A.   Data Handbook

Data for Niue Power Corporation (NPC)'s power system are provided in this handbook for generation plant and distribution system. Data that were missing or assumed are noted accordingly.

A.1   Generation

NPC's Niue Power Station has four Caterpillar generation units with a capacity of 508 kW each. Furthermore, there are two solar panel systems are installed near the High School (24 kW) and the Hospital (36 kW), brought in service since September/October 2009.

Generator details are provided in the table below.

Table 1. NPC Generators

| Generator No. | Serial No. | Base Voltage (V) | Base kVA | PMax (kW) | Hz | Manufacture | Model | Date in Service | | | Status* |
								Year	Month	Day	
Gen 1:	G4C00393	410	538	508	50	Caterpillar	700F				In Service
Gen 2:	G4C01071	410	538	508	50	Caterpillar	700F				In Service
Gen 3:	C6C00215	410	538	508	50	Caterpillar	700F				In Service
Gen 4:	C6C00214	410	538	508	50	Caterpillar	700F				In Service

A.2   Distribution System Data

Distribution system equipments data are listed in this section, including data for distribution feeders, distribution transformers, and secondary wires.

The distribution system consists of two 11 kV feeders, the North Feeder and the South Feeder. The North Feeder consists of only underground cables while in the South Feeder only some 4.5 km is overhead and the major part of this feeder is also consisting of underground cables. Each feeder is connected to the power plant's LV bus bar via a transformer 415 V / 11 kV with a rated power of 750 kVA. Ring-Main-Units located at Youth Camp and Amanau have normally open switches to keep both feeders operate as radio feeder.

Distribution system equipment data are illustrated in the tables below.

Table 2. Power Transformer

ID	From Base kV	To Base kV	kVA	Z %	Z0 %	X/R
TX-NORTH	0.415	11	750	4.36	3.706	5.22021
TX-SOUTH	0.415	11	750	4.99	4.2415	5.22021

Z0 % and X/R ratio as calculated in Easy Power.

Table 3. Single-phase Distribution Transformers

kVA Capacity	Number of Transformer	Transformer total KVA	Typical loss for kVA Rating % *	
			No Load loss	Full Load loss
10	18	180	0.68	2.60
15	3	45	0.6	2.3
25	21	525	0.52	2.04
30	2	60	0.52	2.04
sum	**44**	**810**		

Note:

* Typical loss data from Electric Utility Engineering Reference Book distribution systems by Electric Utility Engineers of the Westinghouse Electric Corporation 1959, 1965.

For those transformers of kVA rating that are not listed as typical rating, extrapolation of typical loss data are calculated and filled in the table.

Table 4. Three-phase Distribution Transformers

kVA Capacity	Number of Transformer	Transformer total KVA	Typical loss for kVA Rating % *	
			No Load loss	Full Load loss
30	11	330	0.25%	1.75%
50	5	250	0.25%	1.75%
100	11	1100	0.21%	1.48%
200	3	600	0.18%	1.15%
sum	**30**	**2280**		

Note:

* Typical loss data from EN 50464-1, 2007 Three-phase oil-immersed distribution transformers 50 Hz, from 50 kVA to 2500 kVA with highest voltage for equipment not exceeding 36 kV - Part 1: General requirements

For those transformers of kVA rating that are not listed as typical rating, extrapolation of typical loss data are calculated and filled in the table.

