

Quantification of Energy Efficiency in the Utilities of the U.S. Affiliate States (Excluding US Virgin Islands)

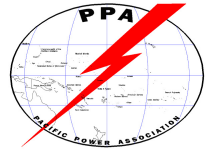
Data Handbook



Pacific Power Association.

Prepared for Pohnpei Utilities Corporation .

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1. Introduction

KEMA Inc has been awarded by the Pacific Power Association (PPA) in Fiji to carry out a project called "Quantification of Energy Efficiency in the Utilities of the U.S. Affiliate States (Excluding US Virgin Islands)".

In this report, an Electrical Data Handbook contains all the electrical characteristics of the power system high voltage equipment in Pohnpei Utilities Corporation (PUC) is provided. All relevant data of the high and medium voltage assets, such as generation data, impedances of lines, cables, transformers, and other equipments if exists. KEMA has incorporated major data of components and equipment in power generation, transmission, distribution and metering. Data template is established to hold comprehensive equipment data, for example for transformers data collected power ratings, primary and secondary voltages, load and no load losses, tap changer data, BIL ratings, cooling class, applicable standards, weight, etc.

2. Data Content

All data contents are identified based on the information KEMA received.

2.1 Generators

There are 7 generators in the Nanpohnmal Power station and 2 hydro units in the Nanpil power station of PUC. However, 2 hydro units are out of service since they have been damaged by a flooding in 2002. The Pohnpei government is currently working on having the 2 hydro units repaired.

Table 1 – Generators

PUC	Substation	NANPOHNMAL							NANPIL	
	Engine #	4	5	6	7	8	9	10	Hydro #1	Hydro #2
GENERATOR DETAILS	ENGINE MAKE	CATERPILLAR			DAIHATSU				BOVING & CO.	
	ENGINE MODEL	3516 STD	3516 STD	3516 STD	12DS32	12DS32	12DS32	12DS32		
	ENGINE SERIAL NUMBER	73Z00310	73Z00309	73Z00312						
	NAME PLATE RATING (kW)	1,135	1,135	1,135	2,500	2,500	2,500	2,500	650	1,152
	DE-RATED (kW)	800	800	800	1800	1,800	1,800	1,800		
	SPEED (RPM)	1200	1200	1200	600	600	600	600	1200	900
	FUEL TYPE	Diesel							Francis Turbine	
	YEAR INSTALLED									
ALTERNATOR DETAILS	MAKE	KATO			NISHISHIBA				KATO	
	TYPE	Brushless	Brushless	Brushless	Brushless	Brushless	Brushless	Brushless	Brushless	Brushless
	MODEL NO.	A248880000			NTAKL	NTAKL	NTAKL	NTAKL	A237830000	A237840000
	SERIAL NO.	123425							93289	93290
	VOLTAGE (V)	4,160	4,160	4,160					277/480	277/480
REMARKS		Overdue for 12,000 hours service								

2.2 Station Transformers

Three substation step-up transformers are operated in the Napohnmal power substation to transfer power from the 4.16 kV generator bus to the 13.8 kV substation bus. No Load and Full Load losses and Z1, Z0 impedances are as specified in PUC Data Outstanding.docx. PUC shall update the data with specific values provided by the transformer manufacturer.

Table 2 – Station Transformers

PUC	Substation Name		NAPOHNMAL		
	Transformer Make		VANTRAN	AICHI	TAKAOKA
	Serial NO.		89V5850	9122548	9348096
	Year of Manufacture			1992	1993
ELECTRICAL CHARACTERISTICS	Rating (MVA)		5	6.3	6.3
	NO. of Phases		3	3	3
	Vector Group		YNd1	Yd1	YNd1
	Voltage (V)	High	13800/7970	13800	13800
		Low	4160	4160	4160
	Impedance (%)	Z1	5.75	5.68	5.58
		Z0			
	Losses (Watts)	No Load	8800 ¹	10000	9000
		Full Load	42125 ²	42000	42500
	Max. Current (A)	HV	220.9	264	204
		LV	693.9	874	874
TANK, CORE & OIL DETAILS	Oil	Vol (Gals)	900	740	925
		Weight (Lbs)		15211	14110
	WEIGHT (LBS)	Net	29000	30424	31306
		Core, Coil & TC		15213	17196
TAPS &	NO. of Taps		5	5	5

¹ Typical data from Electric Power Distribution System Engineering, by Turan Gonen

² Typical data from Electric Power Distribution System Engineering, by Turan Gonen



TC DETAILS	Tapchanger Type	NLTC	NLTC	NLTC
COOLING METHOD		ONAN	ONAN	ONAN
REMARKS		CAT 4, 5, and 6	Engine 7 & 8	Engine 9 & 10

2.3 Distribution Feeders

2.3.1 Feeders

There are 4 main distribution feeders in the PUC system. Majority of the feeders are 13.8 kV overhead lines, with the exception of a section of underground cable. The feeder data template is provided in the table below with a summary of feeder information as represented in the Easy Power model. PUC should add or update with additional data in the future.

