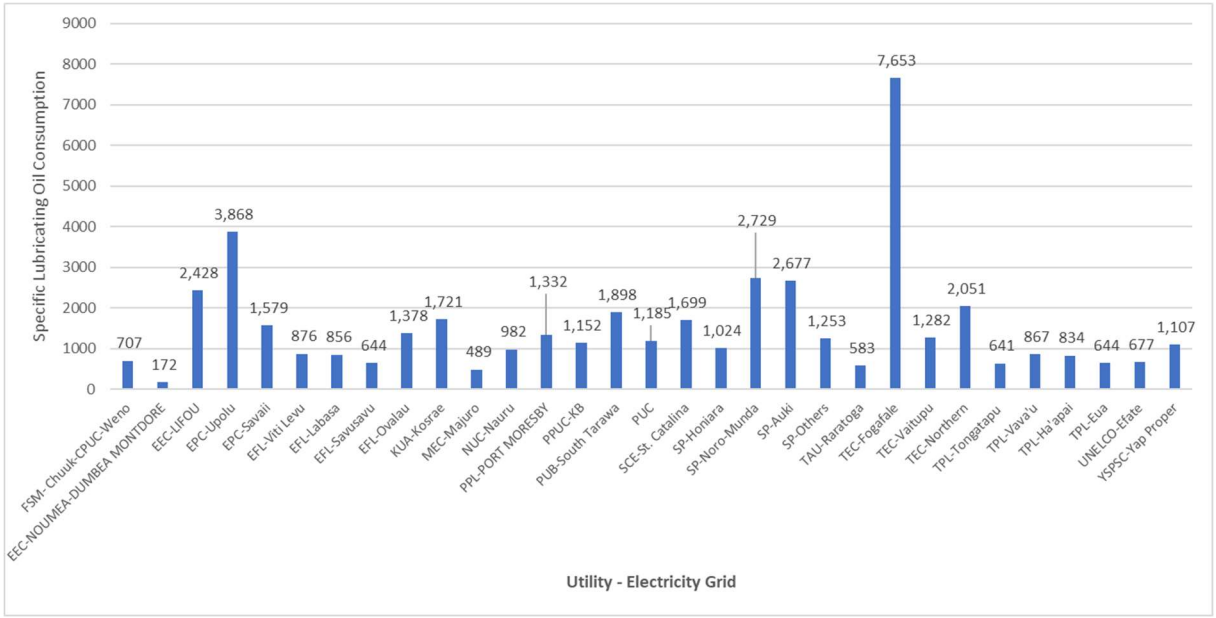


5.2.7 Specific Lubricating Oil Consumption

Specific Lubricating Oil Consumption (SLOC) is a measure of lubricating oil efficiency of usage by the diesel and HFO generating units and is determined by the number of kWh generated per litre of lubricating oil consumed. The benchmark varies according to the size and condition of the diesel engine. Lower lubricating oil efficiency can be attributed to poor maintenance, e.g. due to worn piston rings or leaks in the system. Reasonable values are about 500–700 kWh per litre for a 1 MW engine and 1,000–1,300 kWh per litre for a 4–5 MW engine.

SLOC much like the SFC will become less important as an indicator as the contribution to the energy produced is increased from renewable sources, especially from solar PV power plants.

Figure 5.2.7: Specific Lubrication Oil Consumption – 2021



5.2.8 Forced Outage

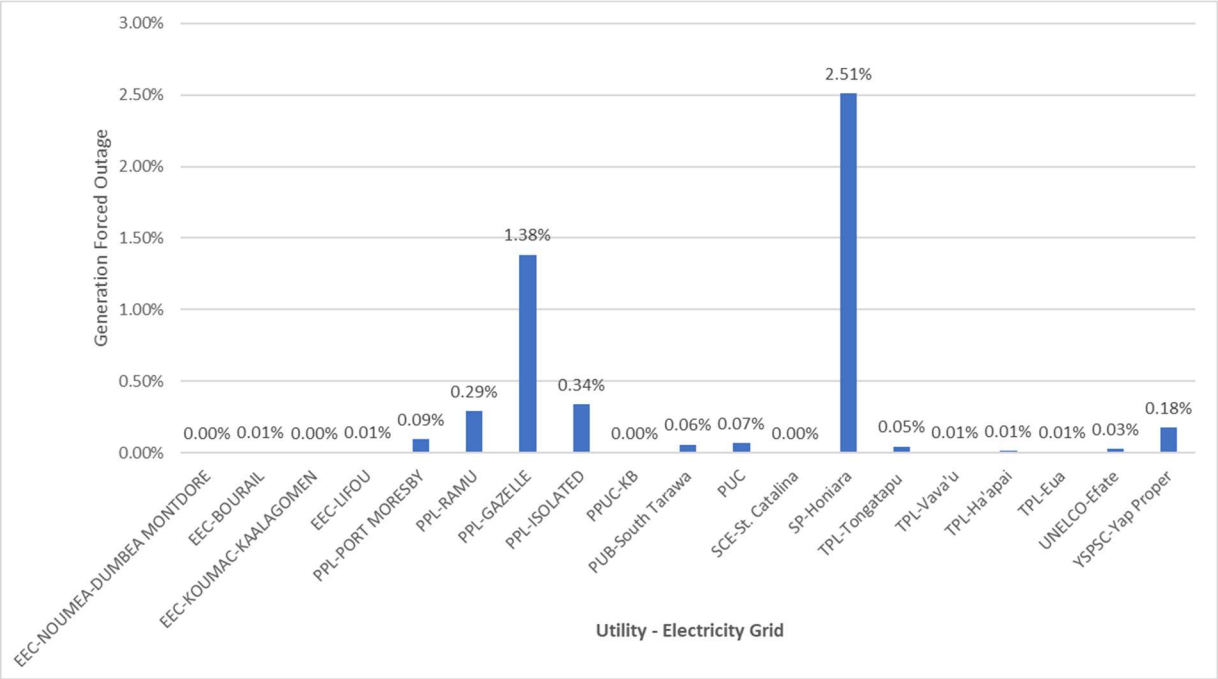
A forced outage is an unplanned outage (or generator downtime) that has been forced on the utility. Unplanned

outages are attributable to issues with generators that compelled the utility to take them out of service.

In 2021, 9 utilities provided sufficient data for 18 grids. The average forced outage indicator for the 18 power grids is 0.3%.

The Pacific benchmark is less than 3%.

Figure 5.2.8: Forced Outages 2021



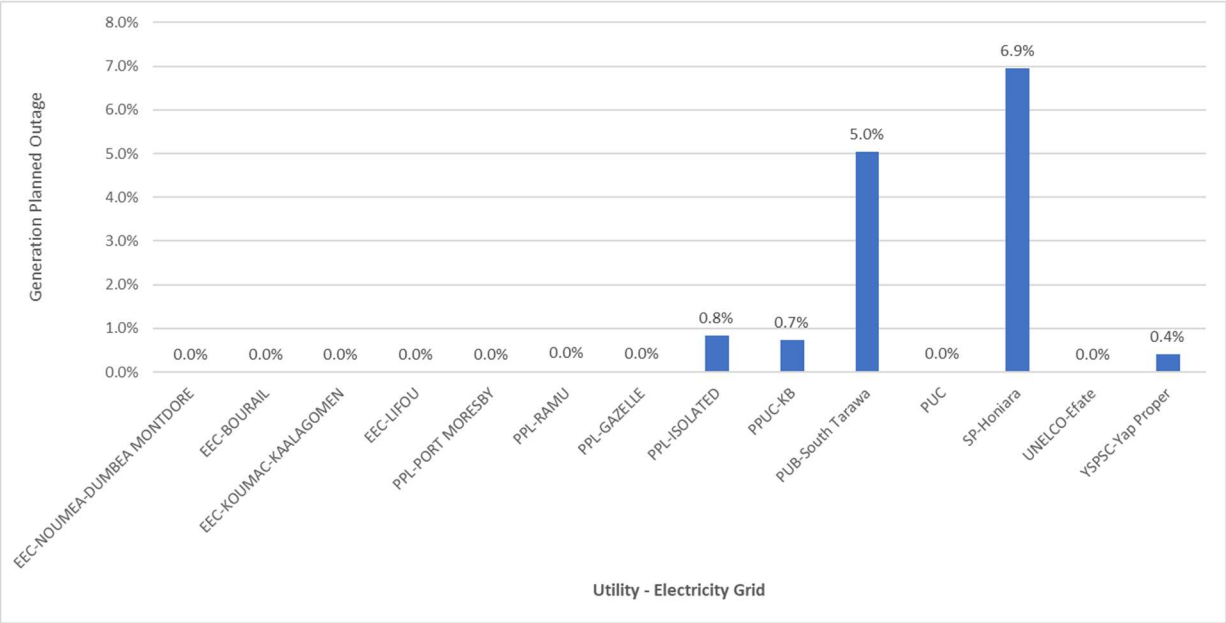
5.2.9 Planned Outage

Planned or scheduled outages measure the proportion of downtime for planned maintenance activities that require the plant to be shut down. It is a scheduled loss of generating capacity as a percentage of installed capacity to generate energy. Planned maintenance of generating equipment is often compromised in Pacific Island utilities. Some reasons for this are; (1) insufficient firm reserve capacity to allow the extended shutdown of generators due for scheduled maintenance, (2) a lack of spare parts in store leading to long downtimes awaiting for delivery of spares, and (3) lack of funds for major contracted service work. When the intervals between maintenance are extended, the probability that generators will break down increases.

Figure 5.2.9 shows the planned outage indicator for seven utilities and 10 power grids

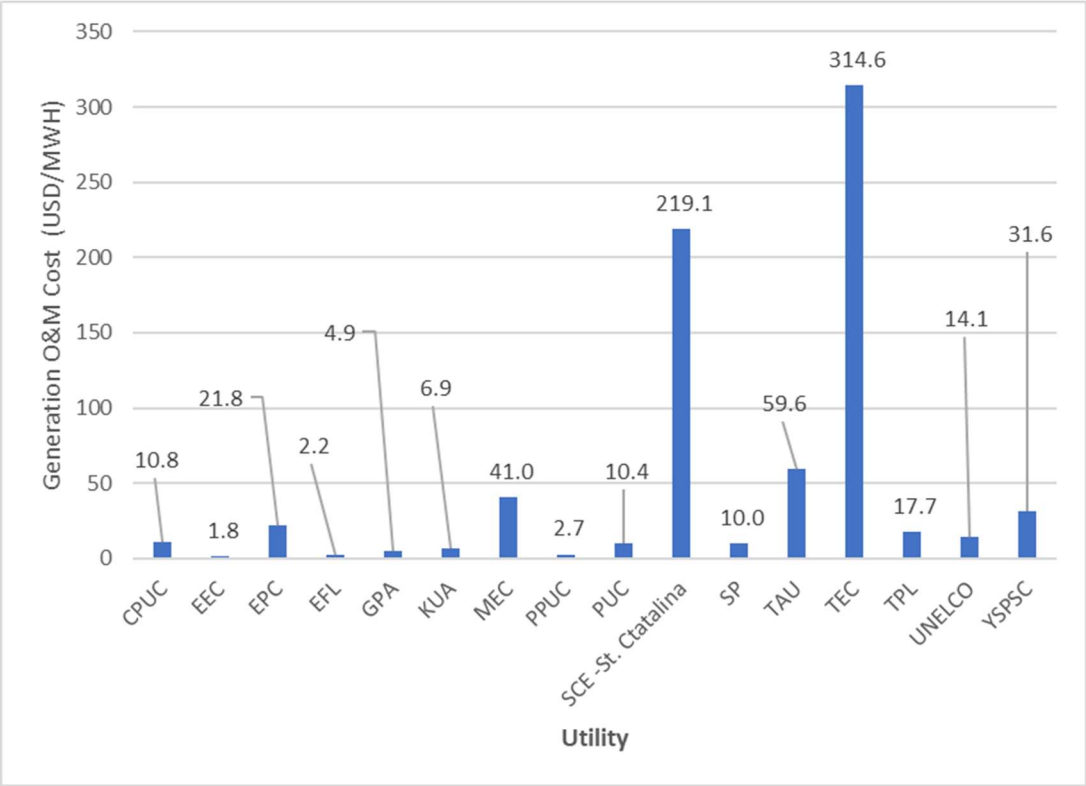
As, planned outages per grid is 1.4%. The Pacific benchmark is below 3%. A indicator that is too low may indicate the lack of scheduled maintenance which if so would eventually result in a higher than expected force outage indicator.

