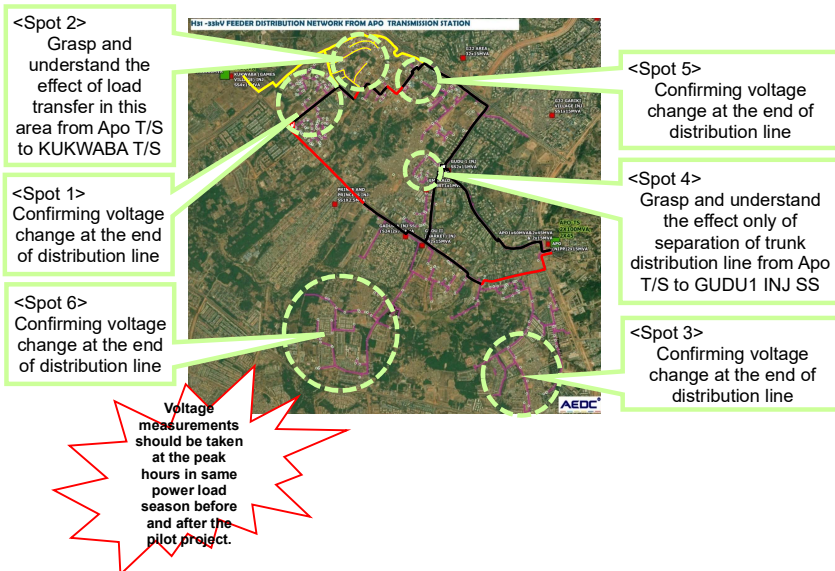


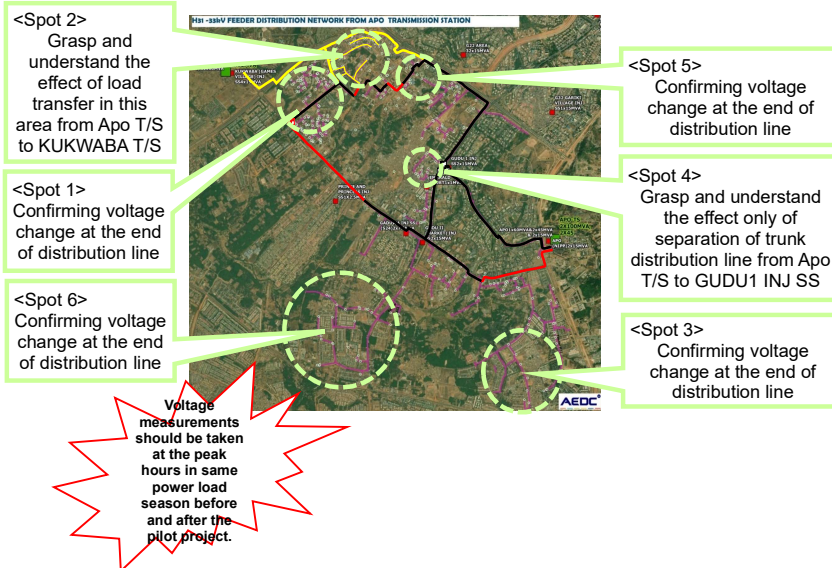
Measuring the voltage at 2nd side of transformers on 33kV distribution line from Apo T/S H31 feeder

Rainy season April to October		No.1		No.9		No.2		No.3		No.20		No.4		No.5		No.6		No.7		No.8		No.9		No.10		No.11		No.12	
Measurement Spot No.		Spot 5		Spot 5		Spot 5		Spot 2		Spot 2		Spot 2		Spot 2		Spot 3		Spot 3		Spot 3		Spot 3		Spot 4		Spot 4		Spot 4	
Measurement Date (Rainy season April to October)		22-May-2023		10-Jan-2023		22-May-2023		23-May-2023		10-Jan-2023		22-May-2023		23-May-2023		23-May-2023		23-May-2023		23-May-2023		23-May-2023		22-May-2023		22-May-2023		22-May-2023	
Measurement Time		18:40Hrs		13:36Hrs		15:00Hrs		13:00Hrs		13:45Hrs		18:55Hrs		19:10Hrs		19:25Hrs		09:34Hrs		10:00Hrs		09:00Hrs		20:30Hrs		20:41Hrs		20:48Hrs	
Transformer Capacity		300kVA		300kVA		300kVA		300kVA		500kVA		300kVA		300kVA		500kVA		500kVA		500kVA		500kVA		500kVA		500kVA		500kVA	
Voltage Ratio		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV	
Voltage at Sec Side of the Transformer		408V		406V		408V		405V		407V		406V		404V		405V		402V		406V		372V		370V		373V		378V	
Converted Prime side voltage		32.4kV		32.3kV		0.0kV		32.4kV		32.4kV		0.0kV		32.3kV		32.2kV		32.0kV		32.3kV		29.6kV		30.4kV		29.4kV		29.6kV	
Current at Sec Side of the Transformer		38.0 A		26.0 A		0.0kV		27.0 A		0.0kV		245.0 A		94.0 A		202.0 A		26.0 A		110A		619.0 A		440.0 A		30.1kV		30.8kV	
Tap position of the Transformer		3		3		3		3		3		3		3		3		3		3		3		3		3		3	
Nos of Tap of the Transformer		5		5		5		5		5		5		5		5		5		5		5		5		5		5	
Source Voltage of H31 feeder at Apo T/S		33.0 kV		33.0 kV		33.2 kV		32.8 kV		33.0 kV		32.8 kV		32.8 kV		32.8 kV		33.0 kV		33.2 kV		32.8 kV		32.8 kV		33.2 kV		33.2 kV	
Source Current of H31 feeder at Apo T/S		0.6 kV		0.7 kV		0.8 kV		0.6 kV		0.6 kV		0.5 kV		0.6 kV		0.5 kV		3.4 kV		3.8 kV		2.7 kV		1.3 kV		2.1 kV		1.9 kV	
Voltage Drop		1.7%		2.2%		2.3%		1.8%		1.9%		1.6%		1.8%		1.5%		10.4%		11.4%		8.4%		4.0%		6.4%		5.7%	
Percentage of Voltage Drop		1.7%		2.2%		2.3%		1.8%		1.9%		1.6%		1.8%		1.5%		10.4%		11.4%		8.4%		4.0%		6.4%		5.7%	
Effect of Pilot Project (Improvement voltage and percentage)																													
Location		COCIN Church, Area 1		Micro Press, Area 1		Fed. Ministry of Tourism, old Secretariat, Area 1		Plot 745, After Multina Depot, Area 1		CAC Church, by VIO, Area 1		Honorable Transformer, by Sentinal Crescent, Durumi		PRSCSH Apo Dutse		HEALTH CARE Apo Dutse		ANGWAN TIV Apo Dutse		Durumi 2, Iya Amala		Durumi 2		Durumi 2 CBN					
Geo-location		9.02243, Lat 7.46794		9.02242, Lat 7.467945		9.027245, Lat 7.46878		9.024845, Lat 7.47007		9.024845, Lat 7.47007		9.029056, Lat 7.464538		9.030046, Lat 7.463506		9.029556, Lat 7.460871		8.9808133, Lat 7.4864247		8.9773005, Lat 7.4865988		8.9790729, Lat 7.4863974		9.010014, Lat 7.470314		9.010015, Lat 7.470313		9.0110508, Lat 7.469915	
Remarks																													
Photos		from front		from left side		from right side		of enlarged transformer																					



Measuring the voltage at 2nd side of

Rainy season April to October		No.13		No.14		No.15		No.16		No.17		No.18		No.21		No.22		No.23		No.24		No.25		No.26		No.27	
Measurement Spot No.		Spot 6		Spot 3		Spot 4		Spot 1		Spot 5		Spot 2		Spot 1		Spot 1		Spot 1		Spot 1		Spot 6		Spot 6		Spot 6	
Measurement Date (Rainy season April to October)		13-Jan-2023		13-Jan-2023		13-Jan-2023		10-Jan-2023		10-Jan-2023		10-Jan-2023		10-Jan-2023		12-Aug-2022		12-Aug-2022		12-Aug-2022		13-Aug-2023		13-Aug-2023		13-Aug-2023	
Measurement Time		14:30Hrs		14:45Hrs		10:45Hrs		12:56Hrs		13:11Hrs		13:58Hrs		13:58Hrs		10:07Hrs		15:44Hrs		15:55Hrs		18:22Hrs		18:30Hrs		18:36Hrs	
Transformer Capacity		300kVA		500kVA		500kVA		200kVA		200kVA		200kVA		200kVA		200kVA		300kVA		200kVA		500kVA		500kVA		500kVA	
Voltage Ratio		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV		33/0.415kV	
Voltage at Sec Side of the Transformer		409V		407V		397V		404V		404V		402V		398V		405V		404V		402V		406V		397V		360V	
Converted Prime side voltage		32.5kV		0.0kV		32.4kV		31.6kV		0.0kV		32.1kV		0.0kV		31.6kV		32.2kV		32.0kV		0.0kV		32.3kV		31.5kV	
Current at Sec Side of the Transformer		100.0 A		49.0 A		19.7 A		200.0 A		2.7 A		38.0 A		26.4 A		46.0 A		15.7 A		147.0 A		38.0 A		0.0kV		32.3kV	
Tap position of the Transformer		3		3		3		3		3		3		3		3		3		3		3		3		3	
Nos of Tap of the Transformer		5		5		5		5		5		5		5		5		5		5		5		5		5	
Source Voltage of H31 feeder at Apo T/S		33.3 kV		33.3 kV		33.3 kV		33.1 kV		33.1 kV		33.0 kV		33.0 kV		32.8 kV		32.8 kV		32.8 kV		33.0 kV		33.0 kV		33.0 kV	
Source Current of H31 feeder at Apo T/S		0.8 kV		0.9 kV		1.2 kV		1.0 kV		1.1 kV		1.4 kV		0.8 kV		0.8 kV		0.8 kV		0.8 kV		0.5 kV		308 A		308 A	
Voltage Drop		2.3%		2.8%		3.5%		2.9%		3.4%		2.4%		2.5%		2.5%		2.5%		1.6%		2.2%		13.3%		4.1%	
Percentage of Voltage Drop		2.3%		2.8%		3.5%		2.9%		3.4%		2.4%		2.5%		2.5%		2.5%		1.6%		2.2%		13.3%		4.1%	
Effect of Pilot Project (Improvement voltage and perc																											
Location		Ocean Centre, Behind Gudu Market, Gudu District		Amina Court Substation 2, Dutse, Apo		Ya amala Substation,behind Emirali Court, Durumi 1		Durumi Govt. Sec. Sch.		Plot 209, Oladipodiya Str, opposite game village, Durumi		Ayuba Waba House Dagba, Durumi, Area 1		Plot 746, Sentinel Crescent, Durumi, Area 1		Durumi Extension		Behind Christ Embassy				Durumi 3		Durumi 3		Durumi 3	
Geo-location		Lat 8.9970815, Long 7.4753783		Lat 8.987029 Long 7.486160		Lat 9.013495 Long 7.471566		Lat 9.02025, Long 7.454161		Lat 9.015183, Long 7.4547983		Lat 9.02189, Long 7.462081		Lat 9.029043, Long 7.464585		Lat 9.01540, Long 7.45460		Lat 9.025790, Long 7.45290		Lat 9.023620, Long 7.45520		8.990839, 7.462483		8.991113, 7.461438		8.991037, 7.461682	
Remarks																											
Photos		from front		from left side		from right side		of enlarged transformer																			



別添資料1 成果品
No. 12-8: 換算停電時間の計算表

Calculation sheet of Converted Outage Duration for H31 feeder in Apo T/S

[illegible]

			33KV DURUMI LINE BREAKER	After Drive 1, Eke S/S 2	100	100	0	0	0	0	0	0	0	0	0
			33KV DURUMI LINE BREAKER	After Drive 1, Eke S/S 3	500	500	0	0	0	0	0	0	0	0	0
			33KV DURUMI LINE BREAKER	Men's court	300	300	0	0	0	0	0	0	0	0	0
			33KV DURUMI LINE BREAKER	Plot 1165, Dr Wasina	200	200	0	0	0	0	0	0	0	0	0
			33KV DURUMI LINE BREAKER	Opp. Crown Court	50	50	0	0	0	0	0	0	0	0	0
			33KV DURUMI LINE BREAKER	Crystall Oasis Water	500	500	0	0	0	0	0	0	0	0	0
			33KV DURUMI LINE BREAKER	AMLS S/S	200	200	0	0	0	0	0	0	0	0	0
			33KV DURUMI LINE BREAKER	Ayuba wabba house	500	500	0	0	0	0	0	0	0	0	0
			33KV DURUMI LINE BREAKER	Metrottle	100	100	0	0	0	0	0	0	0	0	0
			33KV DURUMI LINE BREAKER	Realm Of Glory	300	300	0	0	0	0	0	0	0	0	0
			33KV DURUMI LINE BREAKER	Imperial Hotel	300	300	0	0	0	0	0	0	0	0	0
			33KV DURUMI LINE BREAKER	Meggar press LTD	500	500	0	0	0	0	0	0	0	0	0
			33KV DURUMI LINE BREAKER	Christ Holy Church Int.	100	100	0	0	0	0	0	0	0	0	0
						0	0	0	0	0	0	0	0	0	0
A15	Jumper A13-End of AISA	to	End of H31 distribution line	33KV DURUMI LINE BREAKER		Outage occurred	Outage	Outage	Outage	Outage	Outage	Outage	All recover		
				33KV DURUMI LINE BREAKER	Crown Court Estate	1,000	1,000	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Redeemed of Christian Champion	200	200	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Chanjedatti recycling factory	200	200	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	The Salvation Army ministry	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	RCCG	300	300	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER			0	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER			0	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	50KVA After NNPC	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 143 S/S	200	200	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Beside Plt. 143	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 124	300	300	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 123	200	200	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 121	300	300	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	opp. American Police post	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	American Int. Sch. S/S 1	1,000	1,000	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	American Int. Sch. S/S 2	1,500	1,500	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER		1,000	1,000	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 132	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 133	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	House No. 3	500	500	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 89	500	500	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Opposite Plot 89	200	200	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 134, Chris O. Crescent	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 135, Chris O. Crescent	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 87, Tropicana Est.	200	200	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 136, Chris O.Crescent	300	300	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	100KVA, Off Chris O. Cresc.	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	50KVA, Off Chris O. Cresc.	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Pot 154, off Chris O. Cresc.	200	200	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 164, Amaka W. Cres	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	No.2 Deborah Abba Close	200	200	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	No.5 Deborah Abba Close	200	200	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 150, Amaka S/S	500	500	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	After Plot 150	200	200	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 106	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Grace Villa S/S	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Eveergreen mall S/S	500	500	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Urban Shelter S/S 1	750	750	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Urban Shelter S/S 2	750	750	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Beside Urban Shelter S/S1	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Beside Urban Shelter S/S2	300	300	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	US embassy Qtrs S/S	500	500	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	RCCG opp. urban shellt	200	200	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 295 Ugo F.O Str. S/S 1	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 296 Ugo F.O Str. S/S 2	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Ugo F.O Str. S/S 3	200	200	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 294, Chris Ndubisi S/S 1	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 109, Chris Ndubisi S/S 2	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 293, Chris Ndubisi S/S 3	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 292, Chris Ndubisi S/S 4	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 291, Chris Ndubisi S/S 5	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	B4 IEC Villa stret, C.N	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	B4 IEC Villa stret, C.N 1	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 289 S/S	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 288 S/S	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 316 S/S	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 298 S/S	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	After plot 298 S/S	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 317 S/S	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 221 S/S	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 222 S/S	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 220 S/S	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	After Plot 220 S/S 1	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	After Plot 220 S/S 2	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	After Plot 220 S/S 3	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 319 S/S	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	After Plot 319 S/S	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 299 S/S	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	After IEC Resort s/s1	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 224	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Opp Plot 224	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	After Plot 224 S/S 1	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	After Plot 224 S/S 2	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 257 S/S	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 258 S/S	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 253 S/S	300	300	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 216 S/S	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 215 S/S	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 217 S/S	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 256 S/S	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 247 S/S	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 248 S/S	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 206 S/S	200	200	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 250 S/S	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 237 S/S	200	200	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 251 S/S	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Gss Durumi S/S	300	300	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Hse No. 1 Ukachkwu S/S	300	300	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Hse No. 2 Ukachkwu S/S	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Hse No. 6 Ukachkwu S/S	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Hse No. 3 Ukachkwu S/S	200	200	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Hse No.4, plt 92, Raven Camp	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	After Gss Durumi S/S	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	White hse S/s	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 003 S/S	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	After Plot 003 S/S	100	100	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Beside plot 165 S/s	50	50	0	0	0	0	0	0	0	0
				33KV DURUMI LINE BREAKER	Plot 165 S/S	100									

Calculation sheet of Converted Outage Duration time for H13 feeder in Apo T/S

Would you be able to confirm the current flow and if each load (transformers) is connected between its respective jumpers