Table 3 – Feeders

NAME	Kolonia	Western	Eastern #1	Eastern #2
CONDUCTOR PER PHASE	3	3	3	
MATERIAL	Aluminum	Aluminum	Aluminum	
SIZE	336.4 MCM	336.4 MCM	336.4 MCM	
LENGTH	31,199 ft	190,088 ft	139,375 ft	
TEMP (C)	75	75	75	
EARTH RESISTANCE				
GMD (ft)	3.4	3.4	3.4	
AVERAGE HEIGHT (ft)	45	45	45	
R1 (Ohms/mile)	0.332	0.332	0.332	
X1 (Ohms/mile)	0.617	0.617	0.617	
R0 (Ohms/mile)	0.617	0.617	0.617	
X0 (Ohms/mile)	3.0597	3.0597	3.0597	
Xc (MOhm-mile)	0.146	0.146	0.146	
Xc0 (MOhm-mile)	0.434	0.434	0.434	
RATING Amps	530	530	530	
REMARKS				

2.3.2 Distribution Transformers

Distribution transformers are counted from Excel file *Feeders_Sorted.xlsx* obtained from PUC. Distribution transformers are listed in the tables below:

Table 4 – Transformer count and kVA capacity sum

PUC	Impedance			Losses (watts)		Number of Transformers	Total kVA Installed
kVA	Z%	R%	X%	No Load	Full Load		
5	2.2	2.1	0.8	41	144	12	60
10	1.8	1.4	1.2	68	204	102	1020
15	1.7	1.3	1.2	84	282	158	2370
25	1.7	1.2	1.2	118	422	70	1750
37.5	1.7	1.1	1.3	166	570	36	1350
50	1.8	1.1	1.4	185	720	27	1350
75	1.7	0.9	1.4	285	985	16	1200
100	1.9	1.9	1.7	355	1275	5	500
200	2.4	1.1	2.2	544	2653	1	200
Total						427	9800

Z%, R%, X%, No Load and Full Load Losses are typical values for transformer in the same class of voltage and kVA capacity. PUC shall update the data with specific values provided by the transformer manufacturers.³

³ Reference: Electric Power Distribution System Engineering, Turan Gonen

2.4 Generator and Feeder Output Meters

Details of generator and feeder output meters are listed below.

Table 5 – Meters

Generator and Feeder Output Meters	Generators #4, 5 and 6	Generators #7, #8, #9 and #10	Feeder Kolonia, Western and Eastern #1	Eastern #2 Feeder
Make	Email Meters	Toshiba Corporation	Toshiba Corporation	GE
Type	SDM	S73-VR	S73-K9VR	EPM
Phase	3-phase	3-phase	3-phase	3 phase
Wires	3 wire	3 wire	3 wire	
Voltage (V)	4160/120	4160/110	4160/115	
Revs/kWh	0.444	2363	2400	
CT Ratio	300/5A	300/5A	600/5A	

2.5 Circuit Breakers and Switches

There is no circuit breaker data or switch data provided for the PUC system.

The table below is provided as a template for future data capture.

Table 6 – HV Circuit Breakers (VCBS and OCBS)

Location	Type	Voltage Rating	Quantity
Total			



Table 7 – Pad Mount Switches

Location	Voltage Rating	Quantity
Total		

2.6 Reactor and Capacitor

There are three capacitors with one mounted on the Eastern feeder and two on the Kolonia 2 feeder. All three are rated at 15 kVAr.

The table below shows capacitor data.

Table 8 – Capacitor Data

Location	Voltage Rating	MVAr	Quantity
Eastern	13.8	0.015	1
Kolonia	13.8	0.015	2
Total		0.03	3

There is no reactor in the PUC system.

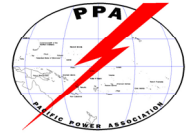
The table below is provided as a template for future reactor data.

Table 9 – Future Reactor Data

Location	Voltage Rating	IMPEDANCE	Quantity
Total			



Appendices



No Appendix for this document.