Figure 5.2.9: Planned Outages



5.2.10 Generation Operations and Maintenance (O&M) Costs

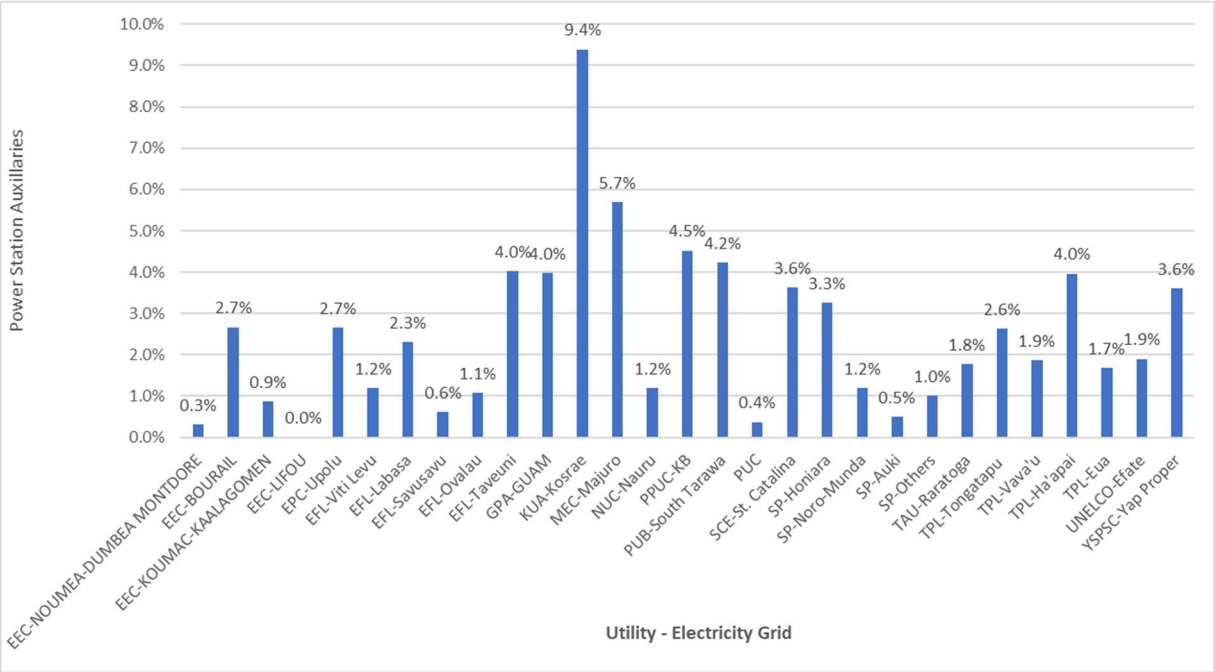
The indicator used is the expenditure on O&M for generating equipment per MWh generated, expressed in USD.



5.2.11 Power Station Usage / Station Auxiliaries

This indicator measures the usage of power in % by the power station to generate electricity. Below 5% is considered acceptable, and lower it is the better.

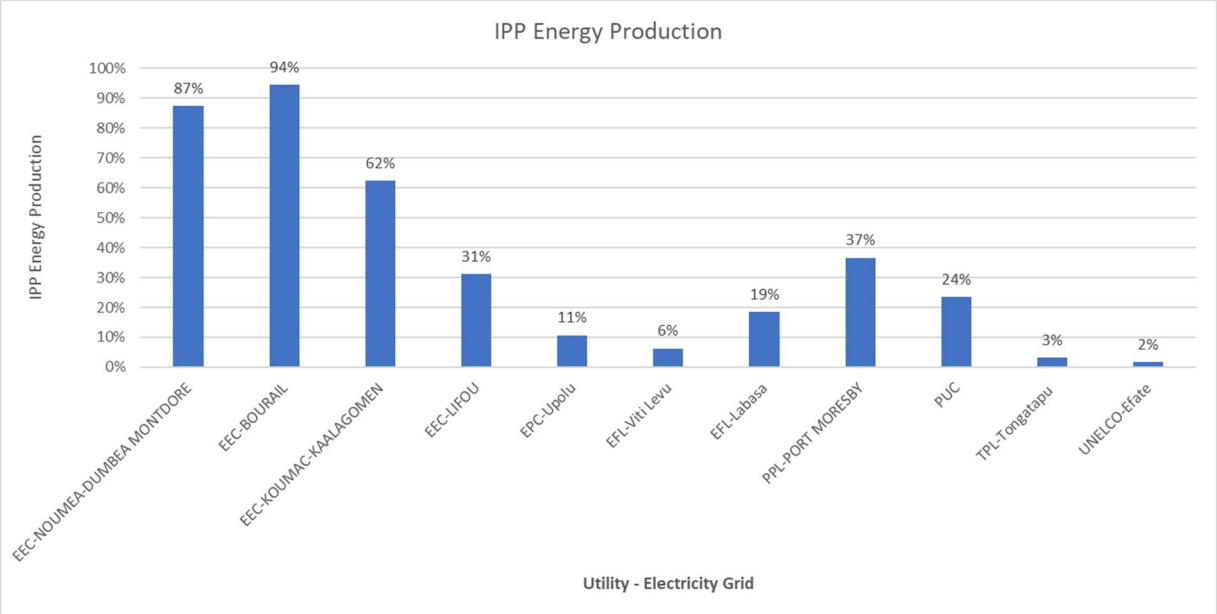
Figure 5.2.11: Power Station Usage



5.2.12 IPP Generation

Independent Power Producer arrangements are increasingly adopted by Pacific Island utilities to involve the private sector in meeting the challenges of capacity investment to satisfy the demand for power. Figure 5.2.12 illustrates the percentage of energy demand met by IPP's for utilities that have adopted this strategy in their production mix.

Figure 5.2.12: IPP Production of Energy 2021

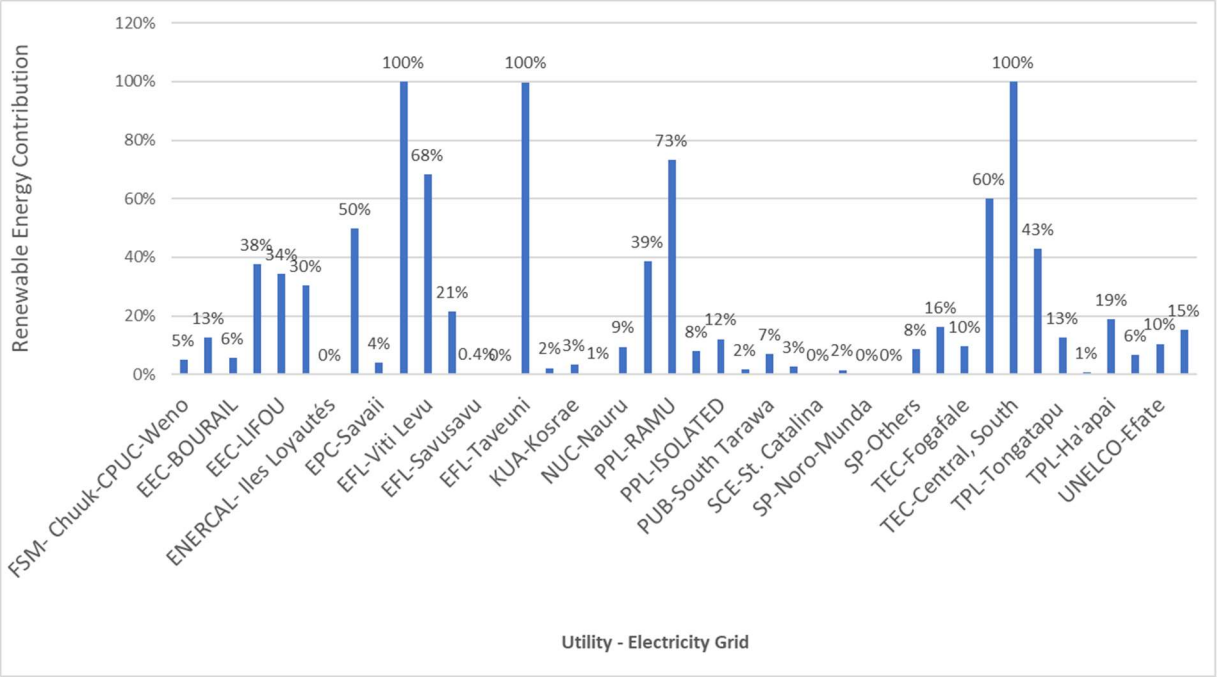


5.2.13 Renewable Energy to Grid

The Pacific Island states have adopted aggressive aspirational target for transitioning to renewable energy to mitigate the impact of climate change. The power sector is a major sector involved in the implementation of this policy.

The contribution to the energy production mix for the utilities that responded to the survey is presented in Figure 5.2.13.

Figure 5.2.13: Renewable Energy Contribution: 2021



The total renewable energy contribution for the utilities that reported their data is 29% as shown in Figure 5.2.14.