						Occ to 1st PC	1st to 2nd PC	2nd to 3rd PC	3rd to 4th PC	4th to 5th PC	5th to 6th PC	Final PC to All recover	Outage Dration without Partial Charge Converted Outage Duration 00day-0h:00m 00day-0h:00m			
Section No.	Jumper	to	next Jumper	Location	Target Distribution Transformer or Substation Transformer	Capacity (kVA)	Outage occurred	1st Partial Charge	2nd Partial Charge	3rd Partial Charge	4th Partial Charge	5th Partial Charge	6th Partial Charge	All recover	Remarks	
	Circuit braaker of H13 new feeder	to	Jumper B1-Connection to tower	33kV H13 New feeder			Outage duration								Time index (yyyy/mm/dd hh:mm)	
							0	0	0	0	0	0	0	0		
B1	Jumper B1-Connection to tower	to	Jumper B2-Former Apo Village	33kV H13 New feeder			Outage occurred	Outage	Outage	Outage	Outage	Outage	Outage	All recover		
							0	0	0	0	0	0	0	0		
B2	Jumper B2-Former Apo Village	to	Jumper B3-Opposite Stick & Stones	33kV H13 New feeder			Outage occurred	Outage	Outage	Outage	Outage	Outage	Outage	All recover		
							0	0	0	0	0	0	0	0		
B3	Jumper B3-Opposite Stick & Stones	to	Jumper B4-Opposite Creative learning	33kV H13 New feeder			Outage occurred	Outage	Outage	Outage	Outage	Outage	Outage	All recover		
							0	0	0	0	0	0	0	0		
B4	Jumper B4-Opposite Creative learning	to	Jumper B5-Kasa De Lucy	33kV H13 New feeder			Outage occurred	Outage	Outage	Outage	Outage	Outage	Outage	All recover		
							0	0	0	0	0	0	0	0		
B5	Jumper B5-Kasa De Lucy	to	Jumper B6-Torch Alive Ministry	33kV H13 New feeder			Outage occurred	Outage	Outage	Outage	Outage	Outage	Outage	All recover		
					CASA DE LUCY HOTEL	500	500	0	0	0	0	0	0	0	0	
					Nice and Clean Wash s/s	300	300	0	0	0	0	0	0	0	0	
					Cliffland Estate S/S2	500	500	0	0	0	0	0	0	0	0	
					RCCG /CKP	100	100	0	0	0	0	0	0	0	0	
					Usman Buba Sarki S/S	100	100	0	0	0	0	0	0	0	0	
					FCT/NJSC	500	500	0	0	0	0	0	0	0	0	
					Simichristy s/s	300	300	0	0	0	0	0	0	0	0	
					Shema filling station	100	100	0	0	0	0	0	0	0	0	
					Hillview Estate s/s 1	500	500	0	0	0	0	0	0	0	0	
					Plot 1104, Cad Zone B11, Kaura District	50	50	0	0	0	0	0	0	0	0	
					Iheadiwa S/S	500	500	0	0	0	0	0	0	0	0	
					Chopwell Resistance S/S	50	50	0	0	0	0	0	0	0	0	
					Plot 25, Gaduwa District	100	100	0	0	0	0	0	0	0	0	
					God's villa s/s	100	100	0	0	0	0	0	0	0	0	
					Sani s/s	100	100	0	0	0	0	0	0	0	0	
					Durumi 3 LFC s/s	500	500	0	0	0	0	0	0	0	0	
					Duplex by LFC Durumi 3	100	100	0	0	0	0	0	0	0	0	
					Joy Umweni s/s Durumi 3	100	100	0	0	0	0	0	0	0	0	
					Durumi 3 Deeper Life Church s/s	300	300	0	0	0	0	0	0	0	0	
					Durumi 3 police post s/s	500	500	0	0	0	0	0	0	0	0	
					Total coop Estate s/s	1,600	1,600	0	0	0	0	0	0	0	0	
					Fafait View Sonic imaging s/s	100	100	0	0	0	0	0	0	0	0	
					Duplex behind Hillview Estate	100	100	0	0	0	0	0	0	0	0	
					White House Durumi 3	100	100	0	0	0	0	0	0	0	0	
					Tiptree S/S	100	100	0	0	0	0	0	0	0	0	
					NPI Estate	500	500	0	0	0	0	0	0	0	0	
					NCDC S/S	500	500	0	0	0	0	0	0	0	0	
					NNPC Estate	500	500	0	0	0	0	0	0	0	0	
					Bala S/S behind TOTAL	100	100	0	0	0	0	0	0	0	0	
					Lafayette Estate Tr 1	500	500	0	0	0	0	0	0	0	0	
					Lafayette Estate Tr 2	500	500	0	0	0	0	0	0	0	0	
					Lafayette Estate Tr 4	500	500	0	0	0	0	0	0	0	0	
					Lafayette Estate Tr 3	500	500	0	0	0	0	0	0	0	0	
					Mobil FS	300	300	0	0	0	0	0	0	0	0	
					Shell Coop Estate S/S 1	500	500	0	0	0	0	0	0	0	0	
					Shell Coop Estate S/S 2	500	500	0	0	0	0	0	0	0	0	
					Shell Coop Estate S/S 3	500	500	0	0	0	0	0	0	0	0	
					Shell Coop Estate S/S4	500	500	0	0	0	0	0	0	0	0	
					Shell Coop Estate S/S 5	500	500	0	0	0	0	0	0	0	0	
					Comrade Aba Moro	100	100	0	0	0	0	0	0	0	0	
					Precious Estate	500	500	0	0	0	0	0	0	0	0	
					MTN Mast by Lavila Estate	50	50	0	0	0	0	0	0	0	0	
					Ipent 6 Estate	500	500	0	0	0	0	0	0	0	0	
					Ebeano supermarket	500	500	0	0	0	0	0	0	0	0	
					Lavilla Estate	500	500	0	0	0	0	0	0	0	0	
					Bentel Estate S/S 2	500	500	0	0	0	0	0	0	0	0	
					Bentel Estate S/S 1	500	500	0	0	0	0	0	0	0	0	
					Doliz Brown Estate	500	500	0	0	0	0	0	0	0	0	
					Private Doliz Brown	100	100	0	0	0	0	0	0	0	0	
					Abuja Manor Estate	500	500	0	0	0	0	0	0	0	0	
					Hillview Estate S/S 2	500	500	0	0	0	0	0	0	0	0	
					Gozie S/S	200	200	0	0	0	0	0	0	0	0	
					Brookville hotel S/S	500	500	0	0	0	0	0	0	0	0	
					Ivory Crown Estate	500	500	0	0	0	0	0	0	0	0	
					Green Valley Estate	500	500	0	0	0	0	0	0	0	0	
					DrekFord Global Concept	200	200	0	0	0	0	0	0	0	0	
					Ekiobe Garden & Shelter S/S	200	200	0	0	0	0	0	0	0	0	
					Gudu market S/S	1,000	1,000	0	0	0	0	0	0	0	0	
					NB Plaza S/S	300	300	0	0	0	0	0	0	0	0	
					OTO shopping mall s/s	500	500	0	0	0	0	0	0	0	0	
					PSN s/s	100	100	0	0	0	0	0	0	0	0	
					Gospel power Assembly Church Gudu	200	200	0	0	0	0	0	0	0	0	
					RCCG/mount alive s/s	500	500	0	0	0	0	0	0	0	0	
					Engine Cost Auto s/s	200	200	0	0	0	0	0	0	0	0	
					Asuquor Diagnostic Center s/s	200	200	0	0	0	0	0	0	0	0	
					Hajara house s/s	100	100	0	0	0	0	0	0	0	0	
					Iskat Designs Ltd s/s	300	300	0	0	0	0	0	0	0	0	
					Abdulwahab Technical S/S	300	300	0	0	0	0	0	0	0	0	
					Mediaserve agency	100	100	0	0	0	0	0	0	0	0	
					Ademu Saleh s/s	100	100	0	0	0	0	0	0	0	0	
					Faridah plaza s/s	300	300	0	0	0	0	0	0	0	0	
					EngineCost s/s	100	100	0	0	0	0	0	0	0	0	
					AJB Mall s/s	100	100	0	0	0	0	0	0	0	0	
					Impacto Trading s/s	300	300	0	0	0	0	0	0	0	0	
					RCCG/Grace Arena s/s	200	200	0	0	0	0	0	0	0	0	
					Plot 5 Oladipo Diya road	100	100	0	0	0	0	0	0	0	0	
					Plot 6 Oladipo Diya Road	100	100	0	0	0	0	0	0	0	0	
					Hon. Patrick House	100	100	0	0	0	0	0	0	0	0	
					Ali Dolari House	100	100	0	0	0	0	0	0	0	0	
					Glass House s/s	100	100	0	0	0	0	0	0	0	0	
					Creative Learner school	100	100	0	0	0	0	0	0	0	0	
					AMA Court s/s	100	100	0	0	0	0	0	0	0	0	
					No. 71 Cad. Zone s/s	100	100	0	0	0	0	0	0	0	0	
					Inspire Home Estate s/s	500	500	0	0	0	0	0	0	0	0	
					House Opposite Inspire Home	100	100	0	0	0	0	0	0	0	0	
					General Adegoke house s/s	300	300	0	0	0	0	0	0	0	0	
					FUNTAJ INT'L SCHOOL	500	500	0	0	0	0	0	0	0	0	
B6	Jumper B6-Torch Alive Ministry	to	Jumper B7-Next Sharia Junction	33kV H13 New feeder			Outage occurred	Outage	Outage	Outage	Outage	Outage	Outage	All recover		
							0	0	0	0	0	0	0	0		
B7	Jumper B7-Next Sharia Junction	to	Jumper B8-Sharia Junction	33kV H13 New feeder			Outage occurred	Outage	Outage	Outage	Outage	Outage	Outage	All recover		
					Touch a life ministry s/s	100	100	0	0	0	0	0	0	0	0	
B8	Jumper B8-Sharia Junction	to	Jumper B9-Oceanic Centre	33kV H13 New feeder			Outage occurred	Outage	Outage	Outage	Outage	Outage	Outage	All recover		
					FCT Jud.comtt	1,000	1,000	0	0	0	0	0	0	0	0	
					Midel Center s/s	300	300	0	0	0	0	0	0	0	0	
					Plot 57, before police outpost	100	100	0	0	0	0	0	0	0	0	
					Cedarcrest Hospital	750	750	0	0	0	0	0	0	0	0	
					Carters Court Estate S/S	1,000	1,000	0	0	0	0	0	0	0	0	
					Amina Court S/S2	500	500	0	0	0	0	0	0	0	0	
					Amina Court S/S 3	500	500	0	0	0	0	0	0	0	0	
					Amina Court S/S5	500	500	0	0	0	0	0	0	0	0	
					Amina Court S/S6	500	500	0	0	0	0	0	0	0	0	
					Amina Court S/S1	500	500	0	0	0	0	0	0	0	0	
					Amina Court S/S4	500	500	0	0	0	0	0	0	0	0	
					Centage Estate SSL	500	500	0	0	0	0	0	0	0	0	
					Centage Estate SSR	500	500	0	0	0	0</					

				Hebron Estate	500	500	0	0	0	0	0	0	0	
				Excel Estate s/s	300	300	0	0	0	0	0	0	0	
				Beacon Int'l School	500	500	0	0	0	0	0	0	0	
				Bhojsons Plc	200	200	0	0	0	0	0	0	0	
				DOLMAN Estate	300	300	0	0	0	0	0	0	0	
				Duplex II Damagaza	100	100	0	0	0	0	0	0	0	
				LMK plot 94	500	500	0	0	0	0	0	0	0	
				Plot 220 by Mango Tree	100	100	0	0	0	0	0	0	0	
				GAAT School	500	500	0	0	0	0	0	0	0	
				Nwangwu Vincent S/S	100	100	0	0	0	0	0	0	0	
				UNI. ILORIN LIAISON OFFICE	200	200	0	0	0	0	0	0	0	
				MAKAMA S/S	100	100	0	0	0	0	0	0	0	
				Patrick Dakum plot 45 S/S	100	100	0	0	0	0	0	0	0	
				St. Jude Plaza S/S	300	300	0	0	0	0	0	0	0	
				Federal Might House S/S	100	100	0	0	0	0	0	0	0	
				Aih. Tijani Yusufu S/S	50	50	0	0	0	0	0	0	0	
				Barr. Festus Kayode S/S	50	50	0	0	0	0	0	0	0	
				Foursquare Gospel Church S/S	100	100	0	0	0	0	0	0	0	
				No.1 Estate s/s	500	500	0	0	0	0	0	0	0	
				Hon. Akindele House	100	100	0	0	0	0	0	0	0	
				Plot 1097 Besides Efab	100	100	0	0	0	0	0	0	0	
				General House besides GSM	200	200	0	0	0	0	0	0	0	
				Combine GSM mast	50	50	0	0	0	0	0	0	0	
B9	Jumper B9-Oceanic Centre	to	Jumper B10-Shafa F/Station	33kV H13 New feeder		Outage occurred	Outage	Outage	Outage	Outage	Outage	Outage	All recover	
				Ocean center	200	200	0	0	0	0	0	0	0	
				FAXX Store Ware House Gudu	300	300	0	0	0	0	0	0	0	
				Behind medic centre, Gudu, Apo s/s	500	500	0	0	0	0	0	0	0	
				Plot 44(B14), Dutse Gudu	50	50	0	0	0	0	0	0	0	
				Behind GAAT School	500	500	0	0	0	0	0	0	0	
				Tonye Hotel S/S	500	500	0	0	0	0	0	0	0	
				DW Plaza Gudu	300	300	0	0	0	0	0	0	0	
				Free Empire S/S	100	100	0	0	0	0	0	0	0	
				Afrodezt House	500	500	0	0	0	0	0	0	0	
				Bukar Ali Dolari S/S	100	100	0	0	0	0	0	0	0	
				Mai-Iron S/S	100	100	0	0	0	0	0	0	0	
				Opposite DOLMAN Estate	100	100	0	0	0	0	0	0	0	
				PAGE School S/S	500	500	0	0	0	0	0	0	0	
				Sunday Enamero S/S	100	100	0	0	0	0	0	0	0	
				Engr Saleh Dunoma S/S	100	100	0	0	0	0	0	0	0	
				Kingsley Anunyuuo S/S	100	100	0	0	0	0	0	0	0	
				Plot 77	100	100	0	0	0	0	0	0	0	
				ZENITH BANK	200	200	0	0	0	0	0	0	0	
				W.A. COLLEGE OF ECONOMICS	300	300	0	0	0	0	0	0	0	
				LAKE CITY PLAZA	300	300	0	0	0	0	0	0	0	
				BUSINESS THRONE PLAZA	500	500	0	0	0	0	0	0	0	
				HEBRON PLAZA	300	300	0	0	0	0	0	0	0	
B10	Jumper B10-Shafa F/Station	to	Jumper B11-Evergreen Garden Adjacent	33kV H13 New feeder		Outage occurred	Outage	Outage	Outage	Outage	Outage	Outage	All recover	
				AYM SHAFa FS	100	100	0	0	0	0	0	0	0	
				MKK PLAZA	500	500	0	0	0	0	0	0	0	
B11	Jumper B11-Evergreen Garden Adjacent	to	Jumper B12-Gaduwa junction	33kV H13 New feeder		Outage occurred	Outage	Outage	Outage	Outage	Outage	Outage	All recover	
				S24 Gaduwa Injection S/S	7,500	7,500	0	0	0	0	0	0	0	
				S24Gaduwa Injection S/S	7,500	7,500	0	0	0	0	0	0	0	
				S23 Gudu 2 Injection S/S	15,000	15,000	0	0	0	0	0	0	0	
				S23 Gudu 2 Injection S/S	15,000	15,000	0	0	0	0	0	0	0	
				33KV GUDU 1 CABLE FDR		0	0	0	0	0	0	0	0	
B12	Jumper B12-Gaduwa junction	to	Jumper B13-Durumi Recreation Park	33kV H13 New feeder		Outage occurred	Outage	Outage	Outage	Outage	Outage	Outage	All recover	
				Louis Valentino s/s	1,000	1,000	0	0	0	0	0	0	0	
				Oando Filling Station s/s	300	300	0	0	0	0	0	0	0	
				MRS Filling Station	300	300	0	0	0	0	0	0	0	
B13	Jumper B13-Durumi Recreation Park	to	Jumper B14-American international Sch	33kV H13 New feeder		Outage occurred	Outage	Outage	Outage	Outage	Outage	Outage	All recover	
						0	0	0	0	0	0	0	0	
B14	Jumper B14-American international Sch	to	End of H13 distribution line	33kV H13 New feeder		Outage occurred	Outage	Outage	Outage	Outage	Outage	Outage	All recover	
						0	0	0	0	0	0	0	0	

Add the new load (Hotel?) at end point of H13 feeders due to changing SW installation point to next pole

Calculation sheet of Converted Outage Duration for H31 feeder in Apo T/S

Example

	Occ to 1st PC	1st to 2nd PC	2nd to 3rd PC	3rd to 4th PC	4th to 5th PC	5th to 6th PC	Final PC to All recover	Outage Dration without Partial Charge Converted Outage Duration
In case that partial charging isn't carried out	02day-16h:19m	00day-1h:48m	00day-5h:41m	00day-2h:07m			09day-8h:49m	12day-10h:44m
In case that partial charge are carried out	02day-16h:19m	00day-1h:47m	00day-5h:37m	00day-0h:04m			00day-6h:26m	03day-6h:15m

Section No.	Location	Target Distribution Transformer or Substation Transformer	Capacity (kVA)	Outage occurred	1st Partial Charge	2nd Partial Charge	3rd Partial Charge	4th Partial Charge	5th Partial Charge	6th Partial Charge	All recover	Remarks
				Outage duration	02day-16h:19m	02day-18h:07m	02day-23h:48m	03day-1h:55m			12day-10h:44m	
				2023/5/17 17:06	2023/5/20 9:25	2023/5/20 11:13	2023/5/20 16:54	2023/5/20 19:01			2023/5/30 3:50	Time index (yyyy/mm/dd hh:mm)
1	33kV H31 feeder	Judges Qtrs 300kVA 33/0.415kV	300	Outage occurred	FW Charge	FW Charge	FW Charge	FW Charge	Outage	Outage	All recover	
			300	0	0	0	0	0	0	0	0	
2	33kV H31 feeder	Garden Delight 300kVA 33/0.415kV	300	Outage occurred	Outage	FW Charge	FW Charge	FW Charge	Outage	Outage	All recover	
			300	300	0	0	0	0	0	0	0	
3	33kV H31 feeder	Didas 500kVA 33/0.415kV	500	Outage occurred	Outage	Outage	Outage	Outage	Outage	Outage	All recover	
		Zone D Second Gate Trx 1	500	500	500	500	500	500	0	0	0	
		Zone D Second Gate Trx 2	500	500	500	500	500	500	0	0	0	
		ANGLICAN GIRLS COLLEGE	300	300	300	300	300	300	0	0	0	
4	33kV H31 feeder	100kVA 33/0.415kV	100	Outage occurred	Outage	Outage	Outage	BK Charge	Outage	Outage	All recover	
		MTN 50kVA 33/0.415kV	50	50	50	50	50	0	0	0	0	
		100kVA 33/0.415kV	100	100	100	100	100	0	0	0	0	
		100kVA 33/0.415kV	100	100	100	100	100	0	0	0	0	
5	33kV H31 feeder	S22 Gudu 1 Injection S/S	15,000	Outage occurred	Outage	Outage	BK Charge	BK Charge	Outage	Outage	All recover	
		S22 Gudu 1 Injection S/S	15,000	15,000	15000	15000	0	0	0	0	0	
		S22 Gudu 1 Injection S/S	15,000	15,000	15000	15000	0	0	0	0	0	
		33KV GUDU 2 CABLE FDR		0	0	0	0	0	0	0	0	
		33KV DURUMI LINE BREAKER		0	0	0	0	0	0	0	0	
		33KV GUDU 2 CABLE FDR		0	0	0	0	0	0	0	0	
		S23 Gudu 2 Injection S/S	15,000	15,000	15000	15000	0	0	0	0	0	
		S23 Gudu 2 Injection S/S	15,000	15,000	15000	15000	0	0	0	0	0	
		33KV BACK FEEDER		0	0	0	0	0	0	0	0	

Total Current Outage Capacity	62,750	62,750	62,450	62,150	2,150	1,800	0	0	0	
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THE PROJECT
FOR
CAPACITY DEVELOPMENT OF POWER DISTRIBUTION

Improvement of (Forced) Outage Management

June 2023

Yachiyo Engineering Co., Ltd.
Kansai Transmission and Distribution, Inc.

First of all

In PIP plan, AEDC has the following goal.

Targets in PIP

Items	Current	After 5 years
Energy delivered - GWh	4,128GWh/year	8,261GWh/year (+4,134GWh)
ATC&C Loss	45%	19.3% (Δ 26%)
Average Frequency of Interruptions	1.12 times/day	0.96 times/day (Δ 0.16 times)
Average Duration of Interruptions	6 hours/day	4 hours/day (Δ 2 hours)

Not an easy goal!!

- This is the goal set by AEDC itself.
- At the same time, this is a kind of “promise” between AEDC and the customers, that AEDC must keep.

How to keep the promise? How to achieve the goal?

- Of course, AEDC needs to reduce the frequency of outage incidents.
- However, simultaneously AEDC is suffering from shortage of manpower and shortage of budget.

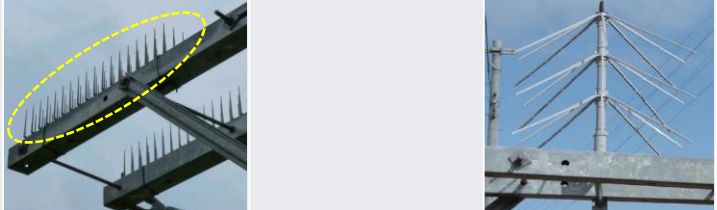
So, how to reduce the frequency of outage incidents in such a situation?

- One way is to execute countermeasures (i.e. the ways to reduce the outage) that are effective and enough.

What is the way to find the effective countermeasure?