Table 5. Underground Distribution Feeder Conductor Data

ID Name	From Bus ID	To Bus ID	Size (mm²)	Length (m)	Insulation	Rating (A)	Material	R1 (ohm/km)	X1 (ohm/km)	R0 (ohm/km)	X0 (ohm/km)	Xc (mohm-km)	Xc0 (mohm-km)
1	N34	N35	35	3973	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
2	N32-1	N32	35	462	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
4	N31	N30	35	5156	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
4_A	N32	N31	35	190	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
5	N30	N29	35	300	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
6	N29-1	N29	35	2596	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
7	N29	N28	35	283	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
8	N28	N27	35	283	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
9	N27	N26	35	2687	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
10	N26	N25	35	312	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
11	N25	N24	35	481	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
12	N24	N23	35	325	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
13	N23	N22	35	1045	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
14	N22	N21	35	1327	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
15	N21	N20	35	878	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
16	N20	N19	35	504	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176

17	N19	N18	35	1440	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
18	N18	N18-1	35	200	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
19	N18-2	N18-1	35	558	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
1B	N33	N32	35	1204	XLPES	141	Copper	0.585768	0.142797	1.17154	0.285594	0.015176	0.015176
1_A	N33	N34	35	5362	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
20	N17	N18	35	1536	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
21	N16	N17	35	527	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
22	N15	N16	35	834	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
23	N14	N15	35	1075	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
24	N13	N14	35	790	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
25	N12	N13	35	488	XLPES	121	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
25A	N13	N13-1	35	431	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
26_1	N10	N11	35	285	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
26_2	N11	N12	35	483	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
28	N11	N11-1	35	1414	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
29	N9	N10	35	1160	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
30	N8	N9	35	826	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
31	N7	N8	35	825	XLPES	141	Copper	0.585768	0.192409	2.34307	0.769634	0.015176	0.015176
32	N6	N7	35	733	XLPES	141	Copper	0.585768	0.192409	2.34307	0.769634	0.015176	0.015176

33A	N5	N5-1	35	350	XLPES	141	Copper	0.585768	0.147385	2.34307	0.58954	0.015176	0.015176
33_1	N4	N5	35	626	XLPES	124	Aluminum	0.973	0.192409	3.892	0.769634	0.015176	0.015176
33_2	N5	N6	35	1002	XLPES	141	Aluminum	0.973	0.192409	3.892	0.769634	0.015176	0.015176
34	N3	N4	35	643	XLPES	124	Aluminum	0.973	0.192409	3.892	0.769634	0.015176	0.015176
35	N2	N3	35	727	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
36	N1	N2	35	388	XLPES	141	Copper	0.585768	0.192409	2.34307	0.769634	0.015176	0.015176
37	S9	S9-1	35	250	XLPES	141	Copper	0.585768	0.192409	2.34307	0.769634	0.015176	0.015176
38	S10	S9	35	1419	XLPES	141	Copper	0.585768	0.192409	2.34307	0.769634	0.015176	0.015176
39	S11	S10	35	790	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
40	S12	S11	35	1400	XLPES	141	Copper	0.585768	0.192409	2.34307	0.769634	0.015176	0.015176
41	S13	S12	35	582	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
42	S14	S13	35	455	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
43	S15	S14	35	1283	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
44	S16	S15	35	1010	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
45	S17	S16	35	865	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
46	S17-1	S17	35	120	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
47	S18	S17	35	3636	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
48	N35	S18	35	415	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
49	N35-1	N35	35	680	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176

54	B6	B7	35	405	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
55	B5	B6	35	694	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
55A	B4	B5	35	732	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
55B	B5-1	B5	35	570	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
56	B3	B4	35	563	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
57	B2	B3	35	650	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
58	B1	B2	35	880	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
59	N1	B1	35	663	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
E	BUS-S	S1	35	130	XLPES	141	Copper	0.585768	0.147385	2.34307	0.58954	0.015176	0.015176
N-1	BUS-N	N1	35	130	XLPES	141	Copper	0.585768	0.192409	2.34307	0.769634	0.015176	0.015176
OH7_1	B10-1	B10	35	200	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
OH7_1_A	S4-1	S4	35	200	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
OH7_1_B	B8-1	B8	35	250	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
OH7_1_C	S3-1-1	S3-1	35	600	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
OH8_1	B9-1	B9	35	120	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
OH8_1_A	S1-3	S1	35	200	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
OH10_1	B7-2	B7	35	110	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
OH11_1	B7-1	B7	35	745	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
OH24_1	S1-2	S1	35	120	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176

OH25_1	S1-1	S1	35	250	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176
OH25_2	S1-1-1	S1-1	35	1386	XLPES	124	Aluminum	0.973	0.214195	3.892	0.856781	0.015176	0.015176

Rating Amps, R1, X1, R0, X0, Xc and Xc0 as calculated in Easy Power.