For Pacific Island Countries the renewable energy contribution to their grids is shown in Figure 5.2.13

Figure 5.2.14: Pacific Island Countries - Renewable Contribution

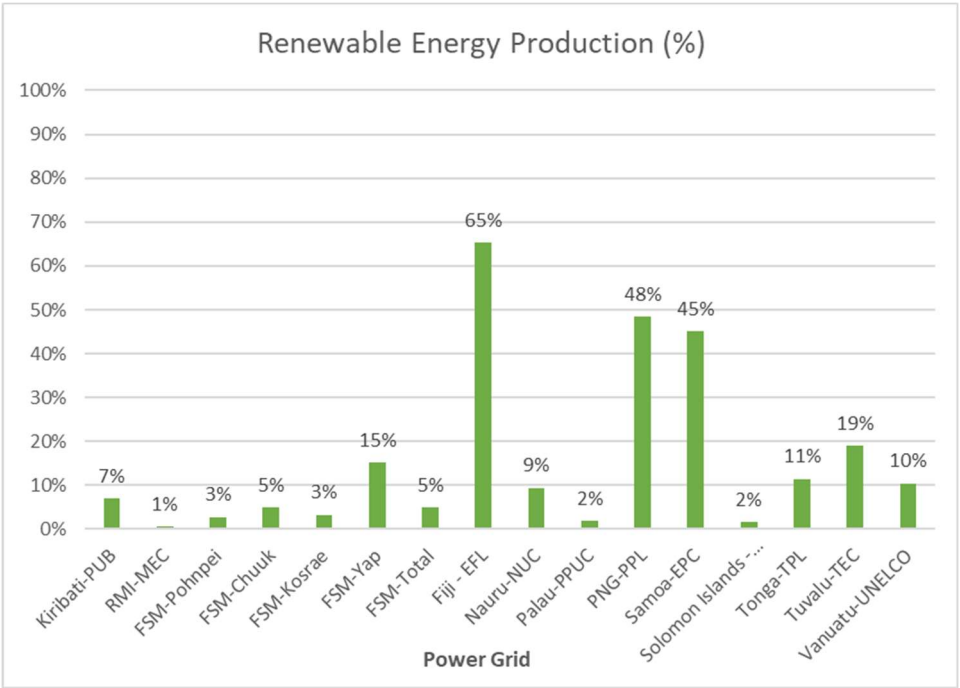
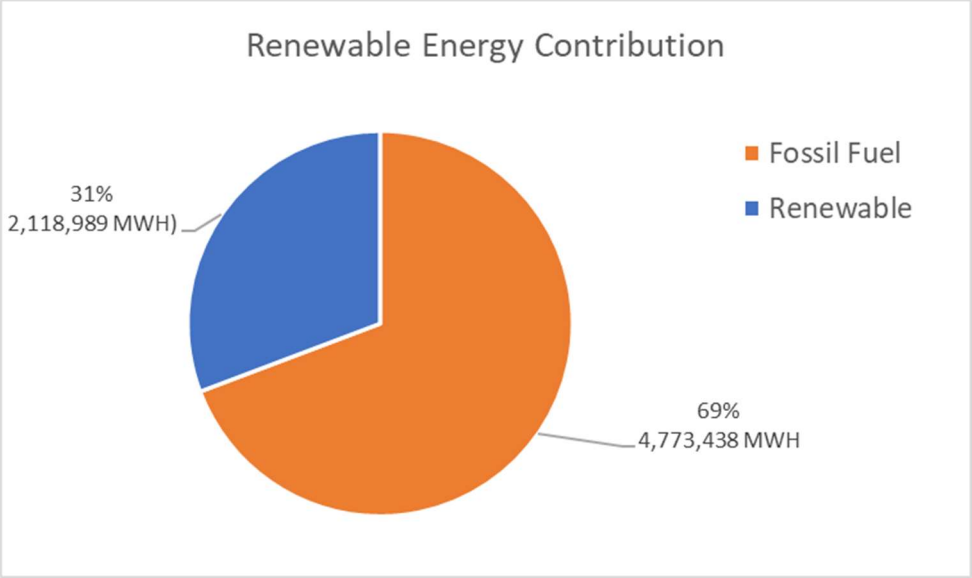


Figure 5.2.15 Renewable Energy Contribution for Pacific Island Power Utilities that Reported for Their Power Grids



Of this Hydro power generation makes up most of the renewable energy generated (24%) followed by solar (4%) and wind (1%).

5.3 Transmission Indicators

5.3.1 Transmission (General)

For the purpose of the benchmarking exercise, the transmission network is defined as equipment operating at a voltage greater than 33kV. For utilities that have a transmission network, the benchmarking questionnaire requested data to determine transmission losses and outage statistics as a measure of transmission system reliability. System reliability has been tracked based on transmission reliability (outage events per kilometre) and average transmission outage duration (in hours).

Five utilities that are members of the PPA have transmission networks and of the five, three participated in 2021 benchmarking survey. The utilities that have transmission networks are ENERCAL, GPA, PPL, EFL and EDT. The indicators are presented in Table 5.3.1.

Utility	Grid	Transmission Losses (%)		Transmission Reliability (Outages per 100 KM)		Transmission SAIDI (Mins/ Customer)				Transmission SAIFI (Eventsd per Customer)			
						Planned		Unplanned		Planned		Unplanned	
		2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
EFL	Viti Levu Interconnected System				0.68				47.22				0.59
GPA	Guam			21.34	4.06		3.03	24.36	32.75		0.02		1.29
PPL	Port Moresby				28.42		5.609		62.13		4.06		19.76
PPL	Ramu			15.38	50.74		7.856	21.95	244.16		1.67		69.84
PPL	Gazelle				134.68		10.830		327.01		1.35		39.83

Table 5.3.1: Transmission Indicators 2021, 2020

5.4 Distribution Indicators

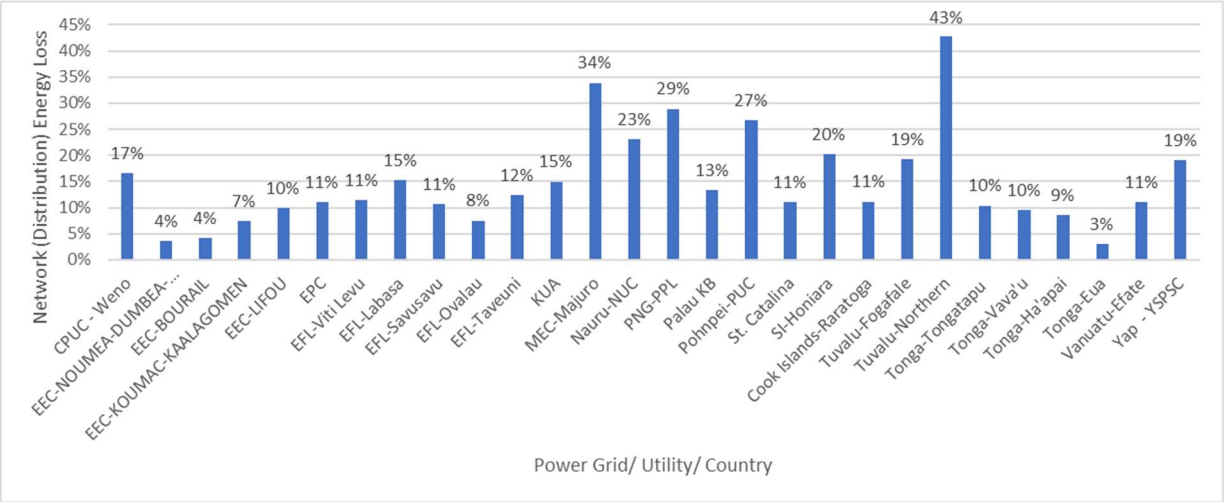
5.4.1 Network Delivery Losses

Network delivery losses are defined as the net generation minus electricity sold, divided by net generation, and expressed as a percentage. Net Generation is energy generated less the power station auxiliary usage. For utilities that have a transmission network, this loss includes the transmission and distribution network losses. This is only true for utility members of the PPA who have transmission network. For the other utility members who do not have a transmission network the Network Delivery Losses is equal to the Distribution Losses. Therefore, in this report the Distribution loss is not presented separately as in previous reports.

The losses comprise technical and non-technical losses. Technical losses are mainly caused resistance in the network lines and cables which may be exacerbated by imbalances in the currents for each phase and high resistance joints in the distribution system. These depend on distribution voltages, loading, conductor material, physical dimensions and state of conductors. Non-technical losses are those attributable to electricity used by a consumer but not paid for, including electricity theft, meter reading and accounting errors, unmetered connections, metering errors, etc.

This category should not include the use of electricity within the utility itself (other facility use), free provision for street lighting, or electricity provided to the water and sewerage waste management for utilities that are responsible for electricity, water and sewerage services. Inclusive of transmission loss this indicator should be below 10% for power grids that have transmission systems while for the smaller utilities this should be below 5%.

Figure 5.4.1: Network (Distribution) Delivery Losses 2021

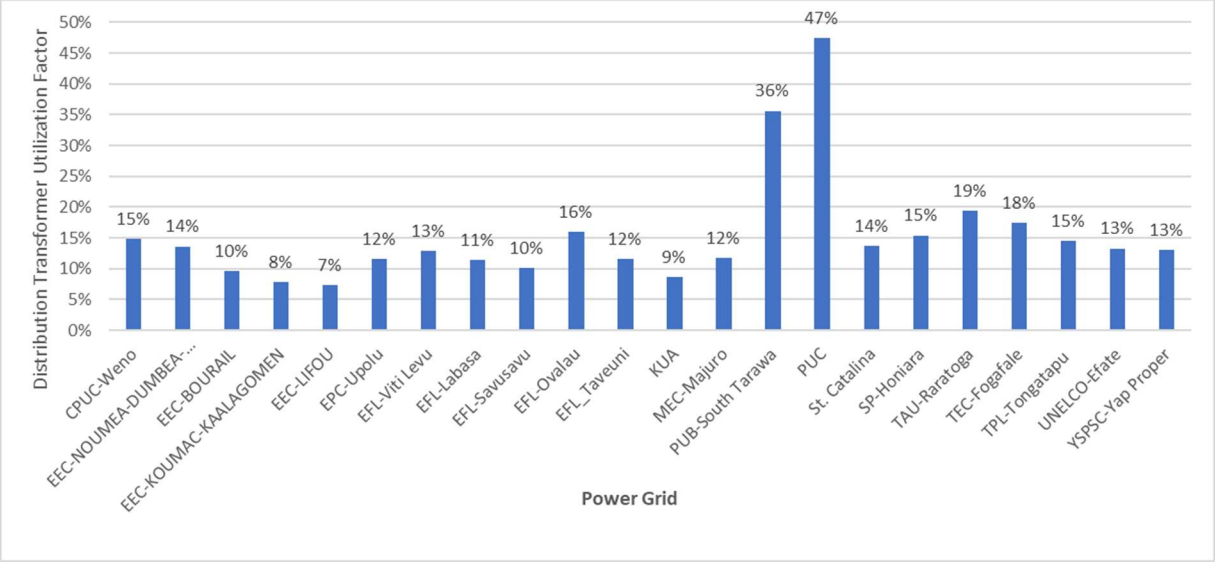


5.4.2 Distribution Transformer Utilization

This indicator measures the transformer average load against the transformer capacity in megavolt amperes (MVA). It is calculated by dividing the total electricity sold by the total capacity of distribution transformers. High utilisation implies an efficient capital expenditure process for investing in distribution transformer capacity to meet the demands of customers. This process takes into consideration non-coincident demand characteristics, demand growth and contingency requirements to maintain supply security and reliability. As seen in Figure 5.4.2, transformer utilisation in Pacific utilities is low. In 2002 a regional goal of 30% was set.

The report noted that "this can only be achieved in the long term because of the long lead times required to improve usage of capital assets. For 2021 the range for TUF is 7% to 54%. The Benchmark is 30%. It appears that the situation has not improved.