The answer is **Quantitative and appropriate analysis about forced outage incidents**

[Examples of the result of analysis in Kansai, Japan]

	What was turned out	Countermeasure
1	A kind of switchgear called “primary cutout”, which was produced in particular month and year by a particular manufacturer , was easily broken due to manufacturing defect and it caused earth fault so often.	Replacement of those were done on a priority basis.
2	In specific area, birds’ nest on cross arms caused earth fault so often. 	After the removal of birds’ nest, equipment is installed on cross arms, that makes birds be unable to perch and make their nest. 

What do we need?

- Appropriate recording of (forced) outage incident information
- Good system for recording and analysis

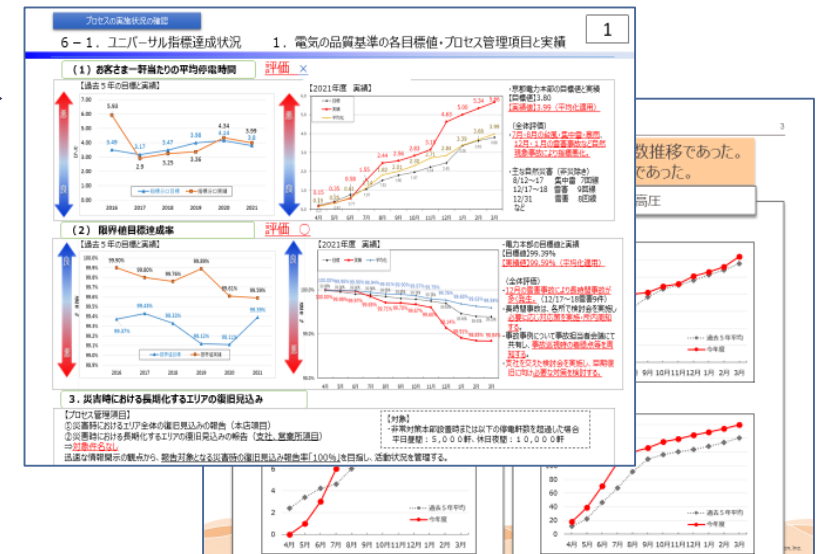
[Example] Forced outage analysis in Kansai

■ Analysis at Headquarters level

HQ implements the company-wide analysis about the outage once a year, and grasps the general tendency of outage incidents. Then HQ creates the company-wide plan to reduce the frequency of outage, and instruct regions to execute the plan.

■ Analysis at Regions level

Kansai has 8 Regions, and each Region implements their own analysis to find what should be done that would not be revealed through the HQ level analysis, because they know more about their own region than HQ. Then they create the plan to deal with them, including the budget request to achieve it.



Survey Result and Our Comment

SURVEY RESULT IN LAST YEAR

- The survey in May last year revealed that, among the **4,274** forced outage incidents from AEDC's system, "Nature of Fault" of **4,228** were "**OTHER**" as the right table shows. This is as much as **98.9%** indeed.
- Looking at the detail of the incidents above, there still are over 500 Cable problems, over 300 Jumper problems, over 300 Vegetation and Animal bridges, over 100 Wire problems, and so on.
- This is not the appropriate recording, but the situation is improved now.

OUR COMMENT

- This situation shows that the general tendency of outage incidents cannot be understood correctly.
- This situation makes it difficult to implement the efficient analysis. It means that it is difficult to find the appropriate countermeasures in order to achieve the reduction of forced outage incidents.

Result of analysis conducted by JICA expert team on data from Fault Reporting Dashboard, May 2022

Nature of Fault	Num.
TRANSFORMER FAULT	16
CIRCUIT BREAKER FAULT	11
CABLE FAULT	5
JUMPER CUT	4
WIRE CUT	3
POLE BROKEN	2
TRANSFORMER OIL LEAKAGE	1
INST. E/F	1
SHATTERED LIGHTNING ARRESTERS	1
RING MAIN UNIT (RMU) FAULT	1
OTHER	4,228
(blank)	1
TOTAL	4,274

Development of the new app

- Before the modification of the current Outage Management System, **Nature of fault** and **Root cause** of each forced outage incident **were recorded**, but they **were not exported** to one Excel spreadsheet. This has been a big obstacle to efficient analysis.
- The new system, **Outage Management App**, has been developed and now its pilot-testing is ongoing at FCT Central Regional Office of AEDC. After the company-wide rollout on the 1st of July, AEDC can export them **in one spreadsheet**.
- This will help AEDC execute the appropriate analysis efficiently based on quantitative data.

Rearrangement of the way of recording outage incidents

1. Rearranged “Nature of Fault”

WIRE CUT	STRAIGHT THROUGH FAILURE	TERMINATION FAILURE
PUNCTURED XLPE CABLE	TRANSFORMER FAULT	J&P FUSE DROP OR FUSE BLOWN
POLE BROKEN	FEEDER PILLAR BURNT	FEEDER PILLAR UNIT BURNT
LINE WAS HIT OR TOUCHED BY TREE	RING MAIN UNIT FAULT	CIRCUIT BREAKER FAULT
TRANSFORMER OIL LEAKAGE	JUMPER CUT	BROKEN WOODEN CROSS ARM
SHATTERED DISC INSULATOR	SHATTERED PIN INSULATOR	SHATTERED ‘D-’FITTINGS
SHATTERED LIGHTENING ARRESTERS	OTHER	

■ Nature of fault is just phenomena. That must never be any Root cause.

■ **“OTHER” as Nature of Fault still remains, but please avoid selecting this as much as possible, because this will not help consider the countermeasure.**

■ **If you have really no choice but to select “OTHER”, you must fill in “DETAIL OF OTHER” definitely. This may help.**

Rearrangement of the way of recording outage incidents

2. Rearranged “Root Cause”

STORMY RAIN AND HEAVY WIND	THUNDER AND LIGHTNING	OTHER NATURAL DISASTERS
OVERFILLED TRANSFORMER OIL	LOOSE BOLT AND NUT DUE TO TRANSFORMER VIBRATION	OTHER IMPERFECT MAINTENANCE
IMPERFECT CONSTRUCTION	CRACKED BUSHING OF TRANSFORMER	WEAR AND TEAR GASKET
PUNCTURED TRANSFORMER BODY	AGING	WATER INGRESS
OTHER IMPERFECT FACILITY	HIGH CHANGES IN ATMOSPHERIC TEMPERATURE	FAULT CAUSED BY CONTRACTOR
PERCHING OF BIRDS	OTHER OBJECTS TOUCHED THE LINE	VANDALISM
VEHICLE CRASH INTO POLE	DIGGERS SPARK CABLE	OTHER FAULT CAUSED BY PUBLIC
CUSTOMER’S INTERNAL OUTAGE SPREAD	OTHER OUTAGE INCIDENT SPREAD	OTHER
UNKNOWN (STILL UNDER PATROL)	UNKNOWN (PATROL IS OVER, BUT NOTHING DISCOVERED)	

■ Root cause is really important when considering the appropriate countermeasure. Therefore this has to be recorded precisely.

■ **“OTHER” still remains, but please avoid selecting this as much as possible, because this will not help. If you have really no choice but to select “OTHER”, you must fill in “ROOT CAUSE IN DETAIL” definitely. This may help.**

Typical examples of countermeasures (1)

Damaged equipment	Root cause	Example of countermeasure
Conductor	Break due to the aging	Replacement
Conductor	Jumper cut	Use of bolt-type connector or compression connector
Conductor	Vegetation touching the conductor	Planned trimming (if permission from authorities is needed, the usual communication with them is important)
		Installing conductor cover (of which use needs to be approved by NEMSA)
		Installing insulated conductor
Conductor	Birds and their nest touching the conductor	Instruments that preventing birds from perching on the conductor or from making nest on the distribution facility  

Typical examples of countermeasures (2)

Damaged equipment	Root cause	Example of countermeasure
Conductor and equipment	Thunder and lightning	Installing additional ground wire and lightning arrester
Transformer	Burnout due to an overload	Decentralization of load by installing additional transformers
Any equipment	Aging	Observe the tendency of damaged equipment carefully. If some specific manufacturer, model number, or manufacture year tend to give the frequent malfunction on the equipment, the total amount of the equipment to be replaced should be grasped and preplanned replacement should be executed.

- We strongly request all of the dispatch operators to accumulate (forced) outage record precisely.
- The purpose of it is to consider the appropriate countermeasure to reduce the frequency of (forced) outage incidents through the appropriate analysis of the accumulated record.
- To reduce the frequency of (forced) outage incidents is the promise between AEDC and the customers, and keeping the promise will improve the customers' satisfaction. Your great effort is highly needed.



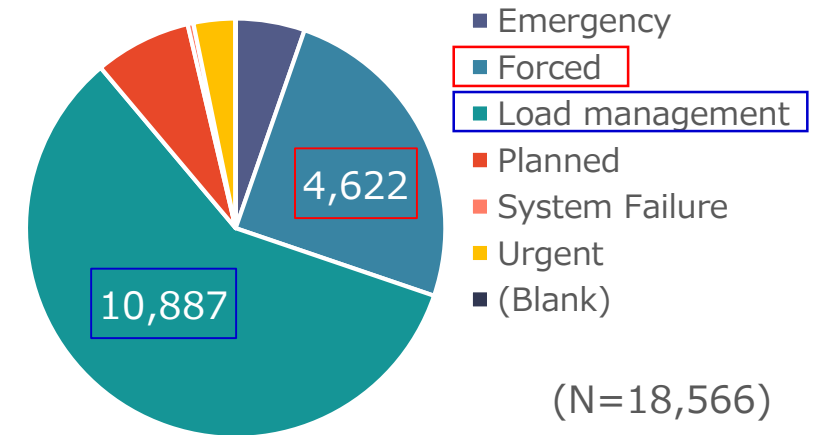
THE PROJECT FOR
CAPACITY DEVELOPMENT OF POWER DISTRIBUTION

Analysis on outage data from Outage Management App (from the beginning of the app till the end of December)

Yachiyo Engineering Co., Ltd.
Kansai Transmission and Distribution, Inc.

First of all

- As already shown, over **50%** of the whole outage incidents is **load management**, and about **25%** is **forced outage**.
- Since outage of load management is often caused by low generation, basically AEDC is not responsible for it. Therefore, working intensively on reduction of forced outage is efficient to reduce the total frequency of outage.
- This will also definitely help AEDC achieve the target on PIP, which is a kind of “promise” between AEDC and the customers.



The target of this analysis is

Forced (permanent) Outage

How to keep the promise? How to achieve the goal?

- Of course, AEDC needs to reduce the frequency of outage incidents.
- However, simultaneously AEDC is suffering from shortage of manpower and shortage of budget.

So, how to reduce the frequency of outage incidents in such a situation?

- One way is to execute countermeasures (i.e. the ways to reduce the outage) that are necessary and sufficient.

- In order to achieve the goals in PIP plan, it is important to **reduce forced outages**.



- In order to **reduce forced outages**, it is important to execute **countermeasures that are necessary and sufficient**.



- In order to come up with **countermeasures that are necessary and sufficient**, it is important to **do quantitative and appropriate analysis**.



- In order to **do quantitative and appropriate analysis**, it is important to **have enough outage data recorded precisely**.

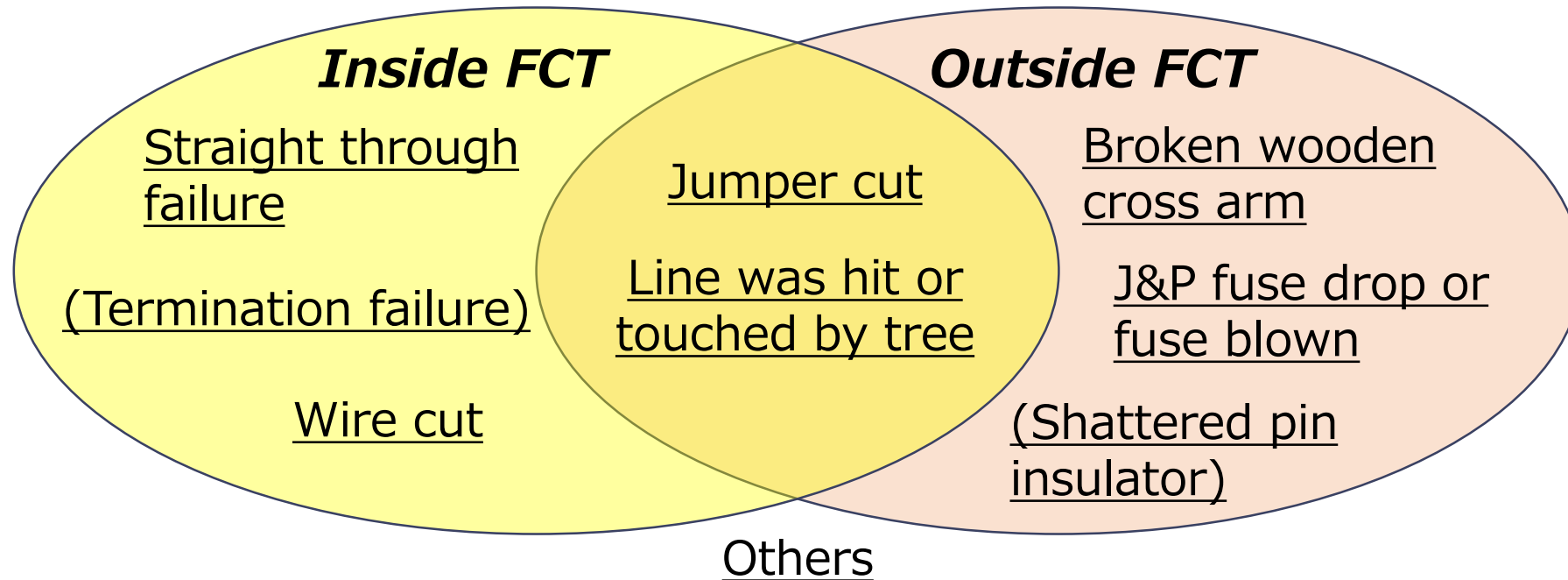
Data quantity (forced permanent outage)

This analysis was executed based on **489** forced permanent outages, from the beginning of the app till the end of December, but the register rates of Fault details and Root causes are not enough yet.

Region	Number of incidents		Fault details registered		Root causes registered	
FCT Central	115	23.5%	73	63.5%	83	72.2%
FCT East	62	12.7%	37	59.7%	43	69.4%
FCT North	27	5.5%	17	63.0%	16	59.3%
FCT South East	84	17.2%	24	28.6%	30	35.7%
FCT South South	41	8.4%	34	82.9%	34	82.9%
FCT West	11	2.2%	5	45.5%	9	81.8%
Nasarawa	18	3.7%	13	72.2%	15	83.3%
Niger	131	26.8%	57	43.5%	67	51.1%
Kogi	0	0.0%	0	---	0	---
Total	489		260	53.2%	297	60.7%

Analysis result (1) From perspective of Fault details

Top **5** elements of “Fault details” inside/outside FCT



(Suggestion)

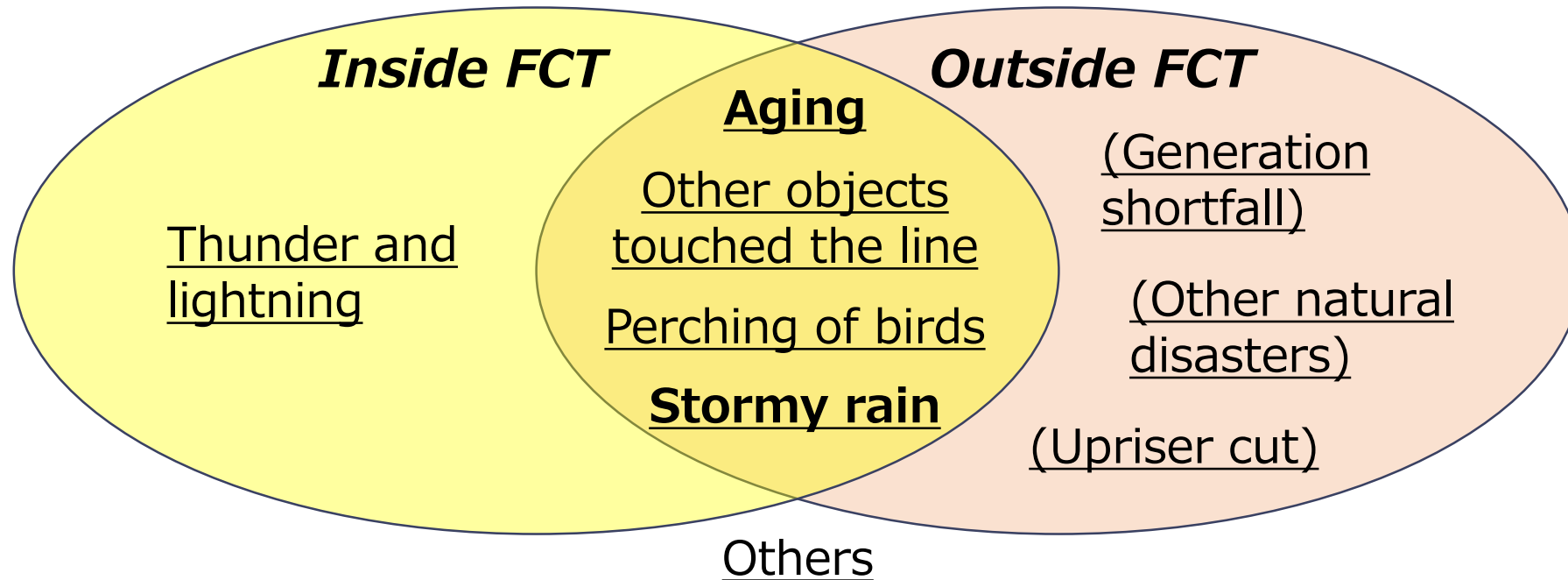
Inside FCT	Both area	Outside FCT
•Straight through failure and wire cut are major kinds of outage which are peculiar to inside FCT regions.	•Jumper cut and vegetation are major issues. •Bolt-type connector and conductor cover should be tried.	•Wooden cross arms should be replaced. •Fuse drop or blown are caused by overloading, so this should be mitigated by appropriate network planning and reinforcement of network capacity.

Analysis result (1) From perspective of Fault details

	FCT C	FCT E	FCT N	FCT SE	FCT SS	FCT W	Inside FCT	Nasara wa	Niger	Kogi	Outside FCT	Total
Broken wooden cross arm		2	1	2	1	1	(7)		17		(17)	24
J & P Fuse drop or fuse blown	7		3		5		(15)	3	5		(8)	23
Jumper cut	10	13	4	8	9	1	(45)	1	11		(12)	57
Line was hit or touched by tree	6	8	1	1	6	1	(23)	2	11		(13)	36
Ring main unit fault	10			1			(11)					11
Shattered lightning arresters	1	5		2			(8)					8
Shattered pin insulator					1		(1)	1	5		(6)	7
Straight through failure	15		2	1			(18)	1			(1)	19
Straight through failure, termination failure	1						(1)					1
Termination failure	18	2	3		1		(24)					24
Wire cut	3	3	2	7	9		(24)	3	2		(5)	29
(Other)	2	4	1	2	2	2	(13)	2	6		(8)	21
(Blank)	42	25	10	60	7	6	(150)	5	74		(79)	229
Total	115	62	27	84	41	11	(340)	18	131	0	(149)	489

Analysis result (2) From perspective of Root causes

Top **5** elements of “Root causes” inside/outside FCT



(Suggestion)

Inside FCT	Both area	Outside FCT
Countermeasures for thunder and lightning. Necessary to install ground wires and lightning arrestors in places where they are needed.	Countermeasure for aging. Necessary to find out what equipment really matters and make an effective plan of replacement, including to secure the budget.	Countermeasures for upriser cut. Putting cover to protect against vandalism or blown objects.