Table 6. Overhead Distribution Feeder Conductor Data

ID Name	From Bus ID	To Bus ID	Material	Size	Length (km)	GMD (m)	Average Height (m)	R1 (ohm/km)	X1 (ohm/km)	R0 (ohm/km)	X0 (ohm/km)	Xc (mohm-km)	Xc0 (mohm-km)	Rating (A)
OH8	B10	B9	HDC(AS1746)	41.6 7/2.75	0.142	2.6	25	0.433199	0.425149	0.581006	1.53371	0.369248	0.877735	136
OH9	B9	B8	HDC(AS1746)	67.4 7/3.50	0.26	2.6	25	0.268312	0.409996	0.416003	1.51856	0.355434	0.964978	183
OH21_1	S3-1	S3	HDC(AS1746)	67.4 7/3.50	0.18	2.6	25	0.268312	0.409996	0.416003	1.51856	0.355434	0.863921	183
OH22	S3	S-2	HDC(AS1746)	41.6 7/2.75	1.23	2.6	25	0.433199	0.425149	0.581006	1.53371	0.369248	0.877735	136
OH_1	S9	S8	HDC(AS1746)	41.6 7/2.75	0.263	2.6	25	0.433199	0.425149	0.581006	1.53371	0.369248	0.877735	136
OH_2	S8	S7	HDC(AS1746)	41.6 7/2.75	0.843	2.6	25	0.433199	0.425149	0.581006	1.53371	0.369248	0.877735	136
OH_3	S7	S6	HDC(AS1746)	41.6 7/2.75	1.002	2.6	25	0.433199	0.425149	0.581006	1.53371	0.369248	0.877735	136

								R1	X1	R0	X0	Xc	Xc0	
OH_4	S6	S5	HDC(AS 1746)	41.6 7/2.75	0.461	2.6	25	0.433199	0.425149	0.581006	1.53371	0.369248	0.877735	136
OH_5	S5	B12	HDC(AS 1746)	41.6 7/2.75	0.56	2.6	25	0.433199	0.425149	0.581006	1.53371	0.369248	0.877735	136
OH_6	B12	B11	HDC(AS 1746)	41.6 7/2.75	0.371	2.6	25	0.433199	0.425149	0.581006	1.53371	0.369248	0.877735	136
OH_7	B11	B10	HDC(AS 1746)	41.6 7/2.75	0.242	2.6	25	0.433199	0.425149	0.581006	1.53371	0.369248	0.978792	136
OH_10	B8	B7	HDC(AS 1746)	41.6 7/2.75	0.134	2.6	25	0.433199	0.425149	0.581006	1.53371	0.369248	0.877735	136
OH_20	S4	S5	HDC(AS 1746)	41.6 7/2.75	0.18	2.6	25	0.433199	0.425149	0.581006	1.53371	0.369248	0.877735	136
OH_21	S3	S4	HDC(AS 1746)	41.6 7/2.75	0.45	2.6	25	0.433199	0.425149	0.581006	1.53371	0.369248	0.877735	136
OH_23	S-2	S1	HDC(AS 1746)	41.6 7/2.75	0.18	2.6	25	0.433199	0.425149	0.581006	1.53371	0.369248	0.877735	136

Rating Amps, R1, X1, R0, X0, Xc and Xc0 as calculated in Easy Power.

GMD (Geometric Mean Distance) and Average Height are assumed.

Table 7. Shunt Reactors in Distribution System

Location	kVAR size	Status
North Feeder	110	In-active
South Feeder	110	In-active