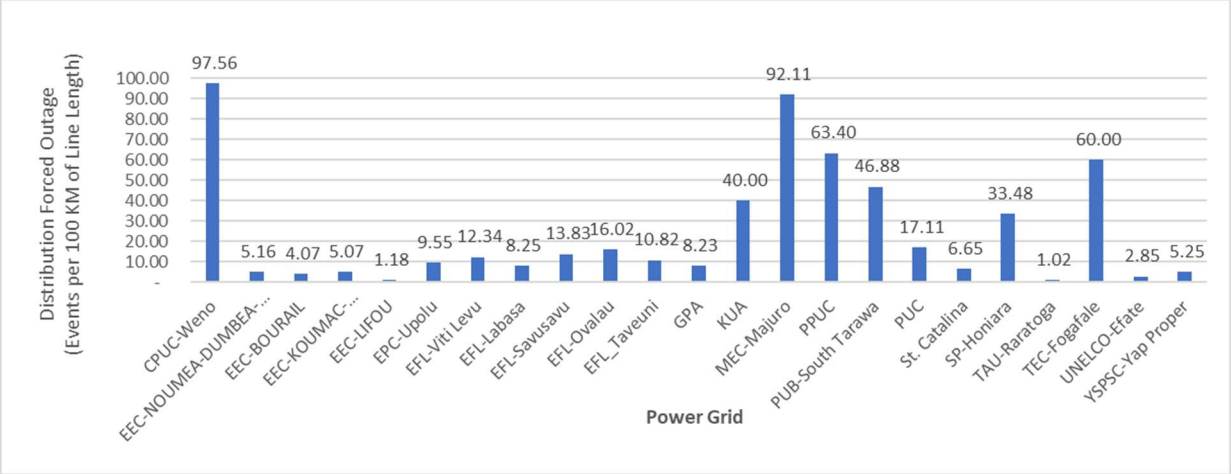
Figure 5.4.2: Transform Utilization Capacity 2020, 2019, 2018



5.4.3 Distribution Reliability

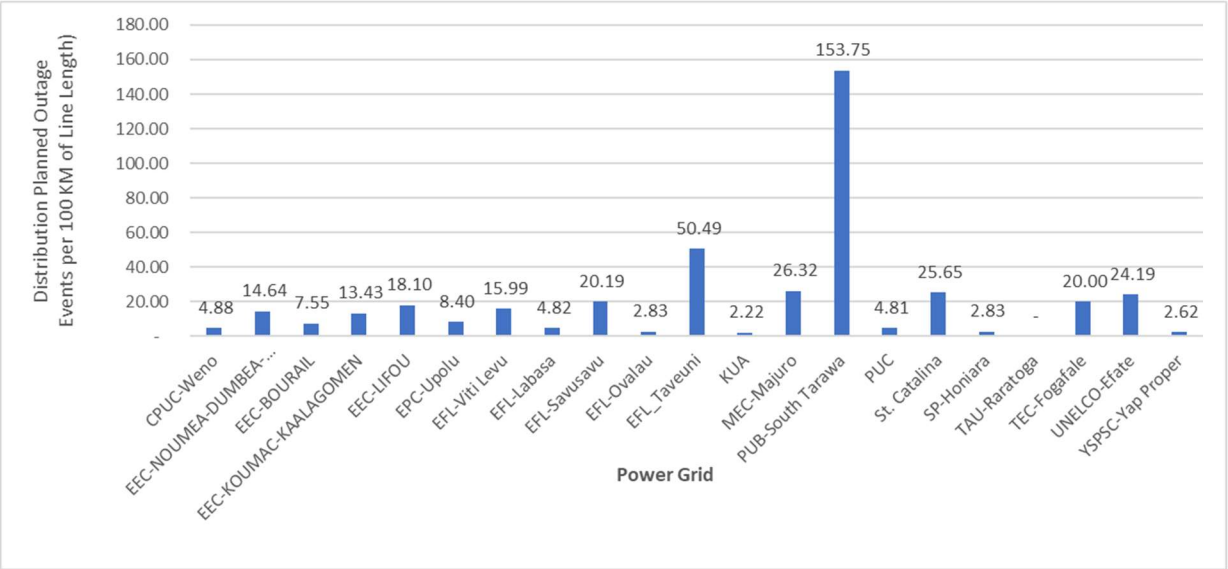
This indicator looks at forced outage events per 100km of distribution line as a way of measuring the reliability of the distribution network. The average for FY 2021 is 21 events per 100 KM of distribution lines. (refer to Figure 5.4.3). The average for the utilities that report for the year 2020 was 29.

Figure 5.4.3.1: Distribution Reliability (Forced Outage Events) 2021



Ongoing maintenance to preserve the condition of infrastructure is key to improving reliability and customer service. The number of planned outage events reflect the maintenance carried out on the distribution network. For those utilities such as EFL that carry out live line work, the planned events would be reduced compared to utilities that do not carry out live line works. The number of planned outage events is shown in Figure 5.4.4.

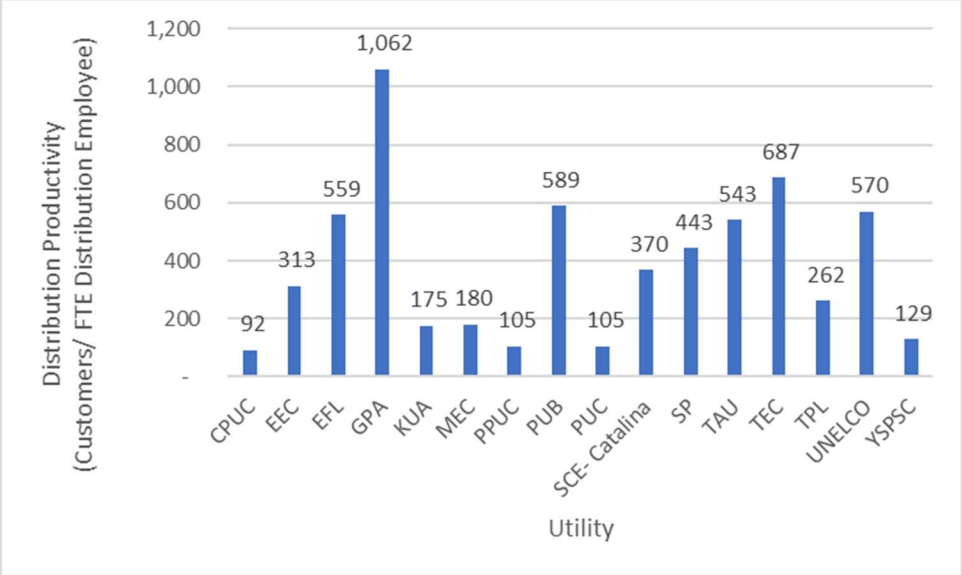
Figure 5.4.3.2: Distribution Planned Outage Events



5.4.4 Customers per Distribution Employee

The number of customers per distribution employee full time equivalent is another indicator of labour productivity.

Figure 5.4.4 Customers per Distribution Employee



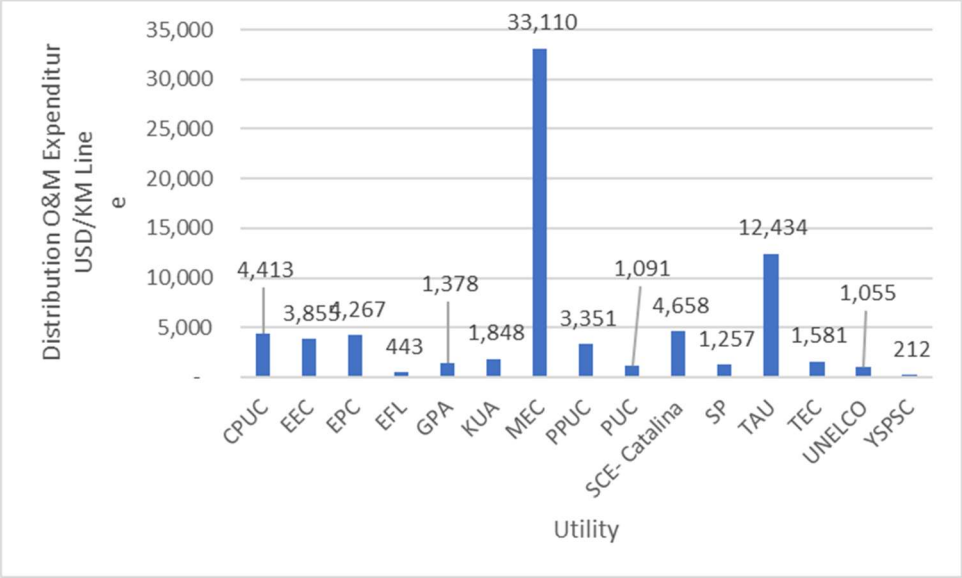
5.4.5 Distribution O & M Expenses

The Distribution Operations and Maintenance O&M costs is the total expenses incurred in the operations and maintenance of the distribution network, converted to USD using the exchange rate

provided in Table 6. This includes all vehicle operating costs and all other costs related to distribution operations. This total O&M cost is divided by the distribution line length.

Figure 5.4.5 compares the Distribution O&M expenses per km line length for the utilities that proved sufficient data.

Figure 5.4.5: Distribution Operations and Maintenance Expenses



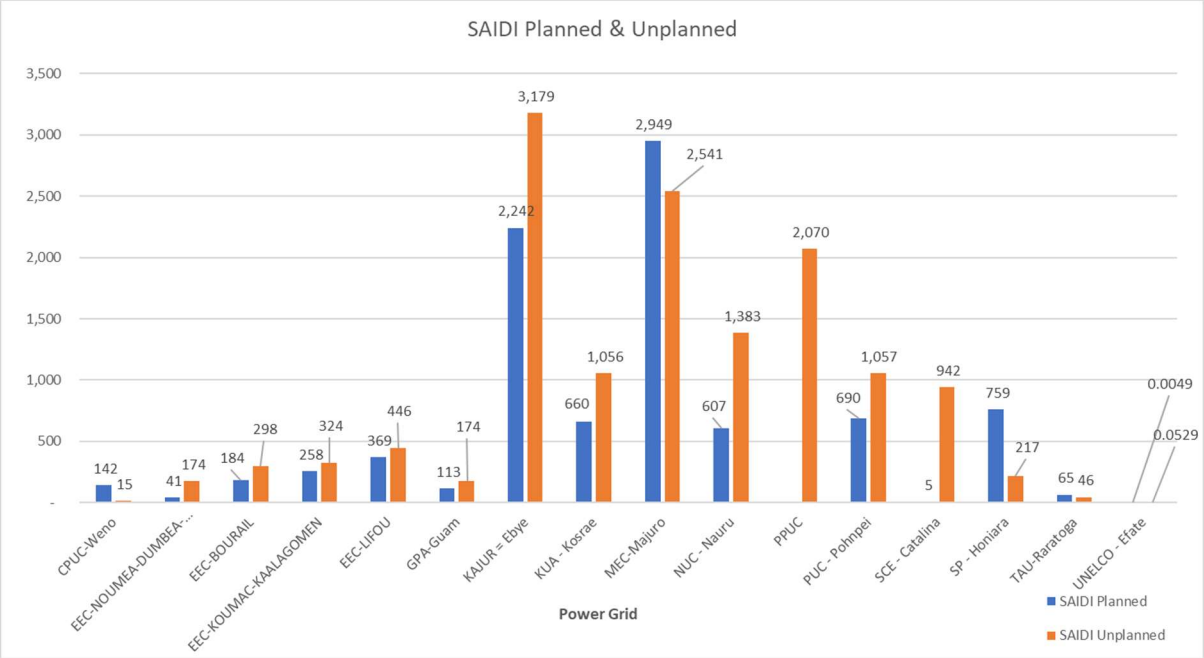
5.5 SAIDI and SAIFI

5.5.1 System Average Interruption Duration Index (SAIDI)

SAIDI indicates the average duration of power outages experienced by customers and is measured in customer minutes. The results are shown in Figure 5.5.1 as Planned and Unplanned outages that have resulted in power interruptions to customers. The categories based on the source of the interruption are, planned and unplanned generation events, and planned and unplanned network events. For the utilities not included in Figure 5.5.1, the data was either not provided or appears to be faulty or is well below the benchmark.