Analysis result (2) From perspective of Root causes

	FCT C	FCT E	FCT N	FCT SE	FCT SS	FCT W	Inside FCT	Nasara wa	Niger	Kogi	Outside FCT	Total
Aging	5	12	2		7		(26)	2	23		(25)	51
Other imperfect facility	2	2	1	3			(8)				(0)	8
Other imperfect maintenance	5		1		1		(7)				(0)	7
Other natural disasters	2	2			1	1	(6)	1	2		(3)	9
Other objects touched the line	3	7	1	7	6	1	(25)	1	6		(7)	32
Perching of birds	5		2		4		(11)		3		(3)	14
Shattered Pot insulator							(0)		3		(3)	3
Stormy rain	25	8	3	7	8	3	(54)	4	8		(12)	66
Thunder and lightning	2	1		5	3	1	(12)		2		(2)	14
Upriser cut	3	4			1		(8)	3			(3)	11
Water ingress	6	1			2		(9)				(0)	9
(Other)	15	4		7	1	2	(29)	2	19		(21)	50
(Unknown)	10	2	6	1		1	(20)	2	1		(3)	23
(Blank)	32	19	11	54	7	2	(125)	3	64		(67)	192
Total	115	62	27	84	41	11	(340)	18	131	0	(149)	489

Analysis result (3)

Relationship between Fault details and Root causes

Companywide

[Legend] * Relationship is relatively high ** Relationship is **very** high

Fault details Root Causes	Broken wooden cross arm	J & P FUSE DROP OR FUSE BLOWN	Jumper cut	Line was hit or touched by tree	STRAIGHT THROUGH FAILURE	Termination failure	Wire cut	Other
Aging	**		**				*	
Other objects touched the line			*	**				
Perching of birds		*						
Stormy rain				**	*	*	*	
Thunder and lightning								
Upriser cut			*					
Other								

[Note] This is just companywide tendency, which does not mean a lot.
 Analysis for the tendency of each region is much more important.

Analysis result (3) Relationship between Fault details and Root causes

[FCT Central] Num. of incidents: **115** / Fault details registered: **73** / Root causes registered: **83**

Root Causes \ Fault Details	Broken wooden cross arm	J & P fuse drop or fuse blown	Jumper cut	Punctured XLPE Cable	Shattered 'D'-fittings	Line was hit or touched by tree	Straight through failure	Shattered lightning arresters	Termination failure	Wire cut	Other (blank)
Aging											
Other imperfect maintenance			**								
Other imperfect facility											
Other objects touched the line											
Perching of birds											
Stormy rain						*	**		**	*	
Thunder and lightning											
Upriser cut											
Water Ingress			*								
Other fault caused by public/ Customer's internal outage spread											
Other (blank/ unknown)											

[Legend] * Relationship is relatively high ** Relationship is **very** high

Analysis result (3) Relationship between Fault details and Root causes

[FCT East] Num. of incidents: **62** / Fault details registered: **37** / Root causes registered: **43**

Root Causes \ Fault Details	Broken wooden cross arm	J & P fuse drop or fuse blown	Jumper cut	Punctured XLPE Cable	Shattered 'D'-fittings	Line was hit or touched by tree	Straight through failure	Shattered lightning arresters	Termination failure	Wire cut	Other (blank)
Aging			**					*		*	
Other imperfect maintenance											
Other imperfect facility											
Other objects touched the line						*					*
Perching of birds											
Stormy rain						**					
Thunder and lightning											
Upriser cut			**								
Water Ingress											
Other fault caused by public/ Customer's internal outage spread											
Other (blank/ unknown)											

[Legend] * Relationship is relatively high ** Relationship is **very** high

Analysis result (3) Relationship between Fault details and Root causes

[FCT North] Num. of incidents: **27** / Fault details registered: **17** / Root causes registered: **16**

Root Causes \ Fault Details	Broken wooden cross arm	J & P fuse drop or fuse blown	Jumper cut	Punctured XLPE Cable	Shattered 'D'-fittings	Line was hit or touched by tree	Straight through failure	Shattered lightning arresters	Termination failure	Wire cut	Other (blank)
Aging											
Other imperfect maintenance											
Other imperfect facility											
Other objects touched the line											
Perching of birds		*									
Stormy rain											
Thunder and lightning											
Upriser cut											
Water Ingress											
Other fault caused by public/ Customer's internal outage spread											
Other (blank/ unknown)			*						*		

Data quantity is not enough, so clear tendency cannot be seen.

[Legend] * Relationship is relatively high ** Relationship is **very** high

Analysis result (3) Relationship between Fault details and Root causes

[FCT South-East] Num. of incidents: **84** / Fault details registered: **24** / Root causes registered: **30**

Root Causes \ Fault Details	Broken wooden cross arm	J & P fuse drop or fuse blown	Jumper cut	Punctured XLPE Cable	Shattered 'D'-fittings	Line was hit or touched by tree	Straight through failure	Shattered lightning arresters	Termination failure	Wire cut	Other (blank)
Aging											
Other imperfect maintenance											
Other imperfect facility			**								
Other objects touched the line			**							*	
Perching of birds											
Stormy rain											*
Thunder and lightning										*	
Upriser cut											
Water Ingress											
Other fault caused by public/ Customer's internal outage spread											
Other (blank/ unknown)											

[Legend] * Relationship is relatively high ** Relationship is **very** high

Analysis result (3)

Relationship between Fault details and Root causes

[FCT South-South] Num. of incidents: **41** / Fault details registered: **34** / Root causes registered: **34**

Fault Details Root Causes	Broken wooden cross arm	J & P fuse drop or fuse blown	Jumper cut	Punctured XLPE Cable	Shattered 'D'-fittings	Line was hit or touched by tree	Straight through failure	Shattered lightning arresters	Termination failure	Wire cut	Other (blank)
Aging										**	
Other imperfect maintenance											
Other imperfect facility											
Other objects touched the line			**			*				*	
Perching of birds		*									
Stormy rain		**				**				*	
Thunder and lightning			**								
Upriser cut											
Water Ingress											
Other fault caused by public/ Customer's internal outage spread											
Other (blank/ unknown)											

[Legend] * Relationship is relatively high ** Relationship is **very** high

Analysis result (3) Relationship between Fault details and Root causes

[FCT West] Num. of incidents: **11** / Fault details registered: **5** / Root causes registered: **9**

Fault Details \ Root Causes	Broken wooden cross arm	J & P fuse drop or fuse blown	Jumper cut	Punctured XLPE Cable	Shattered 'D'-fittings	Line was hit or touched by tree	Straight through failure	Shattered lightning arresters	Termination failure	Wire cut	Other (blank)
Aging											
Other imperfect maintenance											
Other imperfect facility											
Other objects touched the line						*					
Perching of birds											
Stormy rain	*										*
Thunder and lightning				*							
Upriser cut											
Water Ingress											
Other fault caused by public/ Customer's internal outage spread					*						
Other (blank/ unknown)											

Data quantity is not enough, so clear tendency cannot be seen.

[Legend] * Relationship is relatively high ** Relationship is **very** high

Analysis result (3) Relationship between Fault details and Root causes

[Nasarawa] Num. of incidents: **18** / Fault details registered: **13** / Root causes registered: **15**

Root Causes \ Fault Details	Broken wooden cross arm	J & P fuse drop or fuse blown	Jumper cut	Punctured XLPE Cable	Shattered 'D'-fittings	Line was hit or touched by tree	Straight through failure	Shattered lightning arresters	Termination failure	Wire cut	Other (blank)
Aging											
Other imperfect maintenance											
Other imperfect facility											
Other objects touched the line											
Perching of birds											
Stormy rain						*					
Thunder and lightning											
Upriser cut											
Water Ingress											
Other fault caused by public/ Customer's internal outage spread											
Other (blank/ unknown)											

Data quantity is not enough, so clear tendency cannot be seen.

[Legend] * Relationship is relatively high ** Relationship is **very** high

Analysis result (3) Relationship between Fault details and Root causes

[Niger] Num. of incidents: **131** / Fault details registered: **57** / Root causes registered: **67**

Root Causes \ Fault Details	Broken wooden cross arm	J & P fuse drop or fuse blown	Jumper cut	Punctured XLPE Cable	Shattered 'D'-fittings	Line was hit or touched by tree	Straight through failure	Shattered lightning arresters	Termination failure	Wire cut	Other (blank)
Aging	**		**							*	
Other imperfect maintenance											
Other imperfect facility											
Other objects touched the line						**					
Perching of birds											
Stormy rain						*					*
Thunder and lightning		*									
Upriser cut											
Water Ingress											
Other fault caused by public/ Customer's internal outage spread											
Other (blank/ unknown)											

[Legend] * Relationship is relatively high ** Relationship is **very** high

Analysis result (3) Relationship between Fault details and Root causes

Root cause	Fault detail	Possible solution	Num. of incidents
Aging	Wire cut	- Creating and implementing the replacement plan - Try to use conductor covers	9
	Broken wooden cross arm	- Creating and implementing the replacement plan - Replacement at every discovery	15
	Jumper cut	- Require contractor for better installation - Try to use bolt-type connectors	14
Other objects touched the line			8
	Line was hit or touched by tree	- Proper vegetation control - Try to use conductor covers	13
Stormy rain	Line was hit or touched by tree		16
	Wire cut	Creating and implementing the replacement plan	7

82

- These are relatively major combinations of root causes and fault details.
- Ideally, if AEDC could take the countermeasures only for above, AEDC would decrease at least **82 (16.8%)** forced permanent outage incidents.

Conclusion of this presentation (1)

- Analysis of data is really important when considering the countermeasure(s) for outage incidents, because analysis must be quantitative (in other words “based on data”) in order to make the countermeasure(s) appropriate and convincing, i.e., necessary and sufficient. This will help AEDC use its resources efficiently.
- From this perspective, proper outage recording is really crucial, has to be accurate and easy to be analyzed.
 - Because the register rates of both fault details and root causes are 50–60%, reliability of the analysis result on this presentation might be as much as 50–60%.
 - Outage Management App is a great system for quantitative analysis, but the current register rates above mean it is not fully utilized.
 - Lack of amount of data might make it difficult to find the clear tendency. Relationships between Fault details and Root causes in FCT North, FCT West, and Nasarawa are good examples.
- Companywide tendency doesn’t mean a lot because tendency of outage varies depending on region. Therefore analysis has to be done for each region in order to have truly appropriate countermeasure(s).

Conclusion of this presentation (2)

- The purpose of this presentation is not only telling the analysis result conducted by JICA expert, but also encouraging AEDC to realize the advantage of quantitative analysis of outage.
- Result of analysis on this presentation is just an example. This kind of analysis is supposed to be done by AEDC itself. After this project, AEDC has to be able to perform this kind of analysis by themselves.



Analysis result on faults (forced outage) record in Band-A areas from the inception of Outage Management App

Region	All faults	Faults in Band-A area	Which has Fault Detail		Which has Root Cause	
		[a]	[b]	[b/a]	[c]	[c/a]
FCT Central	332	299	121	40%	162	54%
FCT East	340	0	---	---	---	---
FCT South-East	296	58	34	59%	39	67%
FCT South-South	123	106	16	15%	32	30%
FCT North	113	42	28	67%	30	71%
FCT West	38	15	1	7%	11	73%
Nasarawa	25	10	7	70%	10	100%
Niger	264	44	21	48%	24	55%
Kogi	310	51	12	24%	12	24%
(Total)	1,841	625	240	38%	320	51%

- Register rates of **Fault Detail** and **Root cause** are **still very low** obviously.
- Under this situation, analysis result is not necessarily to the point because the data cannot be fully reliable.
- Therefore, the tendencies shown in this document might not be 100% accurate but this is “what can be said at least” from this outage record.
- For the better analysis, AEDC has to make every effort to improve proper outage recording.

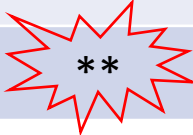
[Legend] * Relationship is relatively high ** Relationship is **very** high

		Major Root Cause					
		Stormy rain	Water ingress	Carbonized RMU	Perching of birds	Imperfect maintenance	Other objects touched the line
Major Fault Detail	Termination failure	**	*				
	Straight through failure	**	**				
	Ring Main Unit Fault			**			
	J&P fuse drop or fuse blown	*			*		
	Jumper cut					**	
	Line was hit or touched by tree	**					**

- Termination failure and Straight through failure look problems about equipment. Therefore it seems that perfect installation is the prime countermeasure. If AEDC would like to prevent this kind of faults before they occur, AEDC has to execute the periodic patrol to check the soundness.
- Root cause of “Ring Main Unit Fault” is carbonized RMU – this does not make sense. Why it got carbonized is the cause, that must be pursued.
- Jumper cut by imperfect maintenance looks like connection-by-hand was disconnected somehow. Proper connectors have to be used.
- Vegetation problem – more frequent trimming is the key countermeasure. If this kind of work is properly done, stormy rain is no longer problem.

Region: FCT North

[Legend] * Relationship is relatively high ** Relationship is **very** high

		Major Root Cause				
		Imperfect facility	Imperfect maintenance	Perching of birds	Unknown	(blank)
Major Fault Detail	Straight through failure	*			 **	
	J&P fuse drop or fuse blown			*		
	Jumper cut		*			 **

- “Unknown” or blank are too many, which do not make sense for analysis. Pursuing the cause of each fault is the very first step to get tendencies and consider countermeasures.
- Termination failure and Straight through failure look problems about equipment. Therefore it seems that perfect installation is the prime countermeasure. If AEDC would like to prevent this kind of faults before they occur, AEDC has to execute the periodic patrol to check the soundness.

Region: FCT South East

[Legend] * Relationship is relatively high ** Relationship is **very** high

		Major Root Cause		
		Imperfect facility	Stormy rain	Thunder and lightning
Major Fault Detail	Line was hit or touched by tree	**		
	Wire cut		*	*

- “Imperfect facility” looks somewhat strange as the root cause of “Line was hit or touched by tree”, but anyway this suggests that trimming was not done properly. More frequent trimming is the key countermeasure.

Region: FCT South South

[Legend] * Relationship is relatively high ** Relationship is **very** high

		Major Root Cause				
		Stormy rain	Perching of birds	Other objects touched the line	Thunder and lightning	Stormy rain
Major Fault Detail	J&P fuse drop or fuse blown	**	**			
	Jumper cut			**	**	
	Wire cut					*
	Line was hit or touched by tree					*

- It is difficult to understand a fuse drop or blown by stormy rain.
- Jumper cut by other objects looks like connection-by-hand was disconnected by flying objects. Proper connectors have to be used.
- Vegetation problem – more frequent trimming is the key countermeasure.

Data quantity is not enough at all,
so clear tendency cannot be seen.

Data quantity is not enough at all,
so clear tendency cannot be seen.

Region: Nasarawa

[Legend] * Relationship is relatively high ** Relationship is **very** high

		Major Root Cause					
		Stormy rain	Aging	Thunder and lightning	Other objects touched the line	Cable Snapped on the main Line	XLPE Cables Puncture
Major Fault Detail	Jumper cut	**					
	J&P fuse drop or fuse blown		*	*			
	Line was hit or touched by tree				**		
	Punctured XLPE cable					*	*

- Jumper cut by Stormy rain looks like connection-by-hand was disconnected by flying objects. Proper connectors have to be used.
- Root cause of “Punctured XLPE cable” is XLPE Cables Puncture – this does not make sense. Why it got punctured is the cause, that must be pursued.

General evaluation and suggestion

Companywide

- As mentioned in the first slide, register rates of Fault Detail and Root cause are still very low. Analysis result under this situation is not necessarily to the point because the data cannot be fully reliable.
- Another observation is that some of the combinations of root cause and fault detail don't make sense. These mean what the fault was like and what caused the fault, so these have to be registered accurately to do appropriate analysis and come up with reasonable countermeasures.
- In short, the action that AEDC must take is improvement of the accuracy of outage recording. Low register rate is out of the question. This action requires HQ's strong leadership, and cooperation between HQ and regions.

Each region

- Described in the slides, actions that have to be taken are different depending on region, but what is sure is that each region must work harder if AEDC would like to prevent faults.
- We understand that it is not easy to cut or trim tree branches on a large scale in Abuja due to the restriction for the preservation of scenery. If AEDC would like to decrease the faults related to vegetation, then AEDC has to work on small but frequent trimming.

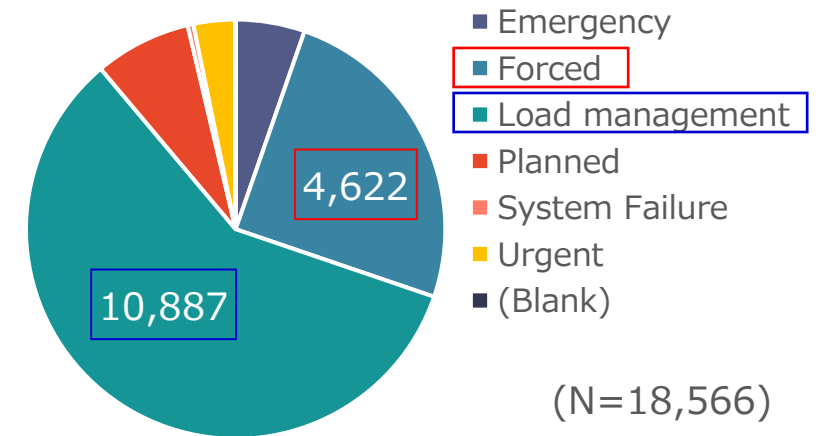
THE PROJECT FOR CAPACITY DEVELOPMENT OF POWER DISTRIBUTION

Reliability improvement ~ Importance of appropriate recording ~

Yachiyo Engineering Co., Ltd.
Kansai Transmission and Distribution, Inc.

First of all

- As already shown, over **50%** of the whole outage incidents is **load management**, and about **25%** is **forced outage**.
- Since outage of load management is often caused by low generation, basically AEDC is not responsible for it. Therefore, working intensively on reduction of forced outage is efficient to reduce the total frequency of outage.
- In Band-A areas, about 80% is forced outage, so reducing forced outages is much more important than in other areas.



The target of
this analysis is

Forced (permanent) Outage

How to reduce forced (permanent) outages?

- Of course, AEDC needs to reduce the frequency of outage incidents.
- However, simultaneously AEDC is suffering from shortage of manpower and shortage of budget.

So, how to reduce the frequency of outage incidents in such a situation?

- One way is to allocate limited management resources intensively on countermeasures (i.e. the ways to reduce the outage) that are truly effective.

- In order to achieve the goals in PIP, it is important to **reduce forced outages**.



- In order to **reduce forced outages**, it is important to execute **truly effective countermeasures** intensively.



- In order to come up with **truly effective countermeasures**, it is important to **do quantitative and appropriate analysis**.

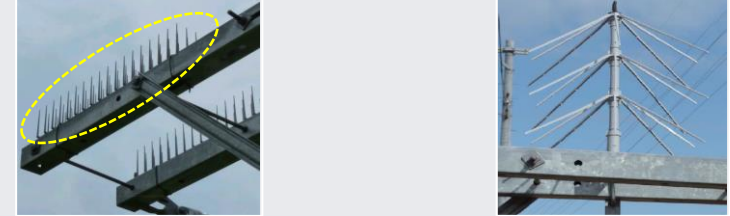


- In order to **do quantitative and appropriate analysis**, it is important to **have enough outage data recorded precisely**.

What is the way to find the effective countermeasure?

The answer is **Quantitative and appropriate analysis about forced outage incidents**

[Examples of the result of analysis in Kansai, Japan]

	What was turned out through analyzing outage record	Countermeasure
Ex. 1	Particular equipment under some particular conditions is easily broken and causes earth fault so often.	Replacement targeted to such particular equipment is conducted
Ex. 2	In specific area, birds' nest on cross arms caused earth fault so often. 	After the removal of birds' nest, equipment is installed on cross arms, that makes birds be unable to perch and make their nest. 