The benchmark for Pacific Island utilities is for the total Planned and Unplanned SAIDI to be below 200 customer minutes.

Figure 5.5.1: SAIDI 2021 (Minutes per Customer)

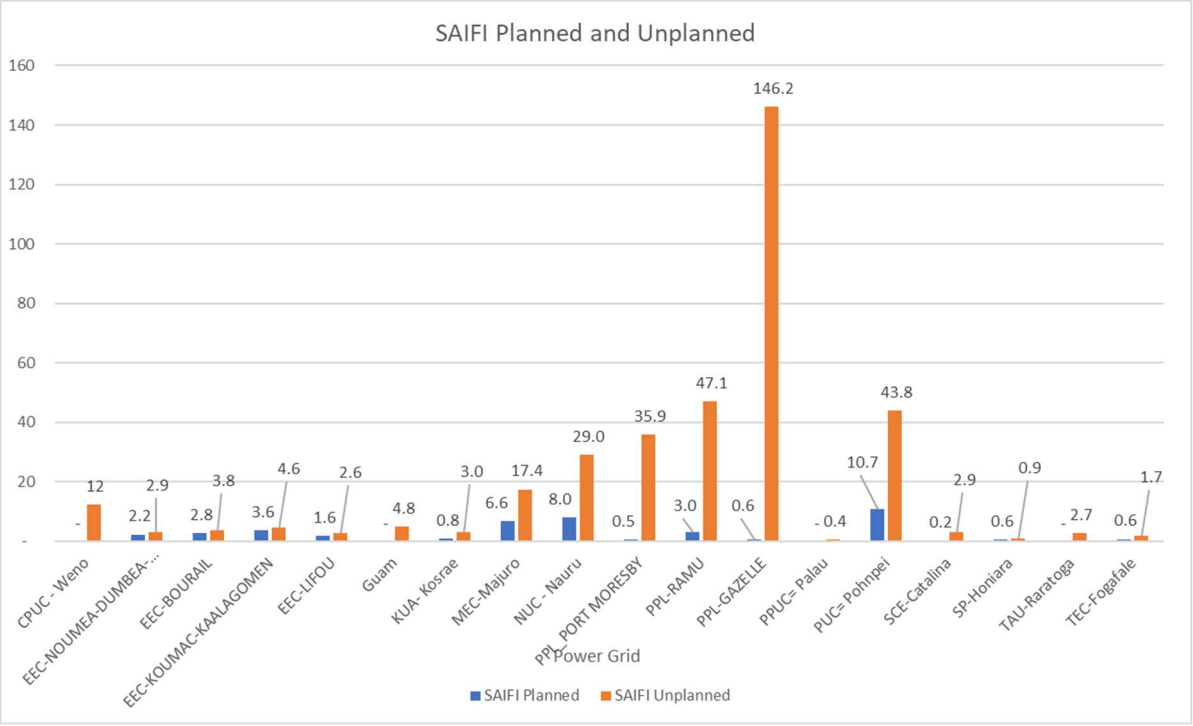


5.5.2 System Average Interruption Frequency Index (SAIFI)

SAIFI indicates the average frequency of power interruptions experienced by customers over the fiscal year. For small island utilities the power interruptions to customers caused by generation events can be significant compared to distribution network events. Figure 5.5.2 shows the Planned and Unplanned SAIFI for each utility. Again, those utilities not included have either not provided data, or the data provided appears to be unreasonably high, or the index is well within the benchmark.

The benchmark for Pacific Island utilities is for the total of Planned and Unplanned SAIFI to be below the average of 10 events per customer.

Figure 5.5.2: SAIFI - Interruptions per Customer 2021



5.6 Financial Indicators

5.6.1 Tariff Impact

Conducting tariff analysis of Pacific utilities is highly complex due to the different tariff schedules and structures. This section therefore compares the impact of the tariff schedule applied to customers of various categories. The monthly bills for a domestic or residential customers with a usage of 100 kWh and 200 kWh and 500 kWh is compared, ranked and graphed in ascending order. The same is done for a commercial customer with a usage of 1,000 and 5,000 kWh per month. For industrial customers the monthly electricity bill for a usage of 10,000 kWh per month is compared.

(i) Residential Customer (100 kWh per month)

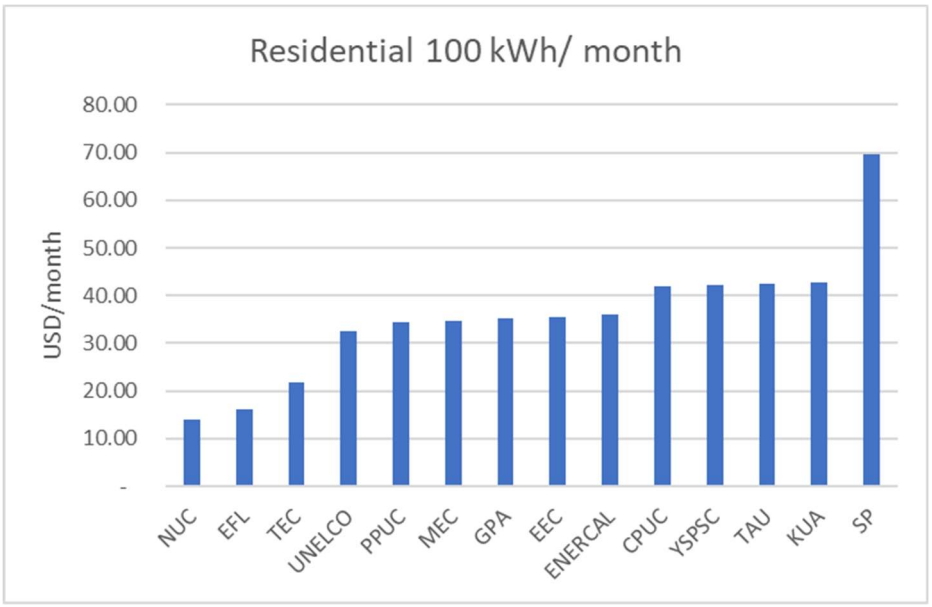


Figure 5.6.1.1: Residential Customer with Usage of 50 kWh per month

(ii) Residential Customer (200 kWh per month)

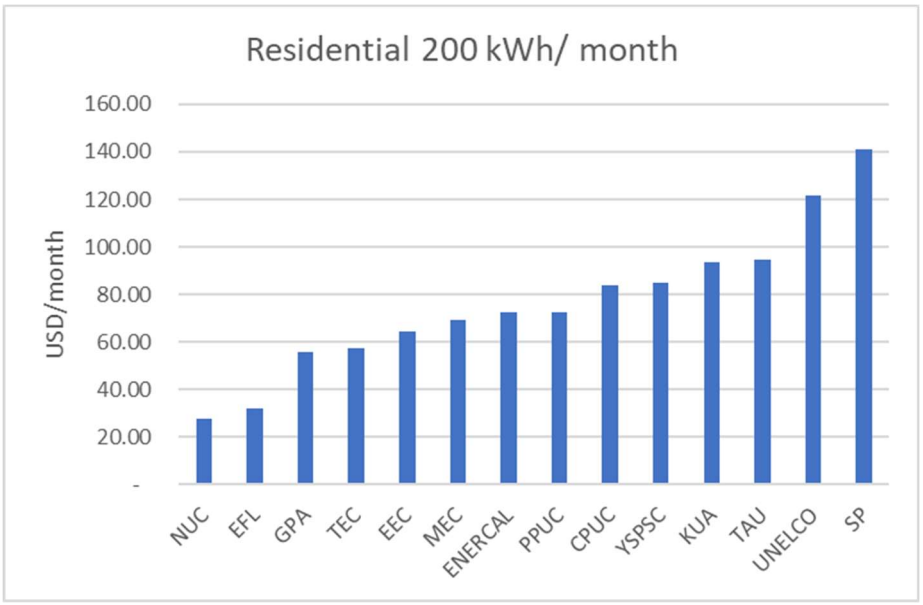


Figure 4.6.1.2 Residential Customer with Usage of 200 kWh per month

(iii) Residential Customer (500 kWh per month)

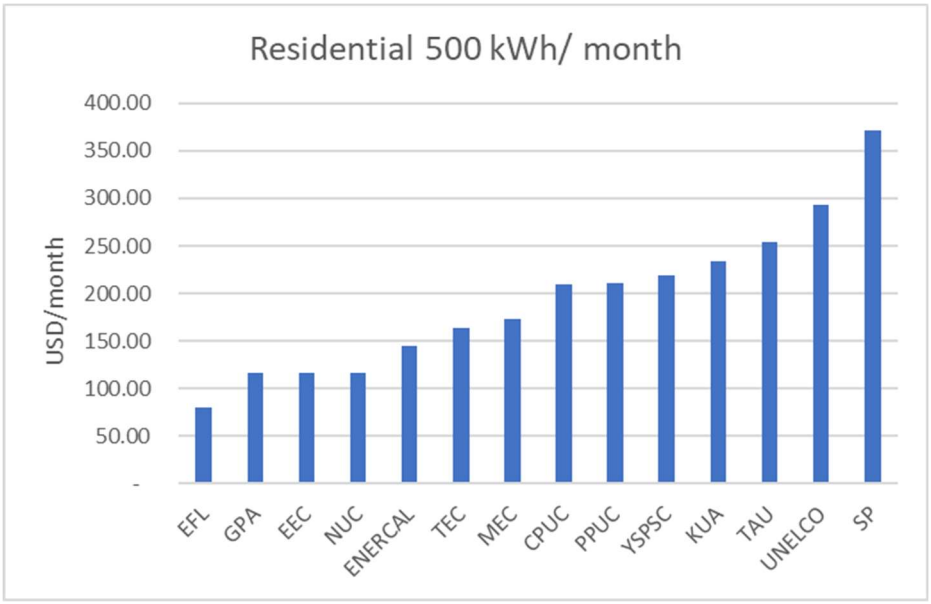


Figure 5.6.1.3 Residential Customer with Usage of 500 kWh per month

(iv) Commercial Customer (1,000 kWh per month)

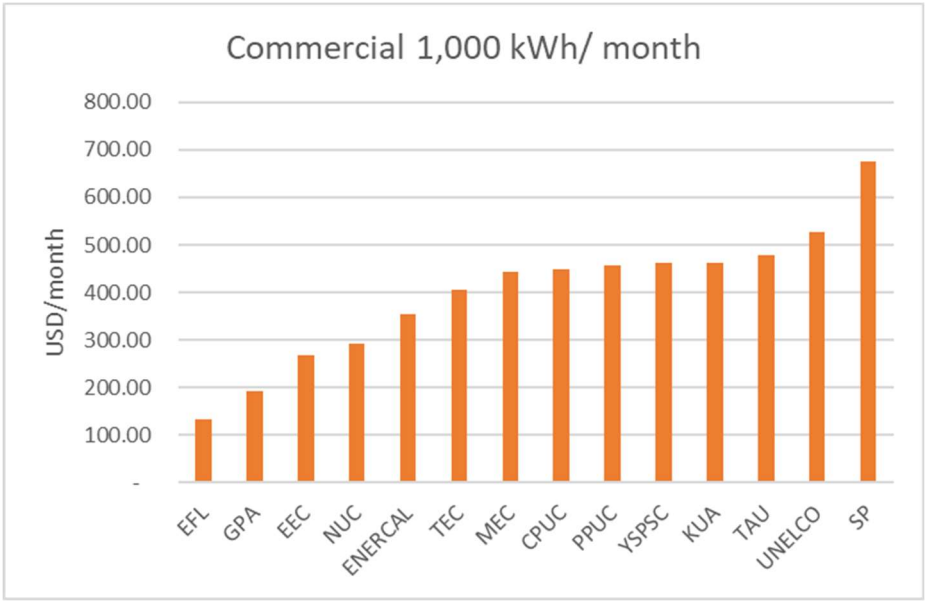


Figure 5.6.1.4: Commercial Customer with Usage of 1,000 kWh per month

(v) Commercial Customer (5,000 kWh per month)

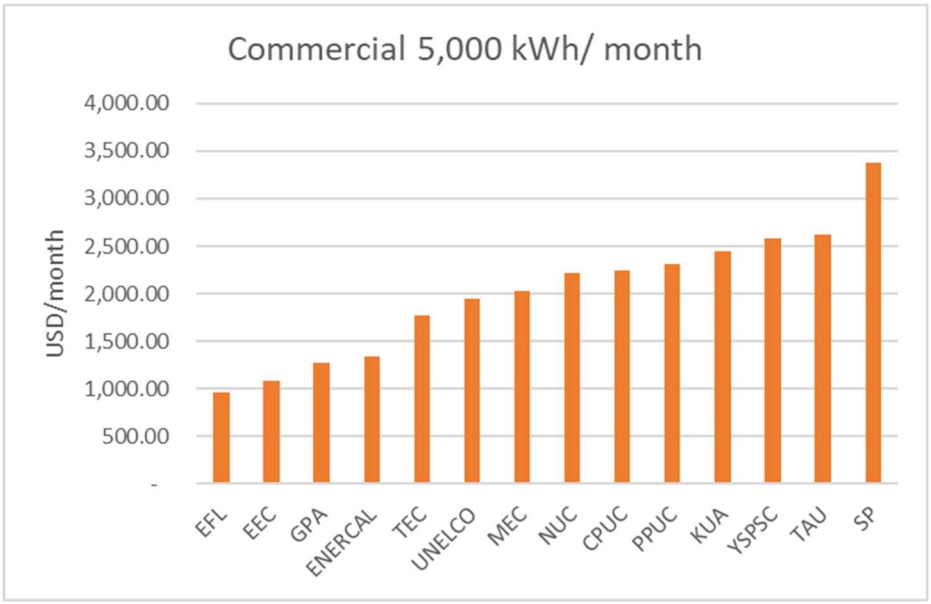


Figure 5.6.1.5: Commercial Customer with Usage of 5,000 kWh per month

(vi) Industrial Customer (10,000kWh per month)

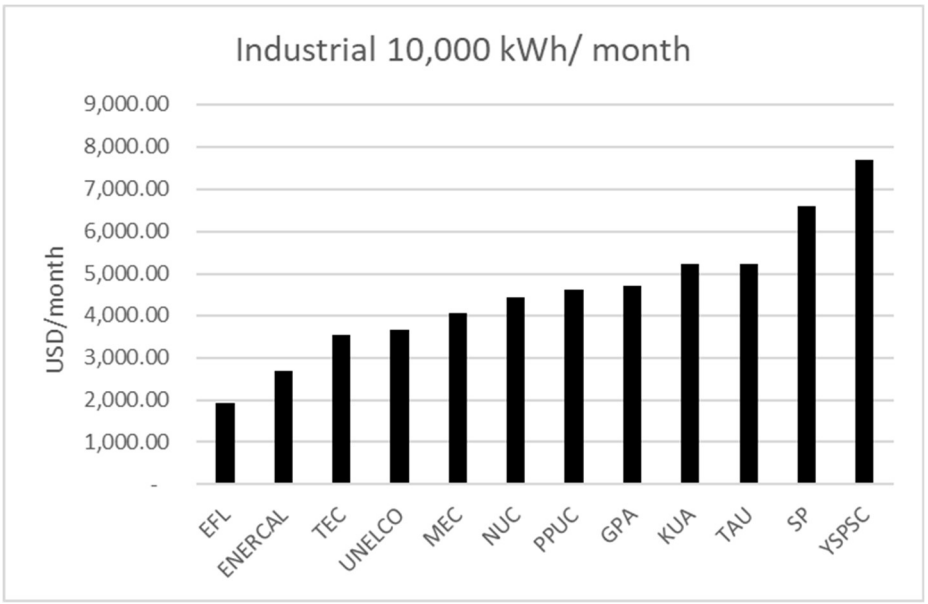


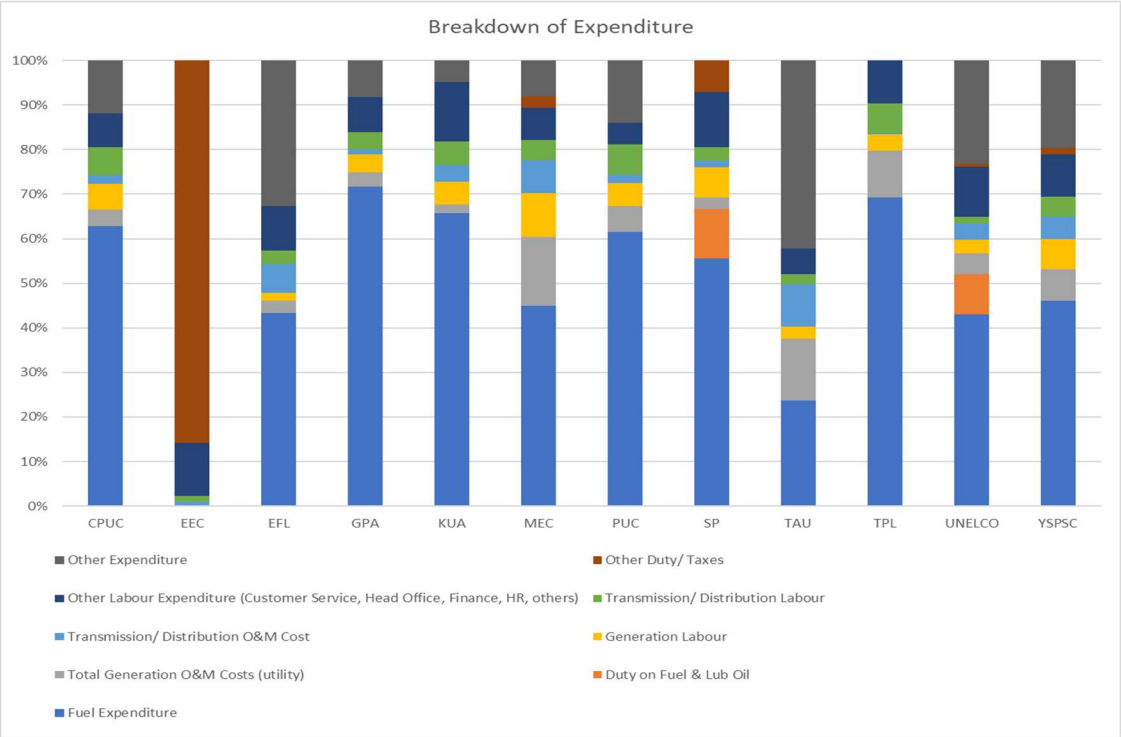
Figure 5.6.1.6: Industrial Customer with Usage of 10,000 kWh per month

5.6.2 Utility Cost Breakdown

The cost categories for which information was collected included hydrocarbon-based fuel and lubrication costs, duty on fuel and lubricating oil, generation O&M, labour and deprecation, transmission and distribution O&M, labour and depreciation, and other overhead expenditure, duty, taxes and miscellaneous costs. The percentage contributions of each component are presented for the utilities that reported sufficient data in Figure 5.7.4 below.

Fuel and lubricating oil expenditure is the largest component in the utilities cost structure ranging from 24% to 72%.

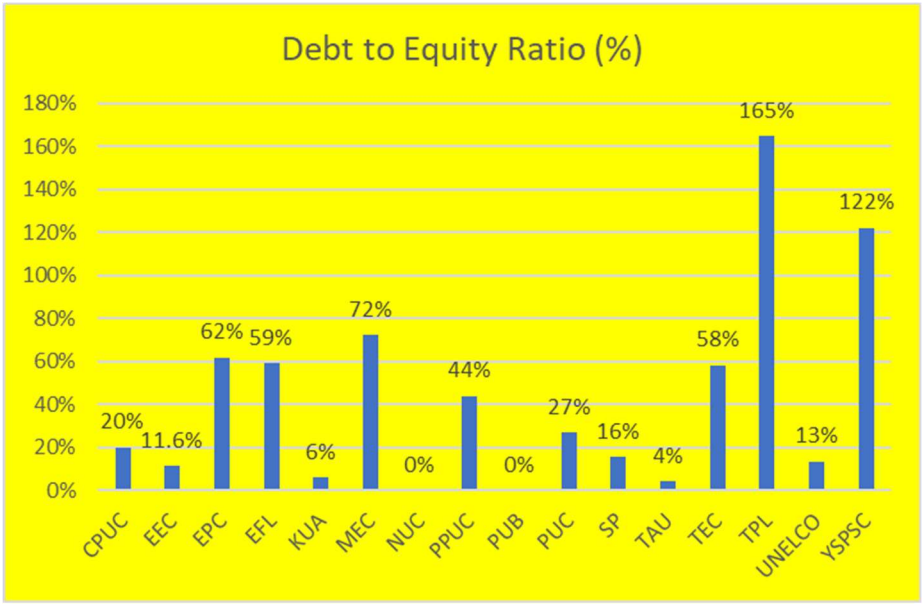
Figure 5.6.2.1: Utility Cost Breakdown 2021



5.6.3 Debt to Equity Ratio

The indicator used for the level of utility debt is the ratio of total liabilities to equity, expressed as a percentage (debt / equity). Borrowing to improve services may be justified, but a high debt-to-equity ratio places a utility in a vulnerable position. Some smaller utilities do not have access to debt funding and rely on their government or grants from donors for large projects and so have no long-term debt obligations.

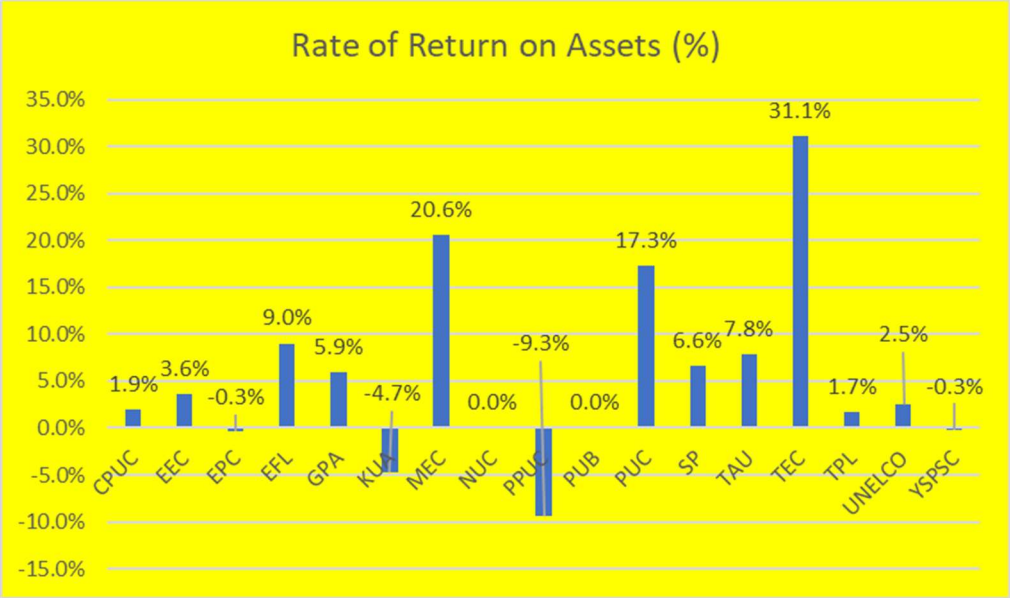
Figure 5.6.3.1: Debt to Equity Ratio 2021



5.6.4 Return on Assets

The Rate of Return on Assets (RORA) is the return generated from the investment in the assets of the business. ROA indicates how efficient management is at using its assets to generate earnings. Pacific power utilities generally do not earn commercial rates of return, and this is reflected in Figure 5.7.6.