What do we need?

- Appropriate recording of (forced) outage incident information
- Good system for recording and analysis

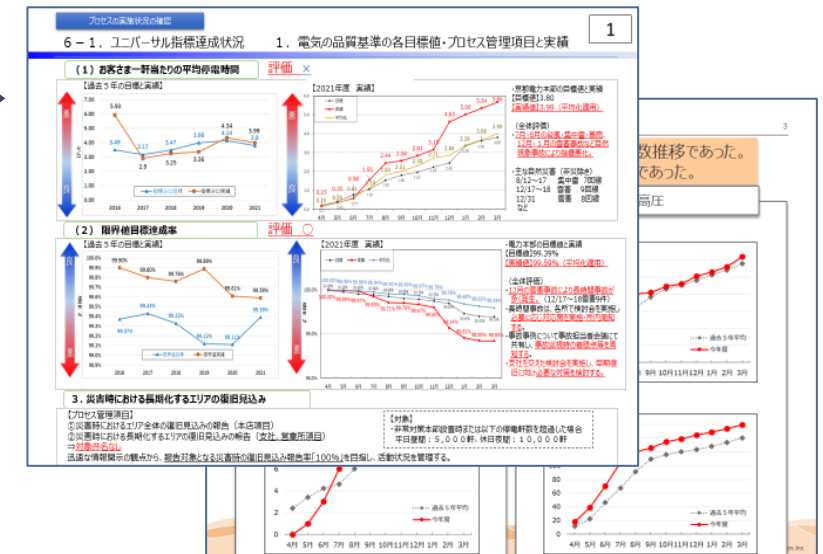
[Example] Forced outage analysis in Kansai

■ Analysis at Headquarters level

HQ implements the company-wide analysis about the outage incidents. Then HQ creates the company-wide plan to reduce the frequency of outage, and instruct Branches to execute the plan.

■ Analysis at Branches and Regions level

Kansai has 8 Branches and over 30 Regions, and each Branch and Region implements their own analysis to find what should be done that would not be revealed through the HQ level analysis, because they know more about their own area than HQ. Then they create the plan to deal with them, including the budget request to achieve it.



Outage recording in AEDC

- AEDC has a good system to record outages which is available company-wide. The system will help AEDC execute the proper recording and the appropriate analysis efficiently based on quantitative data, as far as it performs at its full potential.
- Especially analysis from perspectives of **Fault details** and **Root causes** are important because knowing tendency of outage incidents is crucial when considering the appropriate countermeasures. In this regard, JICA team has been requesting AEDC (HQ dispatch) over and over again to record Fault detail and Root cause of every outage incident.
- However, the register rate of information is not satisfying (see the next slide), so the system looks not fully utilized yet.

Data collection result

Period	Num. of forced permanent outages	Fault details registered	Root causes registered	Remark
7 th Jun. '23 – 27 th Dec. '23	489	260 53.2%	297 60.7%	All feeders
7 th Jun. '23 – 7 th Jul. '25	666	328 49.2%	365 54.8%	All feeders
	240	120 50.0%	140 58.3%	Band A feeders only

Comment

- As shown above, the register rates of both Fault detail and Root cause are very low in spite of the requests over and over again from JICA Expert Team.
- Appropriate analysis cannot be done based on this data. Even if it is analyzed, the result cannot be reliable and will not help AEDC find effective countermeasures based on quantitative data.

Suggestion

- Taking the above into account, HQ dispatch must confirm Fault detail and Root cause are registered for each forced permanent outages on daily basis. When finding cases of which Fault detail and Root cause are not registered, HQ dispatch has to contact the region and command to input them.
- Data collection work is done by regional dispatches, so their understanding and cooperation are quite important. HQ must provide them clear and polite explanation about the issue, and needs to make every effort to ensure their understanding.
- We recommend to try to improve the register rates for execution of better analysis and better countermeasures. How about starting at least in Band-A areas?



The Project for Capacity Development of Power Distribution

Working Group-4

Human Resource Development and Training Deployment

June 2024

Yachiyo Engineering Co., Ltd.
Kansai Transmission and Distribution, Inc.

1. Objective of the Project

The objective of this project is to improve the capacity of engineers and technicians of the Distribution Companies (Discos) to plan, design, operate and maintain their distribution network through;

- i. direct technical transfer from JICA Experts to counterparts and
- ii. developed/improved NAPTIN's training courses.

The specific outputs of the project are that Disco's engineers and technicians will acquire knowledge and capabilities related to (a) technical loss reduction, (b) reliability improvement, (c) quality improvement and to establish a framework to sustain the outcome of the project.

The project will help Discos achieve their proposed performance improvement targets in PIP.

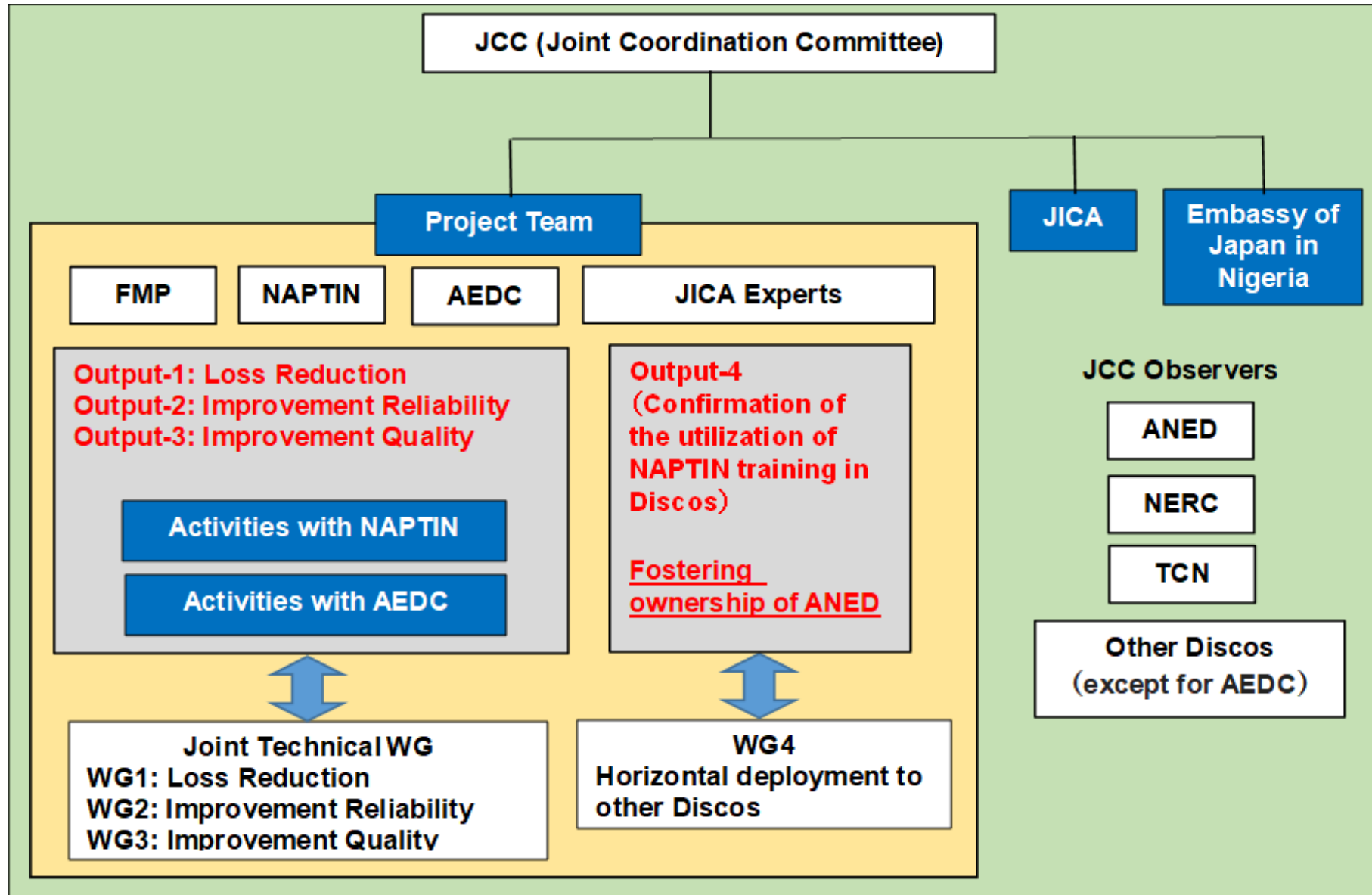
Planned Service Improvement Targets of AEDC

Items	Current	After 5 years
Energy delivered - GWh	4,128GWh/year	8,261GWh/year (+4,134GWh)
ATC&C Loss	45%	19.3% (Δ 26%)
Average Frequency of Interruptions	1.12 times/day	0.96 times/day (Δ 0.16 times)
Average Duration of Interruptions	6 hours/day	4 hours/day (Δ 2 hours)

2. Expected outputs and activities

Outputs	Outline of Activities
<Output-1> Development and implementation of training for loss reduction measures	Preparatory Phase Activities (common to Output 1-4) 0-1 Baseline survey (field survey, update information) Activities related to Output 1-3 (N or A-X corresponds to Output 1-3) <Activities with NAPTIN> (TOT: Training Of Trainers) N-1 Planning training courses, teaching materials preparation, TOT N-2 Conducting training course N-3 Evaluating training courses and giving feedback N-4 Incorporating pilot results into training (Training improvement plans) N-5 Design and construction of training equipment for demonstration
<Output-2> Development and implementation of training to improve reliability	<Activities with AEDC> A-6 Field survey, Extracting issues in business operations A-7 Consideration and implementation of pilot project A-8 Incorporate pilot results into business operations [revising technical standards, SOP (standard operating procedure), etc.]
<Output-3> Development and implementation of training for quality improvement	<Activities with AEDC> A-6 Field survey, Extracting issues in business operations A-7 Consideration and implementation of pilot project A-8 Incorporate pilot results into business operations [revising technical standards, SOP (standard operating procedure), etc.]
<Output-4> Confirmation of the utilization of NAPTIN training in Discos	Activities related to Output-4 4-1 Collecting information, analysis, and presentation of improvement plans for Career framework in AEDC and application of NAPTIN training 4-2 Creating dissemination plans for other Discos Activities for WG-4

3. Structure of project implementation organization



WG4 Implementation schedule(AEDC’s human resources system and training plan)

Phase	Activities	Responsible			2024												2025									
		NAPTIN	AEDC	JET	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10			
Information Gathering	1. Training plan for engineers and technicians at AEDC	○	○	◎		→																				
	2. Role of NAPTIN training in AEDC's training plan for engineers and technicians	○	○	◎		→																				
Analysis	3. Analysis of issues related to the role of NAPTIN training	○	○	◎		→																				
Countermeasure study	4. proposal to introduce NAPTIN training into AEDC's training plan for technicians and engineers	◎	◎	○								→														
												→														
Training Deployment	5. plans to expand training to other discos	◎	◎	○										→												
		◎	◎	○										→												
Action	6. Start of introduction																		→							
																			→							

<Note>

Field Work of JICA Expert Team (JET)

Activities and management by JET

Activities and management by NAPTIN

Activities and management by AEDC

WG4 Activity

ANED is involved in the activities of WG-4 from the initial stage aiming at horizontal deployment of NAPTIN's training program to other Discos. JICA Team will invite other Discos as observers to share information at major meetings. In addition, it is desirable to improve the accessibility to the training courses by utilizing internet and online conference tools so that the staff of each Disco can access them on their own initiative, this will have a positive effect on capacity development.

WG4	Key issue	WG member	Advisor (JICA Experts)
Human Resource Development and Training Deployment	- Improvement of carrier framework - Study measures for deployment and dissemination to other Discos	AEDC - Mr. Ibem Kalu Idika - Ms. Toun Oseni - Ms. Fatima Hassan NAPTIN - Engr. Abdullahi Aliyu - Engr. Chinyere B. Igbokwe - Engr. Lynda Iledare ANED - Ms. Bimpe Amure	(i) Business Manager / Electricity Distribution Business Operation Mr. Kyoji FUJII (vii) Training program development Mr. Kazunori Doi

(1) Collect information, analyze, and propose improvements to the career framework in the AEDC

AEDC’s personnel system and human resource development policy (e.g., OJT and Off-JT concepts, career advancement mechanism, etc.)

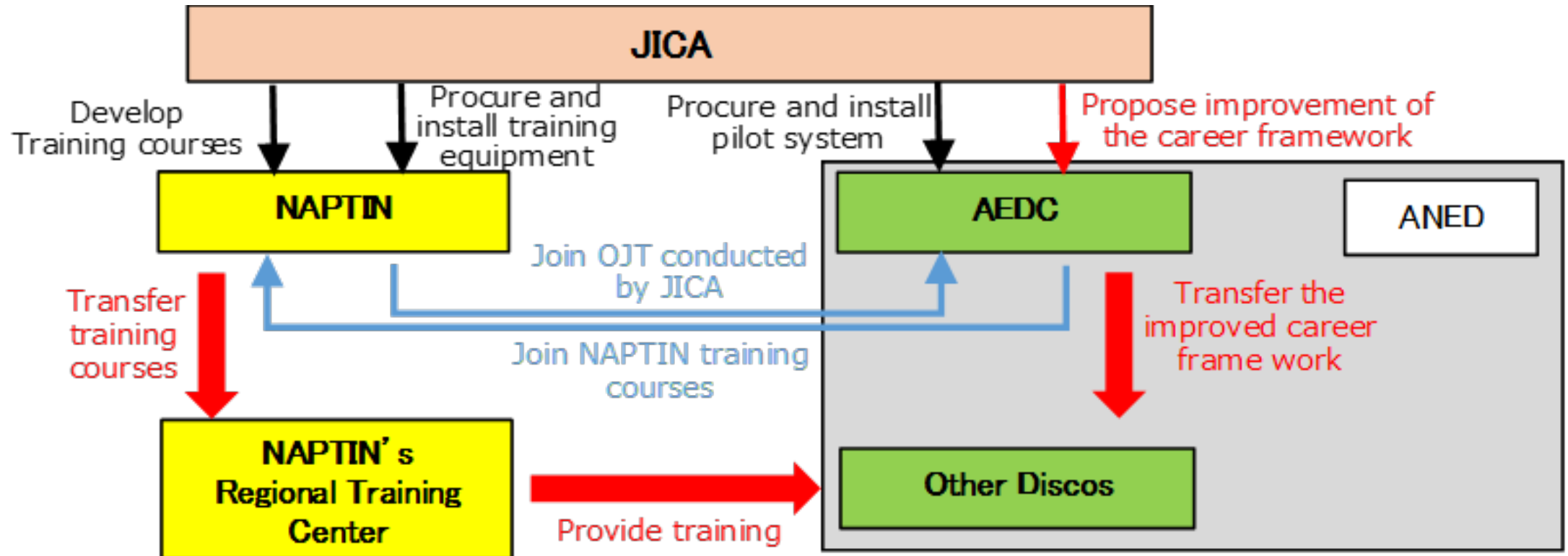
	Contents	Issues and Challenges	solution
AEDC’s personnel system			
human resource development policy			
OJT and Off-JT concepts			
career advancement mechanism			

(2) Study measures for expansion and dissemination to other Discos

NAPTIN will work on the deployment of the developed training contents to regional training centers so that they can be deployed to other Discos, and AEDC will work on the deployment of the improved career framework to other Discos, with a clear structure and role for ANED to be actively involved. The ANED is expected to play a role in providing information to other Discos and in granting certification to NAPTIN training participants.

	How to deploy to other Discos	ANED Involvement	Introduction of the certification system and problems
NAPTIN			
AEDC			
ANED		—	

Conceptual Diagram for Outcome 4



The Project for Capacity Development of Power Distribution

Working Group-4 (Second meeting)

Human Resource Development and Training Deployment

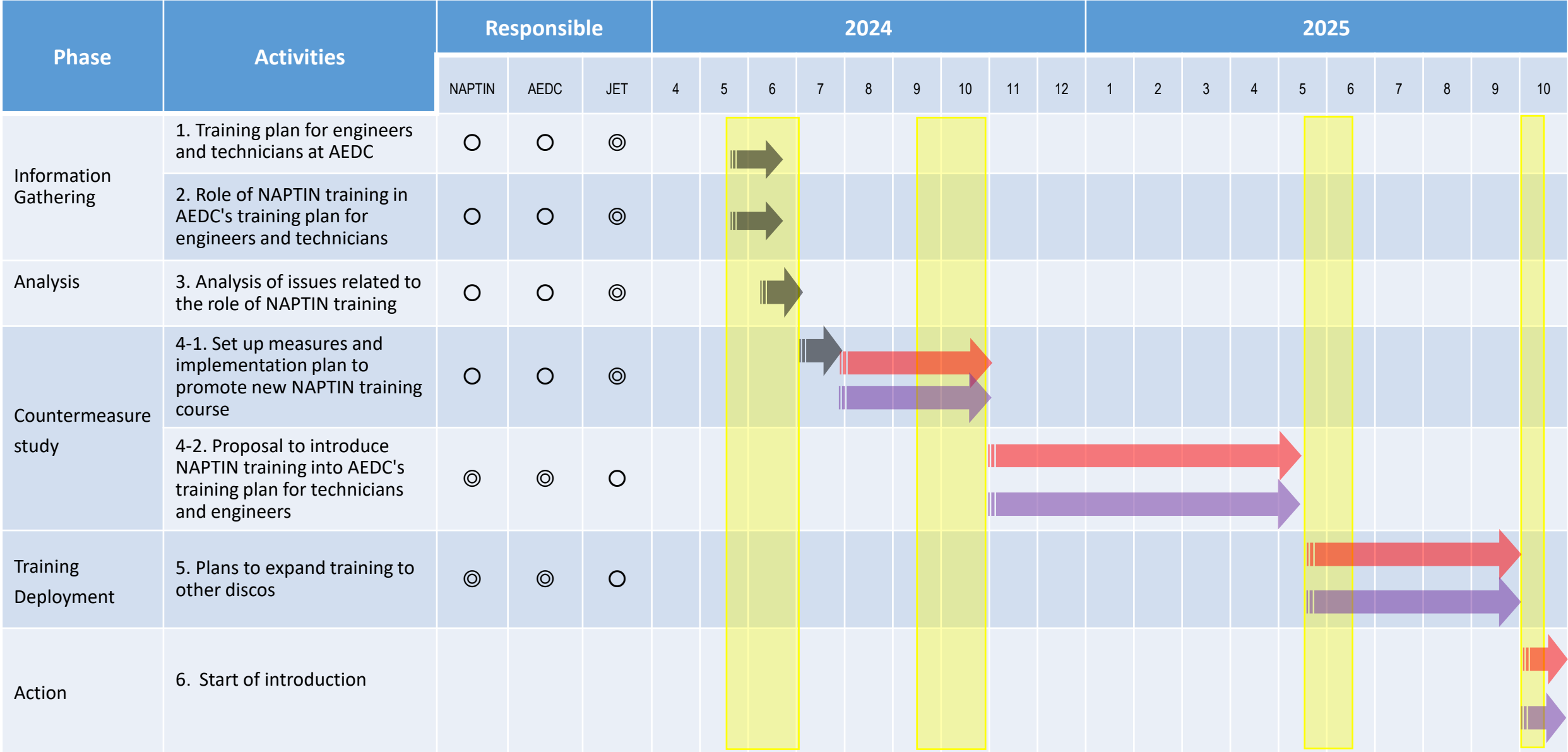
24th June 2024

Yachiyo Engineering Co., Ltd.
Kansai Transmission and Distribution, Inc.