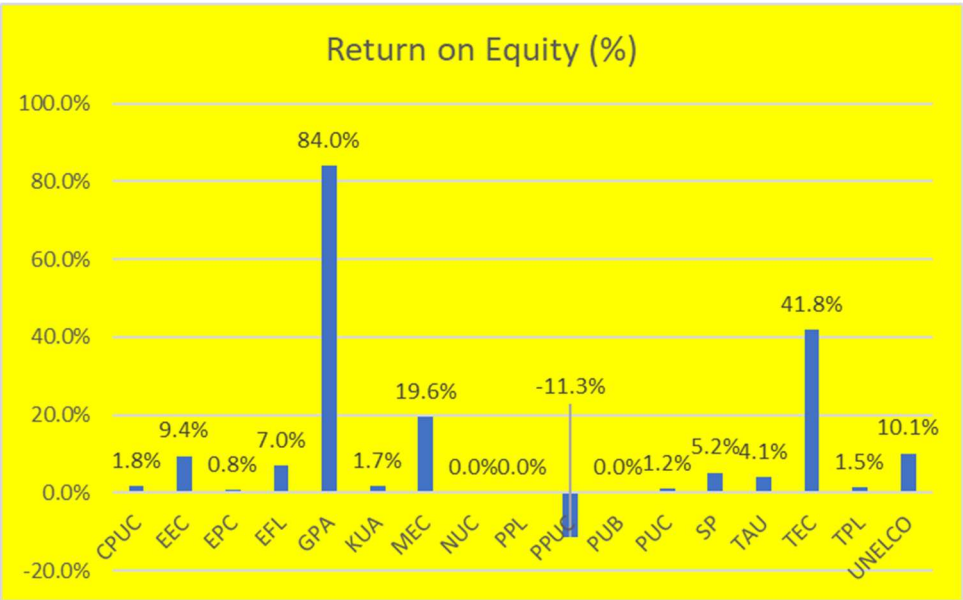
Figure 5.6.4.1: Return on Assets 2021



5.6.5 Return on Equity

ROE measures financial returns on owners' funds invested. Results for ROE are shown in Figure 5.7.7. Some outlying values have been disregarded as their accuracy is not credible.

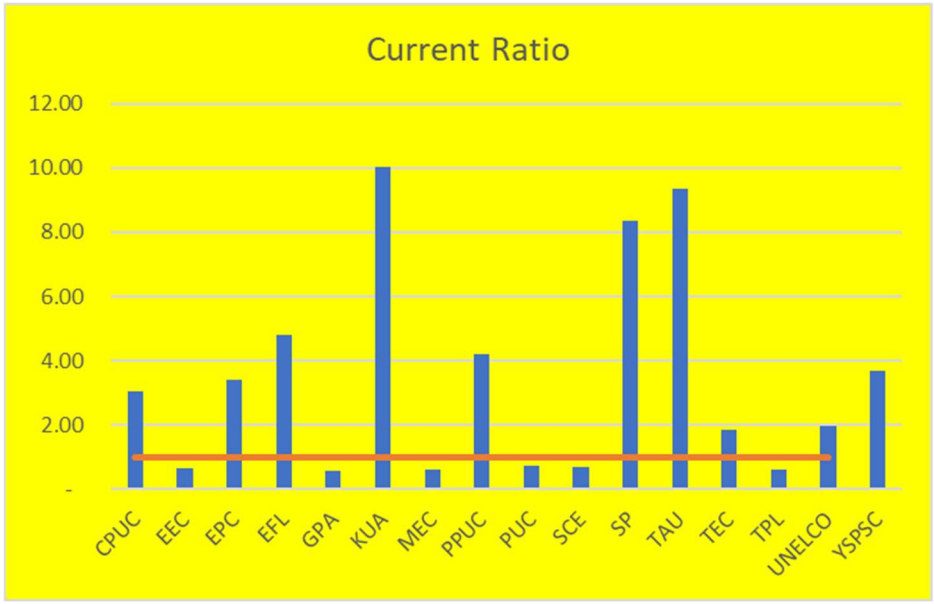
Figure 5.6.5.1: Return on Equity 2021



5.6.6 Current Ratio

The current ratio measures the ability of business to pay its creditors within the next 12 months, i.e., the ability of the utility to meet its current liabilities from current assets. A current ratio above 1 is desirable (See red line in Figure 5.7.8). A ratio below 1 implies that the utility is not able to cover for its current liabilities.

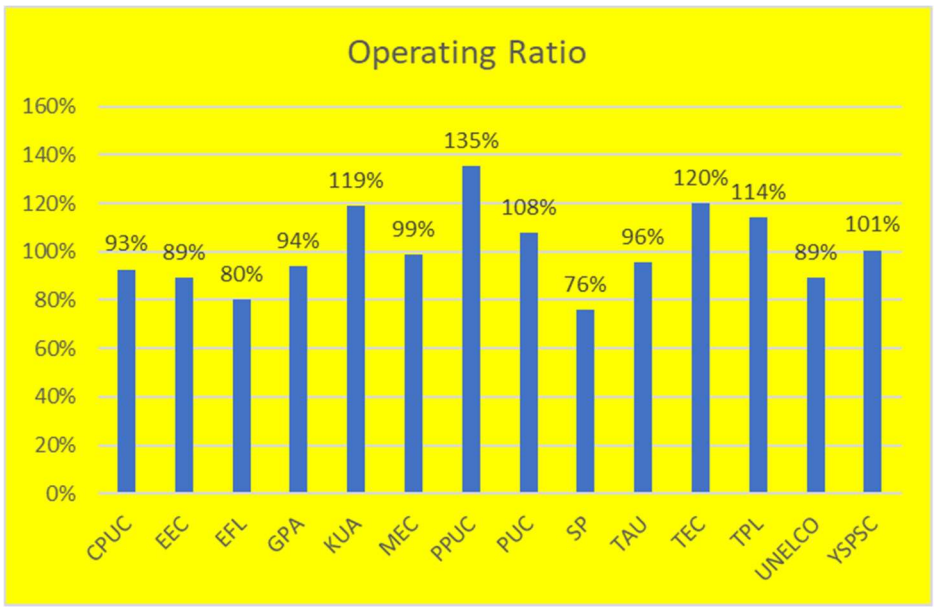
Figure 5.6.6.1: Current Ratio 2021



5.6.7 Operating Ratio

The operating ratio is a measure of how efficiently a business is operating, in this case, providing electricity service. It is determined by the Costs of Goods and Services (COGS) Including depreciation expenses divided by the revenue earned. An operating ratio below 100 indicates a profitable operation. An operating ratio above 100 indicates that it is costing an organisation more to provide the service than the revenue derived from the service.. As shown in Figure 5.7.9, six utilities have an operating ratio above100 and eight utilities have an operating ratio below 100.

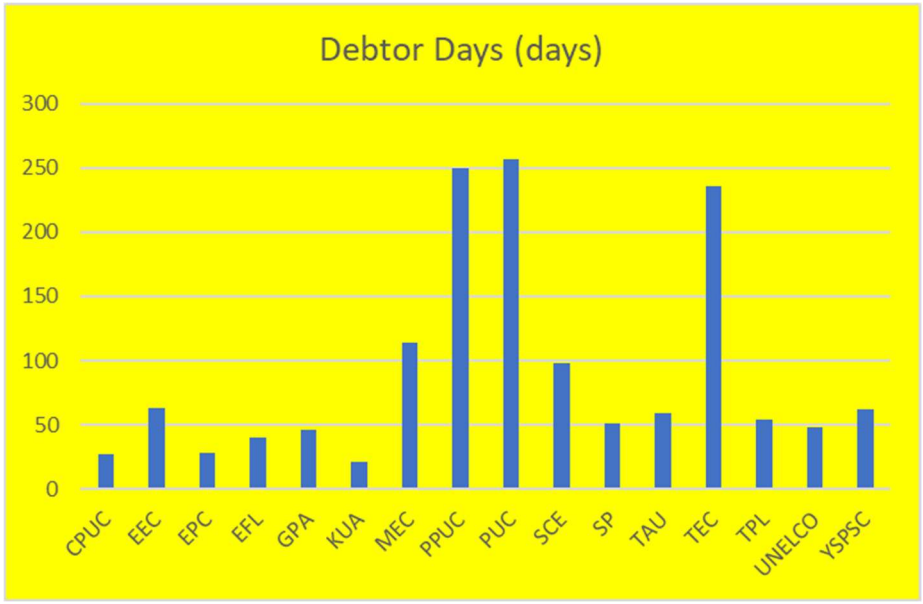
Figure 5.6.7.1: Operating Ratio 2021



5.6.8 Debtor Days

This indicator measures how long it takes, on average, for the utility to collect debts (receivables) owe to it. In 2021, the Pacific average was 95.14 days. In 2020 the average was 78.7 days and the average DD in 2019 was 88 days. The Pacific benchmark is set at 50 days

Figure 5.6.8.1: Debtor Days

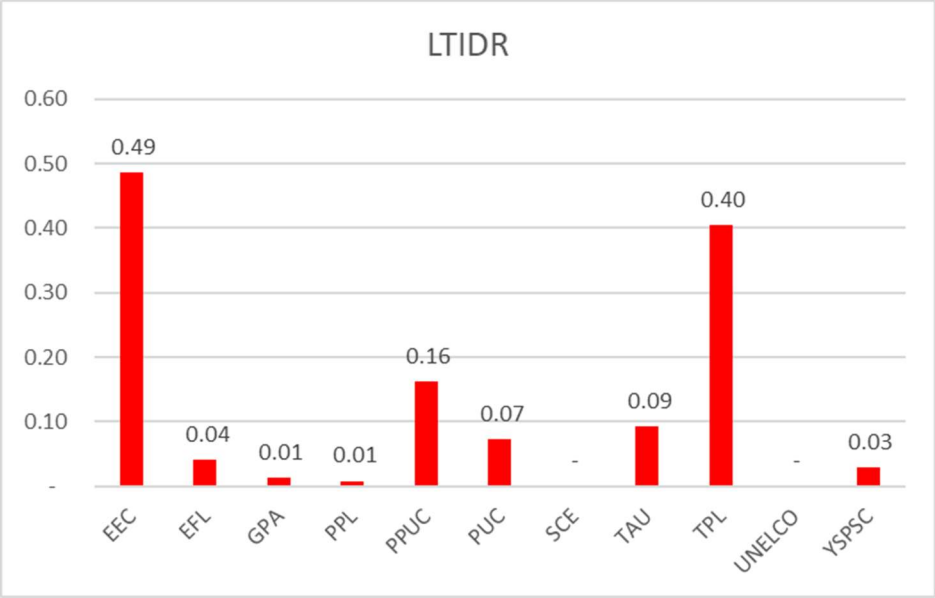

Debtor Days (days)
300
250
200
150
100
50
0
CPUC
EEC
EPC
EFL
GPA
KUA
MEC
PPUC
PUC
SCE
SP
TAU
TEC
TPL
UNELCO
YSPSC

5.7 Human Resources & Safety Indicators

5.7.1 Lost Time Injury Duration Rate

The average for 2021 FY was 0.08 days per FTE employee, compared to 0.58 days for 2020 FY. Unfortunately, only a limited of utilities responded making it difficult to draw any significant conclusions. This is an area that may need improvements in monitoring and recording of incidents.

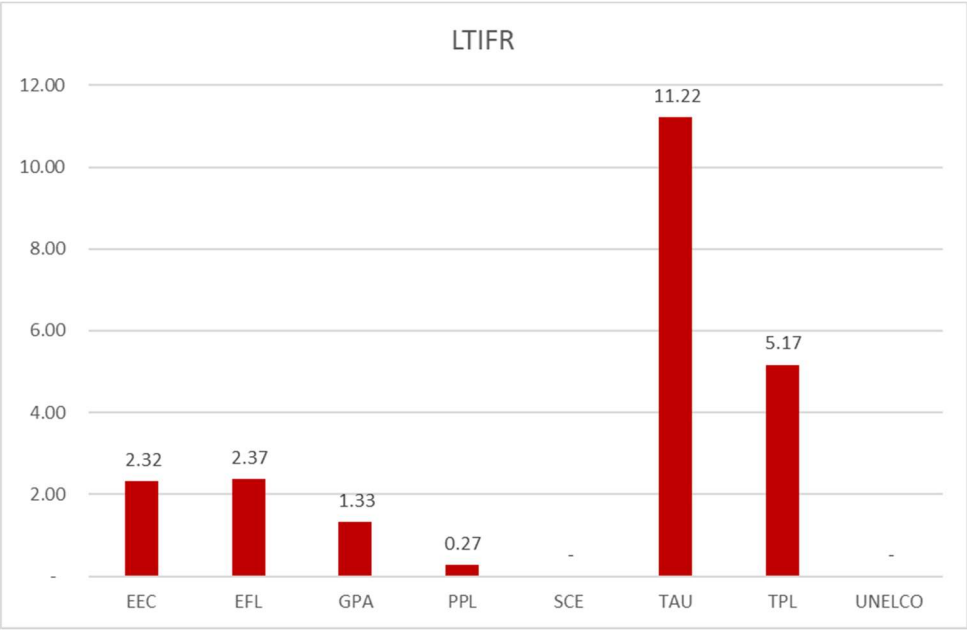
Figure 5.7.1: Lost Time Injury Duration rate 2021



5.7.2 Lost Time Injury Frequency Rate

Only a limited number of utilities were able to provide sufficient data to determine the LTIFR.

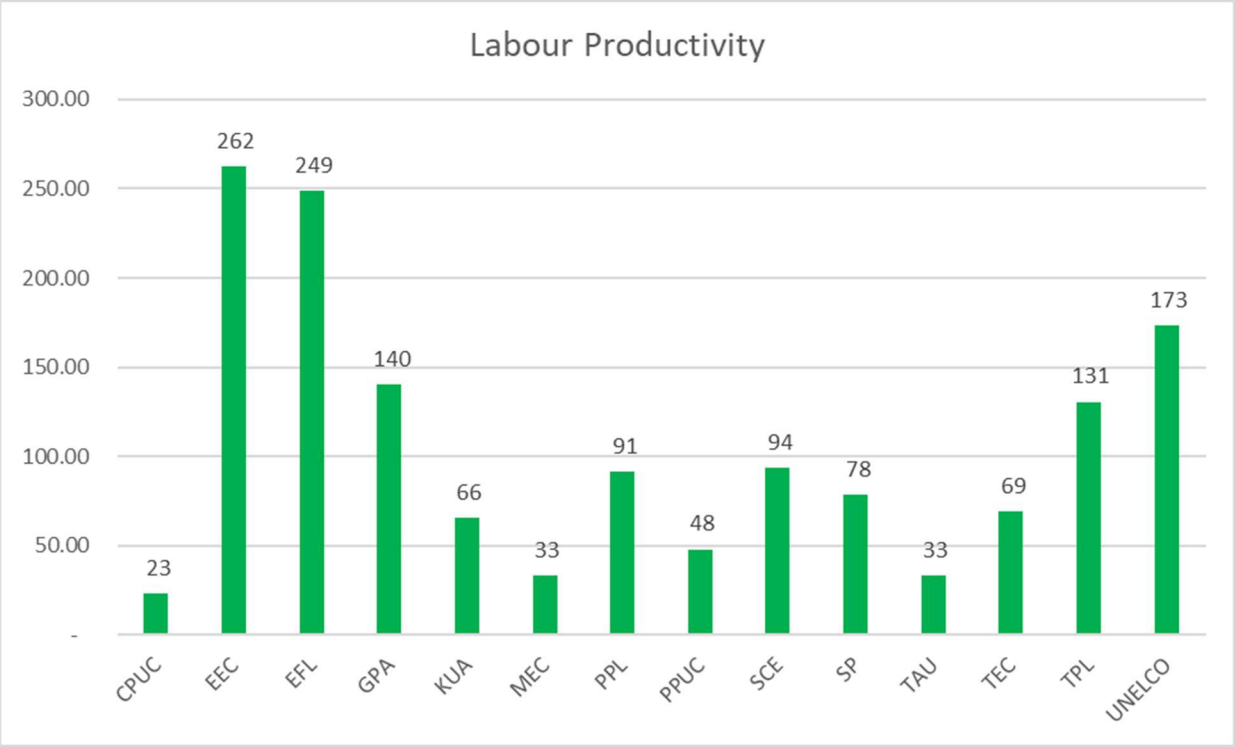
Figure 5.7.2: Lost Time Injury Frequency (Number of incidents per million hours 2021)



5.7.3 Overall Labour Productivity

The average productivity in 2021 is 107 customers per Employee FTE. In 2020 the average was 123, and in 2019 FY, 94. A higher productivity is expected of larger utilities that operate with some economies of scale and are fully or partially privatise such as EEC, EFL and UNELCO.

Figure 5.7.3: Overall Labour Productivity



Note: EEC is a distribution utility involved in minimal energy production.

5.8 Overall Composite Indicator

The overall composite indicator of utility performance was developed in 2011 to rank comparative performances between utilities. Where gaps existed in the data submitted by some utilities it was not possible to calculate an aggregate score.

The overall composite indicator is a simple indicator that equally weights generation efficiency, capacity utilisation, system losses and overall labour productivity, as derived from quantitative scores on a scale up to 100%. Table 5.9.1 ranks the utilities for which the full data was provided.

The composite technical indicator reflects the heavy reliance of power production on fossil fuels and its high impact on the production expenses. With the aggressive pursuance of renewable energy production this indicator that is skewed to favour efficient fossil fuel production, will become less relevant going forward.

Components of Composite Indicator (Maximum score 100%)
Generation efficiency: specific fuel consumption (25%)
Efficient utilisation of assets: capacity factor (25%)
System losses: network delivery losses (25%)
Overall labour productivity: customers per full time utility employee (25%)
Final score weighted in terms of comparative data reliability

Table 5.8.1 Performance Ranking of PIC Power Utilities

PICT	Utilities	Indicators				Performance Score				Total
		SFC	CF	Losses	LP	SFC	CF	Losses	LP	Score
Fiji	EFL	4.402	42%	12%	248.70	25%	10%	19%	24%	78%
Tonga	TPL	3.958	49%	10%	130.64	14%	13%	20%	11%	58%
Vanuatu	UNELCO	3.980	32%	11%	173.22	14%	6%	19%	16%	55%
Tuvalu	TEC	3.470	79%	19%	68.93	1%	25%	12%	5%	43%
New Caledonia	EEC	3.79	23%	4%	262	9%	3%	25%	25%	62%
Palau	PPUC	3.822	42%	13%	47.85	10%	10%	17%	3%	40%
St. Catalina Island*	SCE	3.462	0%	0%	-	1%	4%	19%	7%	31%
Solomon Power	SP	3.912	32%	20%	78.37	12%	6%	12%	6%	36%
Cook Islands	TAU	3.682	25%	11%	33.38	7%	3%	19%	1%	31%
Kosrae, FSM	KUA	3.424	27%	15%	65.66	0%	4%	16%	4%	24%
Chuuk, FSM	CPUC	3.948	24%	17%	23.10	13%	3%	14%	0%	30%
Papua New Guinea	PPL	3.566	41%	29%	91.18	4%	10%	4%	7%	25%
Marshall Islands	MEC	3.828	49%	34%	33.40	10%	13%	0%	1%	24%

PPA Member Utilities in 2022

1. **AMERICAN SAMOA POWER AUTHORITY**
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Facsimile: + (687) 250 253
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FRENCH POLYNESIA
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8. **ELECTRICITE ET EAU DE CALEDONIE**
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10. **GUAM POWER AUTHORITY**
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11. **KOSRAE UTILITIES AUTHORITY**
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23. TUVALU ELECTRICITY CORPORATION
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Website: www.tectuvalu.tv
CEO: Mr. Mafalu Lotolua
General Manager
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General Manager
Email: sapthiy@gmail.com

Table 6: Currency Conversion Table for 2022

Pacific Utility	Country/ Territory	Local Currency	2021	
			Coversion Rate	Conversion Rate Difference
ASPA	Amercian Samoa	USD	1.00000	0.00000
CPUC	Fed. Staes of Micronesia (FSM)	USD	1.00000	0.00000
CUC	Commonwealth of Northern Marianas	USD	1.00000	0.00000
EDT	French Polynesia	XPF	0.00840	-0.00190
EEC	New Caladonia	XPF	0.00840	-0.00190
EEWF	Wallis & Futuna	XPF	0.00840	-0.00190
ENERCAL	New Caladonia	XPF	0.00840	-0.00190
EPC	Samoa	WST	0.35530	-0.04140
EFL	Fiji	FJD	0.43350	-0.04840
GPA	Guam	USD	1.00000	0.00000
KAJUR	Marshall Islands (RMI)	USD	1.00000	0.00000
KUA	Fed. States of Micronesia (FSM)	USD	1.00000	0.00000
MEC	Marshall Islands (RMI)	USD	1.00000	0.00000
NPC	Niue	NZD	0.59000	-0.13160
NUC	Nauru	AUD	0.63250	-0.08391
PPL	Papua New Guinea (PNG)	PGK	0.28410	0.00160
PPUC	Palau	USD	1.00000	0.00000
PUB	Kiribati	AUD	0.63250	-0.08391
PUC	Fed. States of Micronesia (FSM)	USD	1.00000	0.00000
SCE	Santa Catalina Island	USD	1.00000	0.00000
SP	Solomon Islands	SBD	0.12000	-0.00500
TAU	Cook Islands	NZD	0.59000	-0.13160
TEC	Tuvalu	AUD	0.63250	-0.08391
TPL	Tonga	TOP	0.41231	-0.02742
UNELCO	Vanuatu	VUV	0.00818	-0.00060
YSPSC	Fed. States of Micronesia (FSM)	USD	1.00000	0.00000