Contents

1. Implementation schedule for WG-4
2. Answer to the questionnaire regarding technical training
3. Total trained by NAPTIN on electricity distribution related training courses from 2009-2019
4. Project activities: Improve existing classroom training
5. Distribution training facilities to be developed under JICA's capacity development project

1. Implementation schedule for WG-4



2. Answer to questionnaire for AEDC regarding technical training (1)

- AEDC's training plan for technical has 38 courses of which 7 courses utilize external resource.
- Internal training courses cover various aspects of Discos' activities such as Standard Operation Procedures, Permit to Work System, maintenance, relay and protection, accident prevention, loss reduction, safety, metering, NERC regulation, etc.
- Major contents which utilize external resource are Smart Feeder Pillar, Power Protection System, Loss Calculation using NEPLAN, Switchgear and Transformer Maintenance and Cable Joint and Instrument Management of which 3 courses are conducted as E-Learning.
- AEDC has training facilities at Gwagwalada (overhead line training bay) and Garki training rooms.
- NAPTIN's training is included in AEDC's training plan. However, taking part in NAPTIN's training is not a condition for promotion.
- AEDC's opinion: NAPTIN, through its various training modules, can contribute to the overall capacity building of AEDC. This includes training on new technologies, maintenance practices, and energy management systems, which can help AEDC optimize its operations and reduce losses.

2. Answer to questionnaire for AEDC regarding technical training (2)

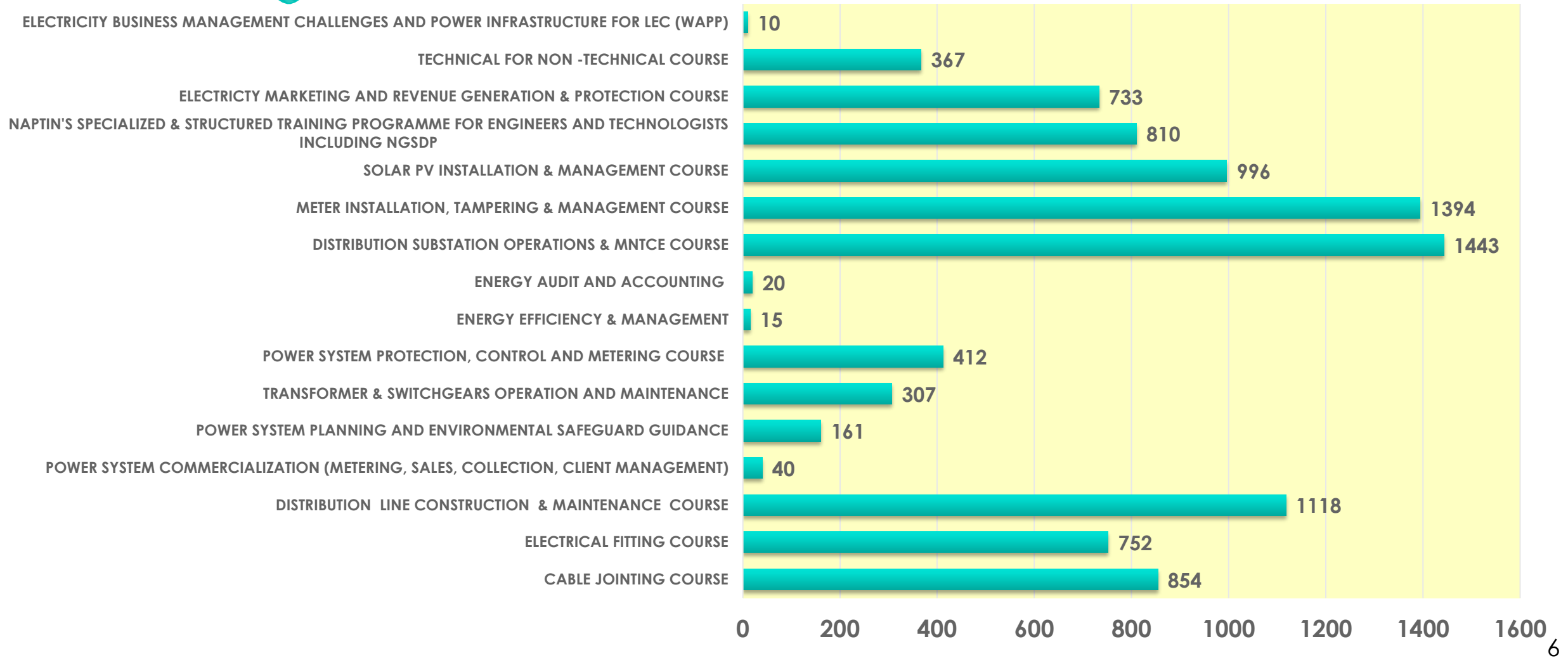
- Question: Is there any promotion and advancement criteria for technical staff by job category and job description?
- Answer: None in place now

- Question: Is participation in NAPTIN training a requirement for advancement or promotion?
- Answer: Such policy does not exist now

- **Further question** to AEDC today: Is there any possibility for AEDC to set up criteria and requirements (such as participation in certain trainings) for advancement and promotion?
- Answer: ?

3. TOTAL TRAINED BY NAPTIN ON ELECTRICTY DISTRIBUTION RELATED COURSES FROM 2009 - 2019												
TYPE OF TRAINING	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
CABLE JOINTING COURSE	48	265	118	51	60	46	184	20	1	50	11	854
ELECTRICAL FITTING COURSE	NIL	88	120	10	80	48	301	30	NIL	50	25	752
DISTRIBUTION LINE CONSTRUCTION & MAINTENANCE COURSE	105	320	110	35	30	50	178	201	19	25	45	1118
POWER SYSTEM COMMERCIALIZATION (METERING, SALES, COLLECTION, CLIENT MANAGEMENT)	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	4	36	0	40
POWER SYSTEM PLANNING AND ENVIRONMENTAL SAFEGUARD GUIDANCE	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	4	10	147	161
TRANSFORMER & SWITCHGEARS OPERATION AND MAINTENANCE	20	35	23	14	10	10	5	25	3	24	138	307
POWER SYSTEM PROTECTION, CONTROL AND METERING COURSE	25	33	25	43	33	2	3	15	40	46	147	412
ENERGY EFFICIENCY & MANAGEMENT	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL		15	0	15
ENERGY AUDIT AND ACCOUNTING	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	1	5	14	20
DISTRIBUTION SUBSTATION OPERATIONS & MNTCE COURSE	75	184	259	18	30	92	286	102	153	164	80	1443
METER INSTALLATION, TAMPERING & MANAGEMENT COURSE	NIL	20	50	50	50	60	1,000	95	26	40	3	1394
SOLAR PV INSTALLATION & MANAGEMENT COURSE	NIL	NIL	NIL	NIL	60	NIL	500	23	36	275	102	996
NAPTIN'S SPECIALIZED & STRUCTURED TRAINING PROGRAMME FOR ENGINEERS AND TECHNOLOGISTS INCLUDING NGSDP	NIL	NIL	NIL	186	120	84	90	145	25	20	140	810
ELECTRICTY MARKETING AND REVENUE GENERATION & PROTECTION COURSE	NIL	133	389	50	30	20	50	40	1	20	0	733
TECHNICAL FOR NON -TECHNICAL COURSE	NIL	NIL	NIL	NIL	NIL	30	NIL	20	237	20	60	367
ELECTRICITY BUSINESS MANAGEMENT CHALLENGES AND POWER INFRASTRUCTURE FOR LEC (WAPP)	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	10	10
TOTAL	273	1078	1094	457	503	442	2597	716	550	800	922	9,432

3. TOTAL TRAINED BY NAPTIN ON ELECTRICITY DISTRIBUTION RELATED COURSES FROM 2009 – 2019 (2)



4. Project activities: Improve existing classroom training

① New training contents on technical loss reduction

1. Calculation of technical loss

- The method of calculating instantaneous technical loss, which is solely theoretical and annual technical loss, which needs a statistical assumption will be learnt.
- For the instantaneous technical loss, the results of **hand calculation** and **software calculation** (by using NEPLAN model which is widely used by DISCOs) will be compared and trainees will understand that both results are almost the same.

2. Causes of technical loss and countermeasures

- A correlation chart will be created to correlate the **causes** and **countermeasures** of technical loss.
- Then, all countermeasures will be evaluated in terms of investment cost, ease of implementation, time for implementation, effect, etc. by giving points on each evaluation criterion and countermeasures which gain higher score are deemed to have higher priority.

3. Power phase detection

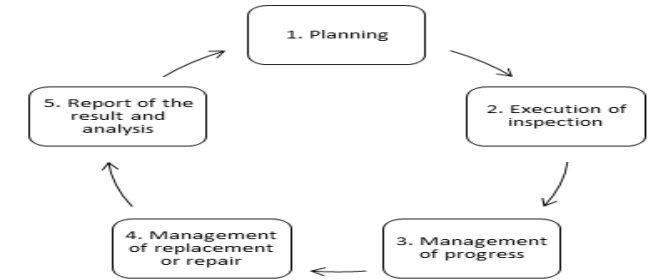
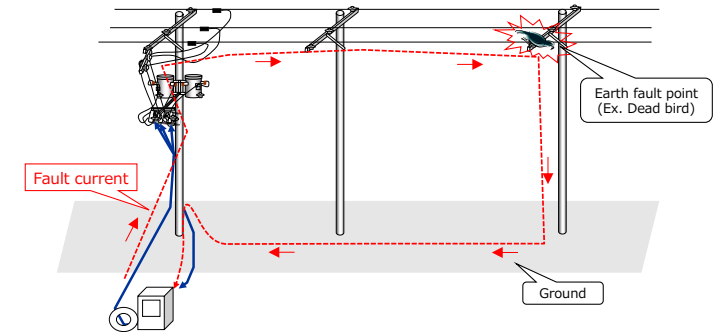
- A phase detection work is required when pole mounted section switches are installed and operated in case power feeding direction is changed to energize intact sections of a loop-shape network after the outage of a feeder.
- Practical training course using a phase comparator will be developed at NAPTIN to experience and become familiarized with a phase comparison work.

4. Project activities: Improve existing classroom training

② New training contents on reliability improvement (1)

No.	Theme	Content(s) to add
1	Fault detecting method	•Theory of fault detecting •Detecting devices
2	Failure cause and inspection method of distribution equipment	•Where to pay attention on patrol
3	Analysis of outage record and countermeasure	•Way of outage recording, for the easy and effective analysis •Analysis of root cause based on the outage record •Appropriate countermeasure based on the analysis result •Reliability KPIs (Converted Duration)
4	Preventive maintenance concept	•Planned and regular work according to predetermined standards and procedures

Example



10.2 Supports

Current description is fine, but what has to be added is the description about "cracks on supports (i.e. poles)". If some kind of cracks is overlooked, the pole might collapse and lead to the disaster to the workers or even to the public, in the worst case.



What "the worst case" above means is, for example, like this, which no one hopes...



[Rank A] Black rust is generated on body of transformer. Where on the body does not matter. Transformers having this black rust must be replaced as soon as possible.



[Rank B] Reddish brown rust is generated on bottom plate or heat radiating plate of transformer (Black rust might be generated locally so inspection should be done very carefully). This kind does not have to be replaced immediately but have to be observed continuously.



4. Project activities: Improve existing classroom training

② New training contents on reliability improvement (2)

No	Theme	Before modification	After modification
1	Fault detecting method	● There had been almost no description about fault detecting method.	● Description about the detecting method and its theory was added, with sample pictures and example calculation.
2	Analysis of outage record and countermeasure	● There was no chapter that describes the analysis of outage record and countermeasure	● One new single chapter was created to describe; • Way of outage recording for the easy and effective analysis • Analysis of root cause based on the outage record • Appropriate countermeasure based on the analysis result ● Also description about a new KPI “converted duration” was added

4. Project activities: Improve existing classroom training

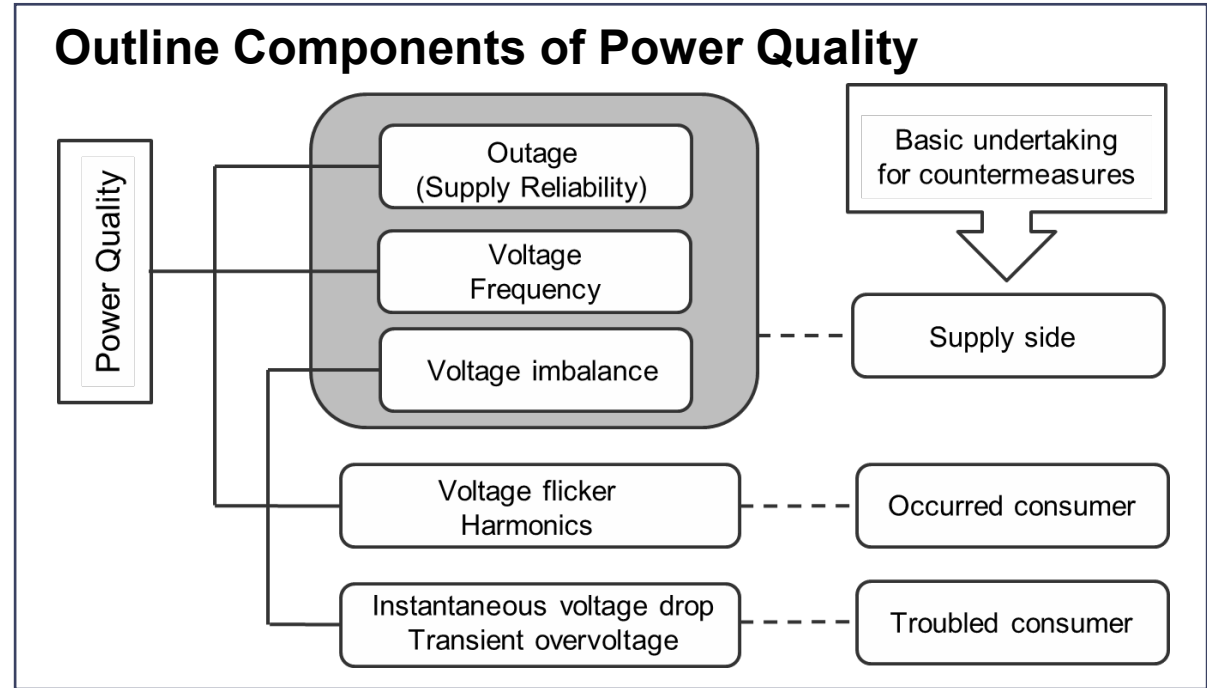
② New training contents on reliability improvement (3)

No	Theme	Before modification	After modification
3	Failure cause and inspection method of distribution equipment	● There had been almost no description about where to pay attention on patrol especially after outage incidents	● Description about where to pay attention on patrol after outage incidents was added, with sample pictures of the frequent causes. ● Also, description about information of the incident that should be had before the patrol was added.
4	Preventive Maintenance Concept	● There had been description about viewpoints on patrol, but sample pictures were not enough.	● Sample pictures were added.

4. Project activities: Improve existing classroom training

③ New training contents on power quality improvement

- Power quality is defined as the degree to which the power supply approaches the ideal case of stable, uninterrupted, zero distortion and disturbance free supply. The power system itself is a major contributor to existing power quality problems, especially continuity, and the quality of grounding connections. The disturbances may be broken down into the several categories.
- Components of Power Anomalies: Transients, Voltage Sags/Dips, Voltage Swells, Voltage Variations or Fluctuations, Voltage Unbalance, Harmonic Distortion, Voltage Flickers, Electromagnetic Interference (EMI), Voltage Drop
- Calculation method of voltage drops is explained and simple calculation of voltage drops using Excel is exercised by trainees.
- Power quality improvement refers to the enhancement of the electrical power supply to ensure it meets specific standards and requirements (IEC, EN, IEEE, etc.). Poor power quality can result in various issues, including voltage fluctuations, harmonics, sags, surges, transients, and interruptions, which can affect the performance and reliability of electrical equipment and systems.
- Mitigating power quality issues is explained that it involves a combination of techniques targeting specific components.



4. Project activities: Improve existing classroom training

④ Training demonstration

- As an opportunity to unveil improved NAPTIN training courses, the training demonstration has been conducted.
- Instructor(s) from each team gave the presentations based on the revised materials, and the feedbacks were given by model trainees which consist of AEDC engineers and NAPTIN instructors from other teams.
- This became a good chance for both NAPTIN and DisCos to start complementary interaction each other.

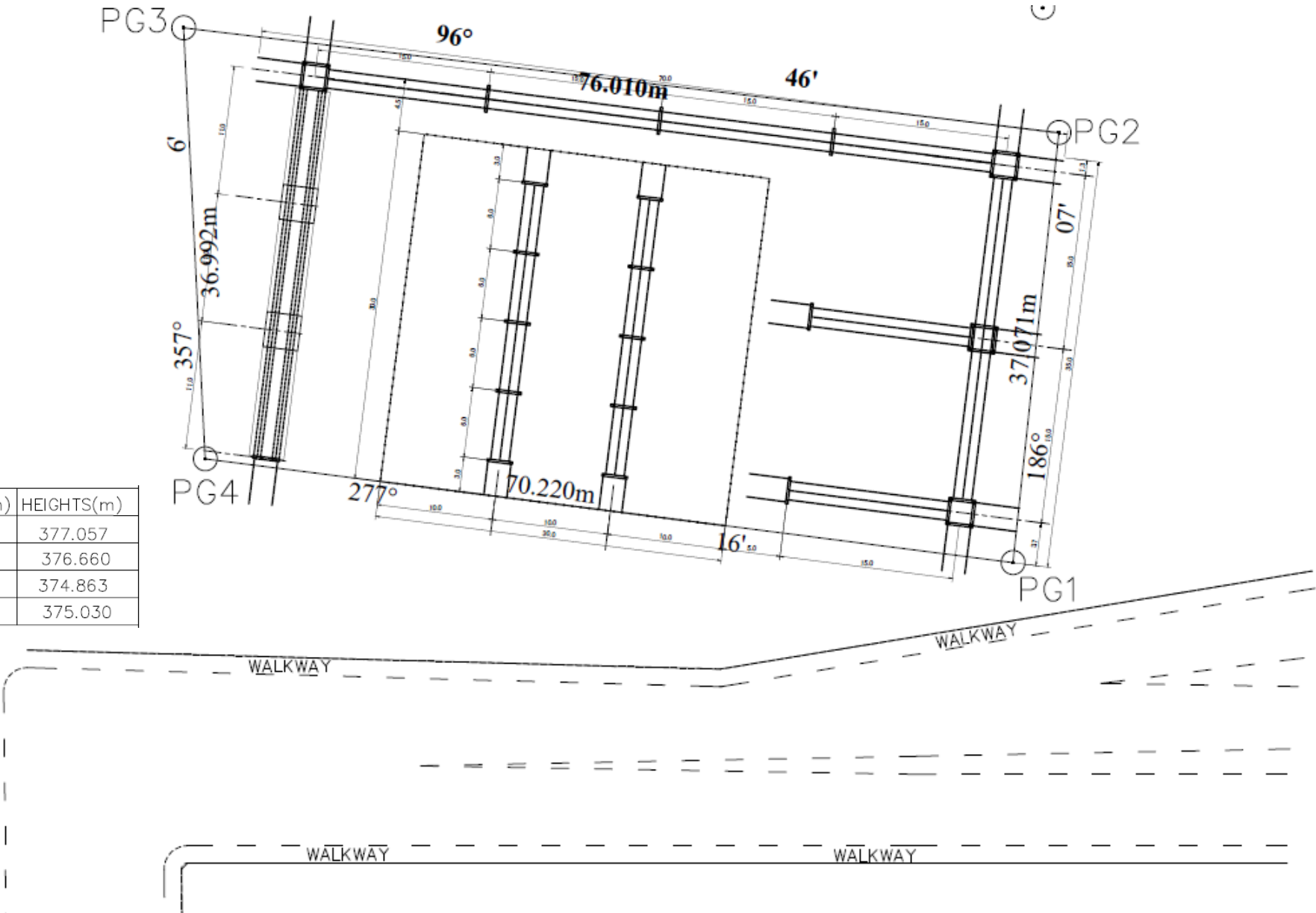


Team (date & time)	Samples of the constructive opinions
Reliability improvement (Thu, May 30, 2024 10:00-)	● Clear, concise, and explicit presentation. Professional and explanatory instructors. ● More illustrations and more physical, practical & detailed examples needed.
Quality improvement (Thu, June 6, 2024 10:00-)	● It is very educative and can help to improve the quality of work and knowledge by colleagues. ● More emphasis should have on local standards and specification (NEMSA and NERC).
Loss reduction (Thu, June 13, 2024 10:00-)	● Very clear and simple to understand. It would enable the knowledge be impacted to others quickly. ● I suggest block diagrams could be used to simplify and focus on the sequence of the calculations.

5. Distribution training facilities: Site location plan

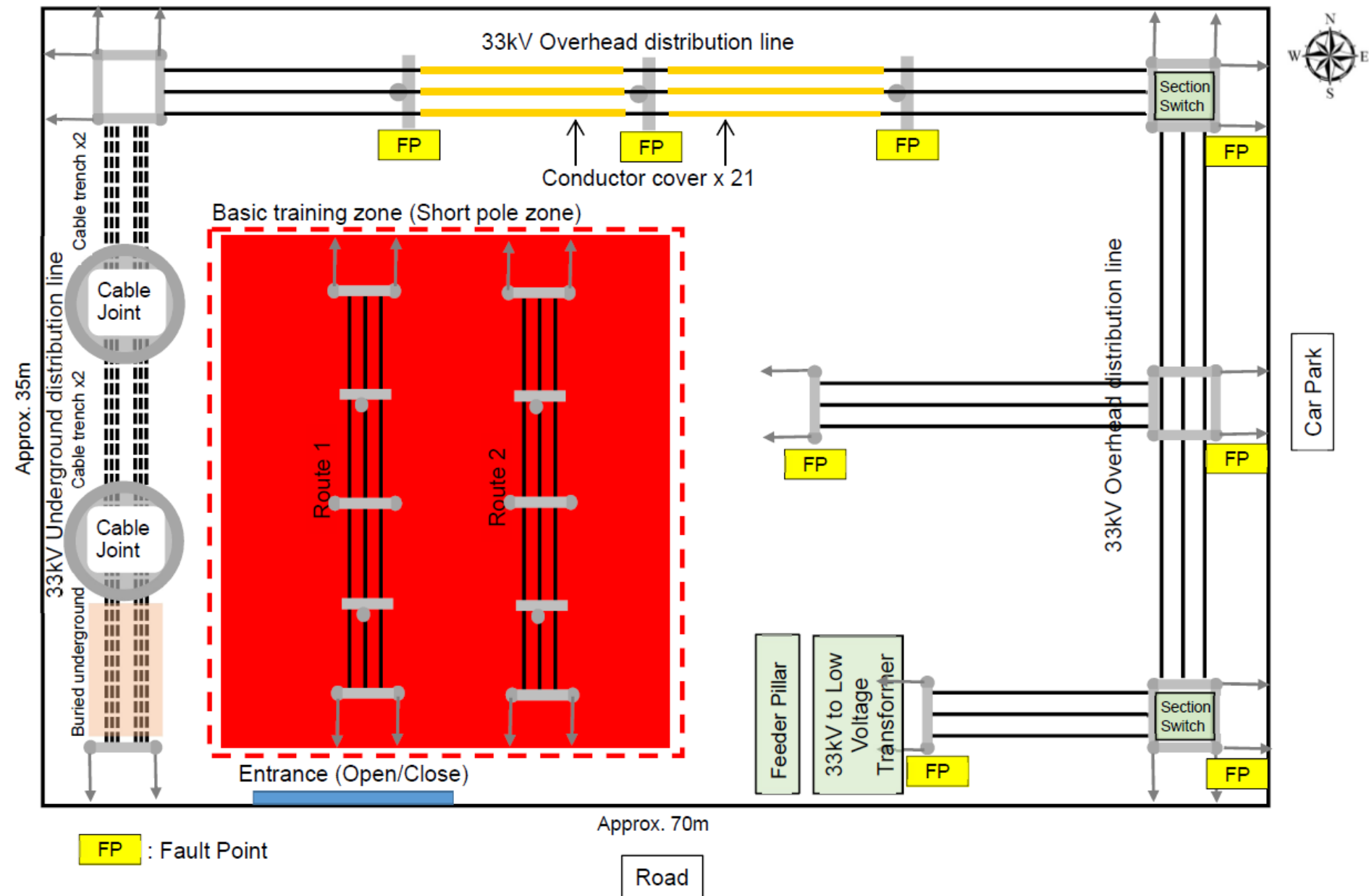
NAPTIN
HQ

ID	EASTINGS(m)	NORTHINGS(m)	HEIGHTS(m)
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PG2	322058.379	997471.975	376.660
PG3	321982.901	997480.951	374.863
PG4	321984.767	997444.006	375.030

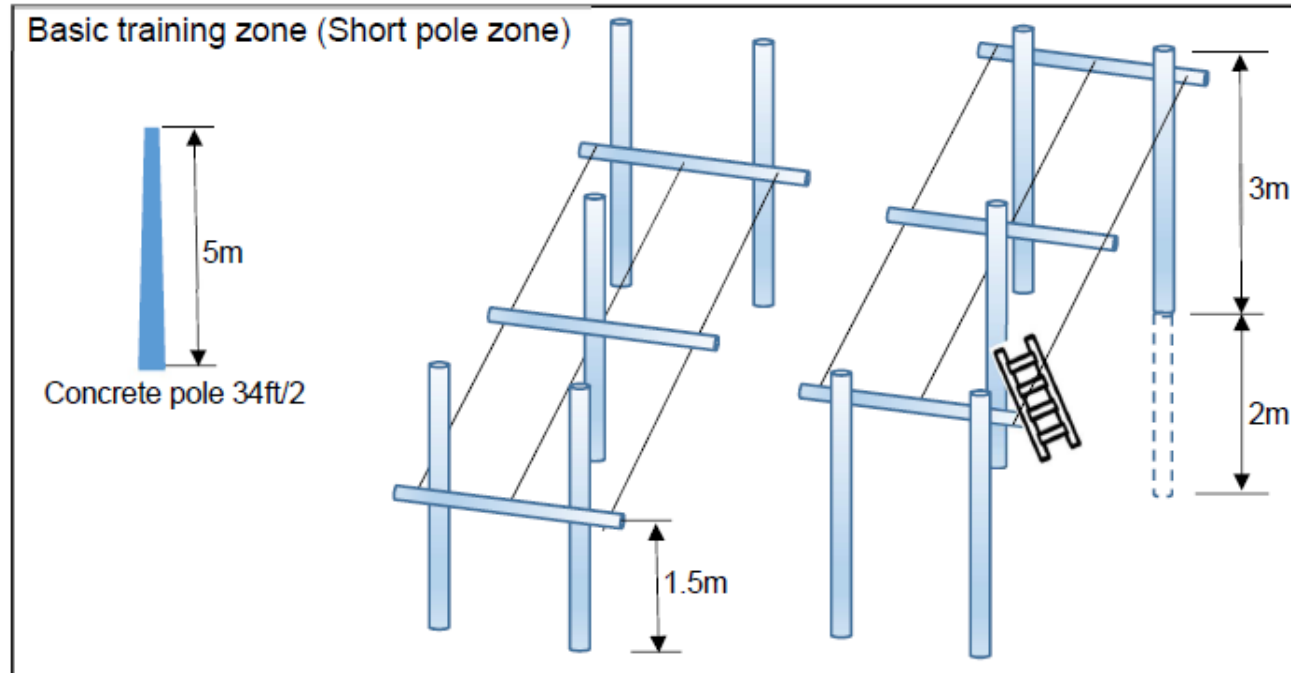
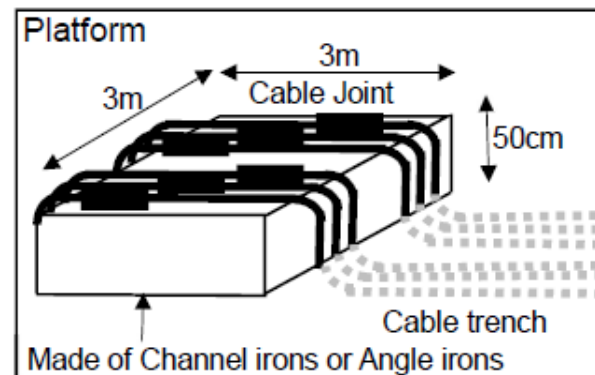
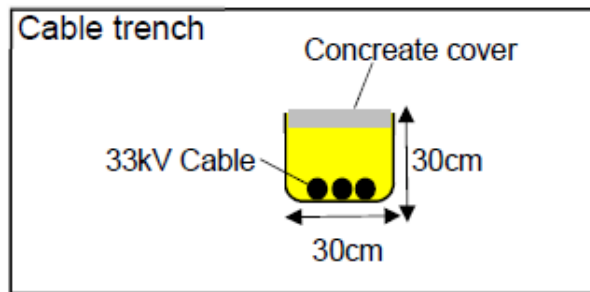
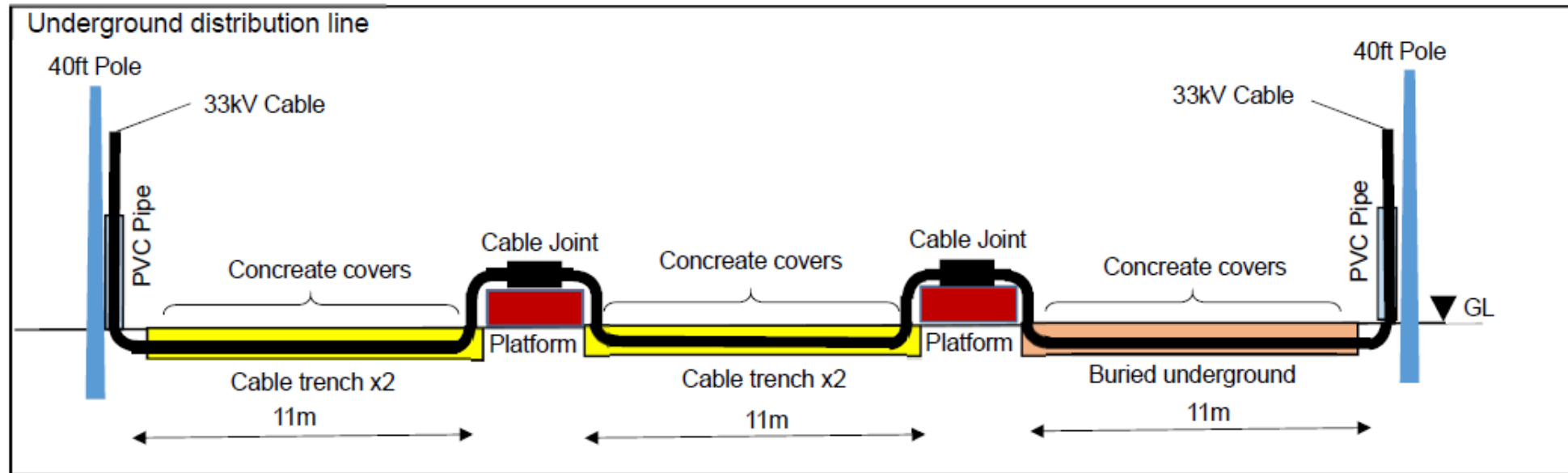


5. Distribution training facilities: Layout plan (1)

Layout plan of the distribution training facility



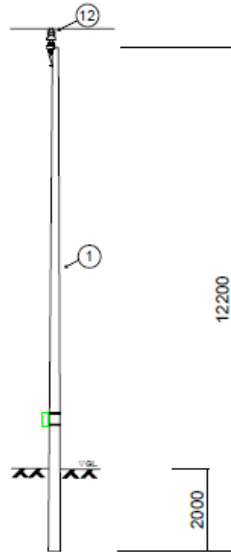
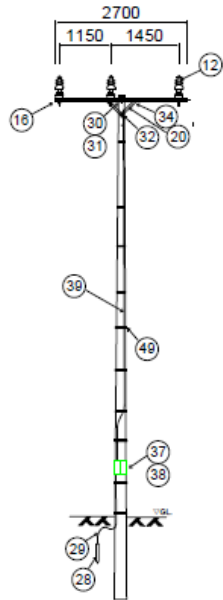
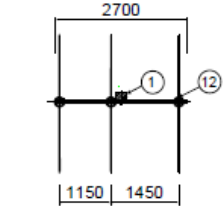
5. Distribution training facilities: Layout plan (2)



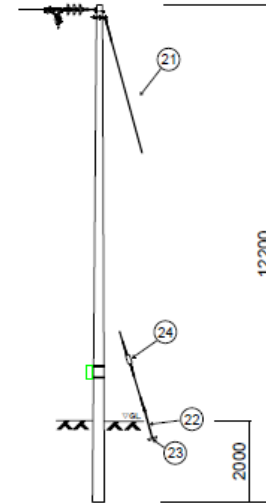
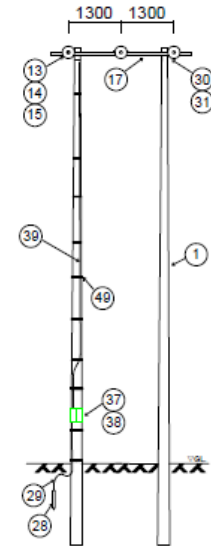
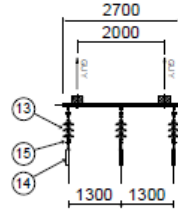
5. Distribution training facilities: Design and types of poles for training bay

33kV overhead distribution line

Type A

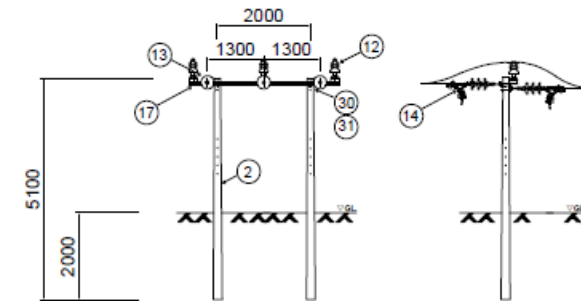
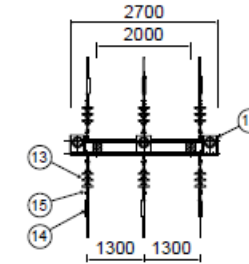


Type B



Basic training zone (Short pole zone)

Type J



6. How to promote NAPTIN's new raining courses?

Measures	How?	Who and When?
1. Advertise new training courses	① Organize an online workshop on new training courses ② Notification of a release of new training courses on NAPTIN's website ③ Use SNS and YouTube with the videos of training scenes for easy and better understanding on new training contents	① JICA Expert Team and NAPTIN in cooperation with FMP and ANED ② NAPTIN ③ NAPTIN
2. Trial full-scale training	Invite Discos' trainees for trial full-scale training for free	NAPTIN but training fee needs to be consulted with FMP
3. Take measures to lower the hurdles of taking part in NAPTIN's training	① Less training fee ② Shorter training period ③ E-learning ④ Unbundle training contents for ease of tailor-made program	①～④ NAPTIN
4. Promote the incorporation of new training courses into Discos' own training plan	① Succeed in incorporating new training courses into AEDC's training plan ② Disseminate the experience of AEDC to other Discos	① AEDC, NAPTIN and JICA Expert Team ② ANED and NAPTIN

The Project for Capacity Development of Power Distribution

Working Group-4 (3rd meeting)

Human Resource Development and Training Deployment

1st August 2024

Yachiyo Engineering Co., Ltd.
Kansai Transmission and Distribution, Inc.

Contents

1. Expected outputs and activities
2. Answer to the questionnaire regarding technical training
3. How to promote NAPTIN's new raining courses
4. Plan of activities for WG4

1. Expected outputs and activities

Outputs	Outline of Activities
<Output-1> Development and implementation of training for loss reduction measures	Preparatory Phase Activities (common to Output 1-4) 0-1 Baseline survey (field survey, update information) Activities related to Output 1-3 (N or A-X corresponds to Output 1-3) < Activities with NAPTIN > (TOT: Training Of Trainers) N-1 Planning training courses, teaching materials preparation, TOT N-2 Conducting training course N-3 Evaluating training courses and giving feedback N-4 Incorporating pilot results into training (Training improvement plans) N-5 Design and construction of training equipment for demonstration
<Output-2> Development and implementation of training to improve reliability	< Activities with AEDC > A-6 Field survey, Extracting issues in business operations A-7 Consideration and implementation of pilot project A-8 Incorporate pilot results into business operations [revising technical standards, SOP (standard operating procedure), etc.]
<Output-3> Development and implementation of training for quality improvement	< Activities with AEDC > A-6 Field survey, Extracting issues in business operations A-7 Consideration and implementation of pilot project A-8 Incorporate pilot results into business operations [revising technical standards, SOP (standard operating procedure), etc.]
<Output-4> Confirmation of the utilization of NAPTIN training in Discos	Activities related to Output-4 4-1 Collecting information, analysis, and presentation of improvement plans for Career framework in AEDC and application of NAPTIN training 4-2 Creating dissemination plans for other Discos

Activities for WG-4

2. Answer to questionnaire for AEDC regarding technical training (1)

- AEDC's training plan for technical has 38 courses of which 7 courses utilize external resource.
- Internal training courses cover various aspects of Discos' activities such as Standard Operation Procedures, Permit to Work System, maintenance, relay and protection, accident prevention, loss reduction, safety, metering, NERC regulation, etc.
- Major contents which utilize external resource are Smart Feeder Pillar, Power Protection System, Loss Calculation using NEPLAN, Switchgear and Transformer Maintenance and Cable Joint and Instrument Management of which 3 courses are conducted as E-Learning.
- AEDC has training facilities at Gwagwalada (overhead line training bay) and Garki training rooms.
- **Five (5) NAPTIN's training courses** are included in AEDC's training plan. However, taking part in NAPTIN's training is not a condition for promotion.
- AEDC's opinion: NAPTIN, through its various training modules, can contribute to the overall capacity building of AEDC. This includes training on new technologies, maintenance practices, and energy management systems, which can help AEDC optimize its operations and reduce losses.

2. Answer to questionnaire for AEDC regarding technical training (2)

Five NAPTIN's training courses included in AEDC's training plan

- (1) Basic Power protection Systems- **E-Learning**
- (2) Power Distribution Modelling and NEPLAN Loss Calculation- **E-Learning**
- (3) Energy Classes and Conservation- **E-Learning**
- (4) Cable Jointers, Fitter and Instrument Management Course
- (5) Switchgear & Transformer maintenance

2. Answer to questionnaire for AEDC regarding technical training (3)

- Question: Is there any promotion and advancement criteria for technical staff by job category and job description?
- Answer: None in place now

- Question: Is participation in NAPTIN training a requirement for advancement or promotion?
- Answer: Such policy does not exist now

- **Further question** to AEDC today: Is there any possibility for AEDC to set up criteria and requirements (such as participation in certain trainings) for advancement and promotion?
- Answer: Preparation of AEDC's career framework is ongoing.

⇒ One of the activities for WG4 is to examine AEDC's career framework, make recommendation and present improvement measures such as incorporating NAPTIN's training courses as a prerequisite for promotion and advancement. Since AEDC's career framework does not exist at this moment, WG4 will start working on it when it is completed.

WG4 will work on promotion and dissemination measures for NAPTIN's training courses which have been upgraded through JICA's Capacity Development Project prior to AEDC's career framework.

In order to understand the training plan and career framework of other Discos, the questionnaire sent to AEDC will be distributed to other 10 Discos through ANED.

3. How to promote NAPTIN's new training courses? (1)

Measures	How?	Who and When?
1. Advertise new training courses	① Organize an online workshop on new training courses ② Notification of a release of new training courses on NAPTIN's website ③ Use SNS and YouTube with the videos of training scenes for easy and better understanding on new training contents	① JICA Expert Team and NAPTIN in cooperation with FMP and ANED ② NAPTIN ③ NAPTIN
2. Trial training (full contents)	Invite Discos' trainees for trial training (full contents) for free	Training fee needs to be consulted with NAPTIN&FMP
3. Take measures to lower the hurdles of taking part in NAPTIN's training	Reduce training fee by the measures below ① Introduce E-learning (<u>No accommodation, meal and travel expenses</u> required) ② Make tailor-made training programs which exactly fit trainees' needs (<u>Minimize</u> training period)	①～② NAPTIN - The mode of E-Learning is an interactive online lecture. - Pros and cons of online/physical training need to be studied.
4. Promote the incorporation of new training courses into Discos' own training plan	① Succeed in incorporating new training courses into AEDC's training plan and implement the training plan ② Disseminate the experience of AEDC to other Discos	① AEDC, JICA Expert Team and NAPTIN ② NAPTIN and ANED

3. How to promote NAPTIN's new training courses? (2)

Measures	How?	Who and When?
5. Examine AEDC's career framework and propose improvement plan	① Develop career framework ② Examine developed career framework ③ Propose improvement plan for the career framework ④ Incorporate the proposal into AEDC's career framework	① AEDC ② JICA Expert Team ③ JICA Expert Team ④ AEDC

3. How to promote NAPTIN's new training courses? (3)

3 Take measures to lower the hurdles of taking part in NAPTIN's training

3-① Introduce E-Learning

Steps	Work procedure
Step-1 Select contents suitable for E-Learning	1. Classroom trainings (All or selected parts?) 1-1 Technical loss reduction 1-2 Reliability improvement 1-3 Quality improvement 2. Practical trainings (Explanation on theory only) 2-1 Fault exploration and restoration for overhead line 2-2 Fault exploration and restoration for underground line 2-3 Measuring work for power and phase detector
Step-2 Develop training materials for E-Learning courses	1. Modify developed training materials for the three classroom trainings above (1-1, 1-2 and 1-3) to fit E-Learning 2. Develop E-Learning contents of the practical trainings for three courses above (2-1, 2-2 and 2-3)
Step-3 Review and feedback from JICA Experts	JICA Experts will review the developed E-Learning contents and give feedback to NAPTIN.
Step-4 Finalize the E-Learning contents	NAPTIN will finalize the E-Learning contents incorporating feedback from JICA Experts.

3. How to promote NAPTIN's new training courses? (4)

3 Take measures to lower the hurdles of taking part in NAPTIN's training

3-② Make tailor-made training programs which exactly fit trainees' needs

Steps	Work procedure
Step-1 Itemize training contents for the ease of customization	1. Itemize contents of classroom trainings 1-1 Technical loss reduction 1-2 Reliability improvement 1-3 Quality improvement 2. Itemize contents of practical trainings 2-1 Fault exploration and restoration for overhead line 2-2 Fault exploration and restoration for underground line 2-3 Measuring work for power and phase detector
Step-2 Add explanation to the itemized training contents	Add detailed explanation, duration and training fees on the itemized training contents of the classroom and practical trainings above for trainees to easily pick up necessary training contents.
Step-3 Develop a consultation form for training customization	Develop an online consultation form to extract training needs from Discos and customize training contents

4. Plan of activities for WG-4 (1)

Measures	Activities	Responsible				2024												2025									
		NAPTIN	AEDC	ANED	JET	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10			
1. Advertise new training courses	1-1 Organize an online workshop on new training courses	○		○	◎						↔																
	1-2 Notification of a release of new training courses on NAPTIN’s website	◎													↔												
	1-3 Use SNS and YouTube with the videos of training scenes for easy and better understanding on new training contents	◎													↔												
2. Trial full-scale training	Invite Discos’ trainees for trial full-scale training for free	◎	○		○														↔								
3. Take measures to lower the hurdles of taking part in NAPTIN’s training	①-1 Select contents suitable for E-Learning	◎	○		○				↔																		
	①-2 Develop training materials for E-Learning courses	◎	○		○					↔																	
	①-3 Review and feedback from JICA Experts	◎			○						↔																
	①-4 Finalize the E-Learning contents	◎			○							↔															
	②-1 Itemize training contents for the ease of customization		◎		○										↔												
	②-2 Add explanation to the itemized training contents															↔											
	②-3 Develop a consultation form for training customization	○		◎	○													↔									
<Note>																											

<Note>

Field Work of JICA Expert Team (JET)

↔Activities and management by JET

↔Activities and management by NAPTIN

↔Activities and management by AEDC

4. Plan of activities for WG-4 (2)

Measures	Activities	Responsible				2024												2025									
		NAPTIN	AEDC	ANED	JET	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10			
4. Promote the incorporation of new training courses into Discos' own training plan	4-1 Succeed in incorporating new training courses into AEDC's training plan and implement the training plan	◎	◎ ◎		○																						
	4-2 Disseminate the experience of AEDC to other Discos	◎	○	○																							
5. Examine AEDC's career framework and propose improvement plan	5-1 Develop career framework		◎																								
	5-2 Examine developed career framework				◎																						
	5-3 Propose improvement plan for the career framework				◎																						
	5-4 Incorporate the proposal to AEDC's career framework		◎																								

<Note>

Field Work of JICA Expert Team (JET)

Activities and management by JET

Activities and management by NAPTIN

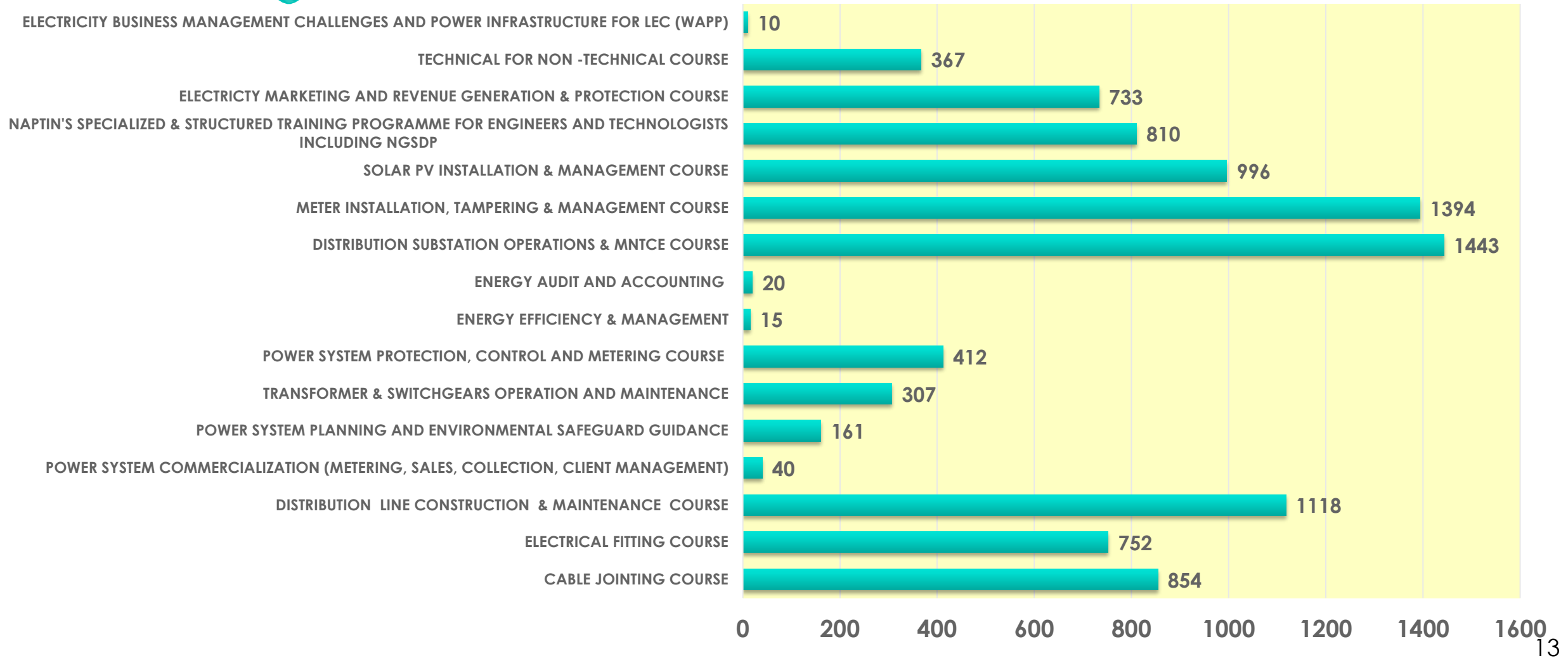
Activities and management by AEDC

Activities and management by ANED

3. TOTAL TRAINED BY NAPTIN ON ELECTRICTY DISTRIBUTION RELATED COURSES FROM 2009 - 2019

TYPE OF TRAINING	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
CABLE JOINTING COURSE	48	265	118	51	60	46	184	20	1	50	11	854
ELECTRICAL FITTING COURSE	NIL	88	120	10	80	48	301	30	NIL	50	25	752
DISTRIBUTION LINE CONSTRUCTION & MAINTENANCE COURSE	105	320	110	35	30	50	178	201	19	25	45	1118
POWER SYSTEM COMMERCIALIZATION (METERING, SALES, COLLECTION, CLIENT MANAGEMENT)	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	4	36	0	40
POWER SYSTEM PLANNING AND ENVIRONMENTAL SAFEGUARD GUIDANCE	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	4	10	147	161
TRANSFORMER & SWITCHGEARS OPERATION AND MAINTENANCE	20	35	23	14	10	10	5	25	3	24	138	307
POWER SYSTEM PROTECTION, CONTROL AND METERING COURSE	25	33	25	43	33	2	3	15	40	46	147	412
ENERGY EFFICIENCY & MANAGEMENT	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL		15	0	15
ENERGY AUDIT AND ACCOUNTING	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	1	5	14	20
DISTRIBUTION SUBSTATION OPERATIONS & MNTCE COURSE	75	184	259	18	30	92	286	102	153	164	80	1443
METER INSTALLATION, TAMPERING & MANAGEMENT COURSE	NIL	20	50	50	50	60	1,000	95	26	40	3	1394
SOLAR PV INSTALLATION & MANAGEMENT COURSE	NIL	NIL	NIL	NIL	60	NIL	500	23	36	275	102	996
NAPTIN'S SPECIALIZED & STRUCTURED TRAINING PROGRAMME FOR ENGINEERS AND TECHNOLOGISTS INCLUDING NGSDP	NIL	NIL	NIL	186	120	84	90	145	25	20	140	810
ELECTRICTY MARKETING AND REVENUE GENERATION & PROTECTION COURSE	NIL	133	389	50	30	20	50	40	1	20	0	733
TECHNICAL FOR NON -TECHNICAL COURSE	NIL	NIL	NIL	NIL	NIL	30	NIL	20	237	20	60	367
ELECTRICITY BUSINESS MANAGEMENT CHALLENGES AND POWER INFRASTRUCTURE FOR LEC (WAPP)	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	10	10
TOTAL	273	1078	1094	457	503	442	2597	716	550	800	922	9,432

3. TOTAL TRAINED BY NAPTIN ON ELECTRICITY DISTRIBUTION RELATED COURSES FROM 2009 – 2019 (2)



4. Project activities: Improve existing classroom training

① New training contents on technical loss reduction

1. Calculation of technical loss

- The method of calculating instantaneous technical loss, which is solely theoretical and annual technical loss, which needs a statistical assumption will be learnt.
- For the instantaneous technical loss, the results of **hand calculation** and **software calculation** (by using NEPLAN model which is widely used by DISCOs) will be compared and trainees will understand that both results are almost the same.

2. Causes of technical loss and countermeasures

- A correlation chart will be created to correlate the **causes** and **countermeasures** of technical loss.
- Then, all countermeasures will be evaluated in terms of investment cost, ease of implementation, time for implementation, effect, etc. by giving points on each evaluation criterion and countermeasures which gain higher score are deemed to have higher priority.

3. Power phase detection

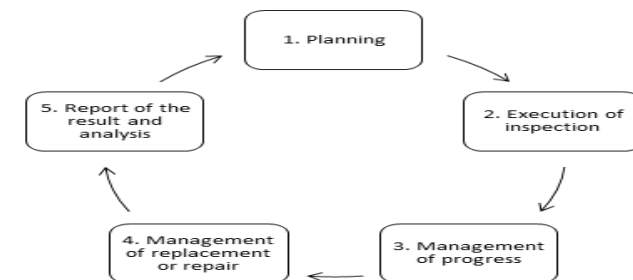
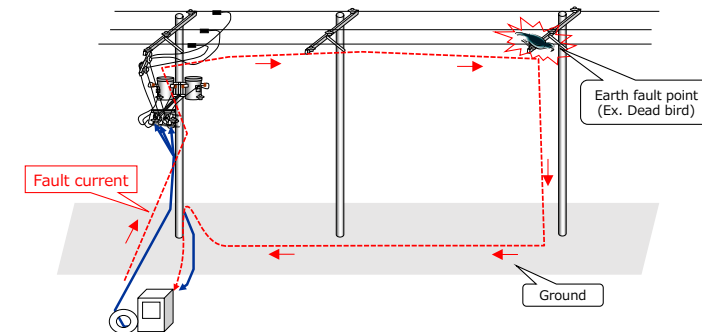
- A phase detection work is required when pole mounted section switches are installed and operated in case power feeding direction is changed to energize intact sections of a loop-shape network after the outage of a feeder.
- Practical training course using a phase comparator will be developed at NAPTIN to experience and become familiarized with a phase comparison work.

4. Project activities: Improve existing classroom training

② New training contents on reliability improvement (1)

No.	Theme	Content(s) to add
1	Fault detecting method	•Theory of fault detecting •Detecting devices
2	Failure cause and inspection method of distribution equipment	•Where to pay attention on patrol
3	Analysis of outage record and countermeasure	•Way of outage recording, for the easy and effective analysis •Analysis of root cause based on the outage record •Appropriate countermeasure based on the analysis result •Reliability KPIs (Converted Duration)
4	Preventive maintenance concept	•Planned and regular work according to predetermined standards and procedures

Example



10.2 Supports-

Current description is fine, but what has to be added is the description about "cracks on supports (i.e. poles)". If some kind of cracks is overlooked, the pole might collapse and lead to the disaster to the workers or even to the public, in the worst case.



What "the worst case" above means is, for example, like this, which no one hopes...



[Rank A] Black rust is generated on body of transformer. Where on the body does not matter. Transformers having this black rust must be replaced as soon as possible.



[Rank B] Reddish brown rust is generated on bottom plate or heat radiating plate of transformer (Black rust might be generated locally so inspection should be done very carefully). This kind does not have to be replaced immediately but have to be observed continuously.



4. Project activities: Improve existing classroom training

② New training contents on reliability improvement (2)

No	Theme	Before modification	After modification
1	Fault detecting method	● There had been almost no description about fault detecting method.	● Description about the detecting method and its theory was added, with sample pictures and example calculation.
2	Analysis of outage record and countermeasure	● There was no chapter that describes the analysis of outage record and countermeasure	● One new single chapter was created to describe; • Way of outage recording for the easy and effective analysis • Analysis of root cause based on the outage record • Appropriate countermeasure based on the analysis result ● Also description about a new KPI “converted duration” was added

4. Project activities: Improve existing classroom training

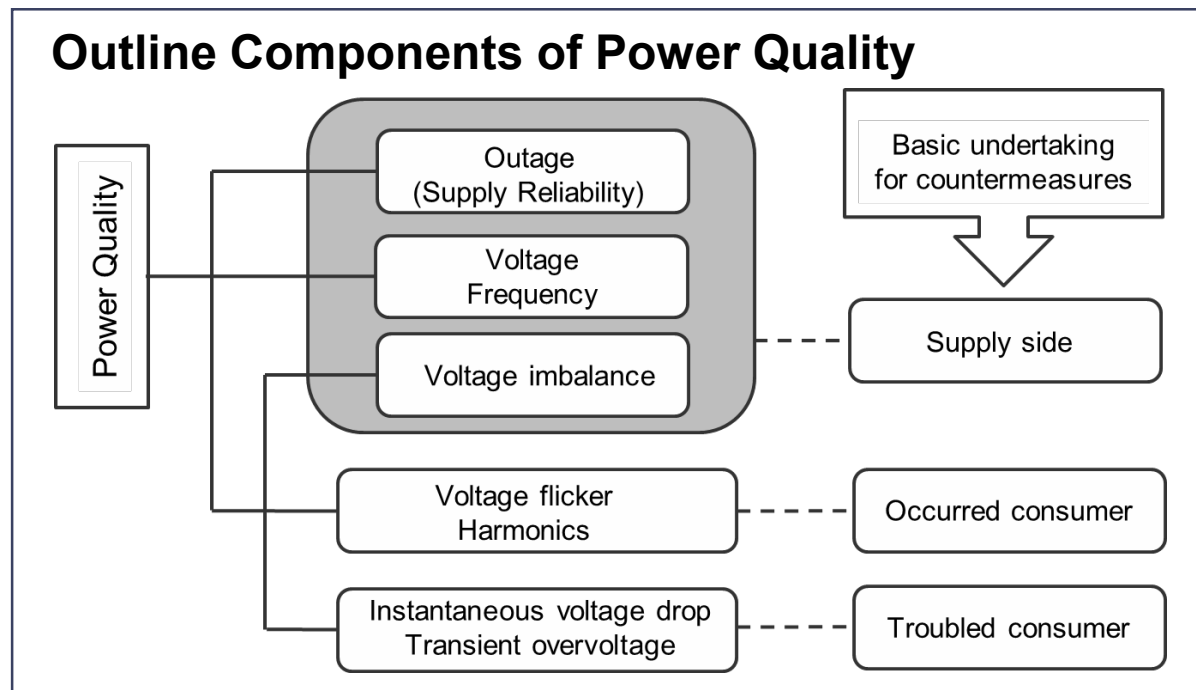
② New training contents on reliability improvement (3)

No	Theme	Before modification	After modification
3	Failure cause and inspection method of distribution equipment	● There had been almost no description about where to pay attention on patrol especially after outage incidents	● Description about where to pay attention on patrol after outage incidents was added, with sample pictures of the frequent causes. ● Also, description about information of the incident that should be had before the patrol was added.
4	Preventive Maintenance Concept	● There had been description about viewpoints on patrol, but sample pictures were not enough.	● Sample pictures were added.

4. Project activities: Improve existing classroom training

③ New training contents on power quality improvement

- Power quality is defined as the degree to which the power supply approaches the ideal case of stable, uninterrupted, zero distortion and disturbance free supply. The power system itself is a major contributor to existing power quality problems, especially continuity, and the quality of grounding connections. The disturbances may be broken down into the several categories.
- Components of Power Anomalies: Transients, Voltage Sags/Dips, Voltage Swells, Voltage Variations or Fluctuations, Voltage Unbalance, Harmonic Distortion, Voltage Flickers, Electromagnetic Interference (EMI), Voltage Drop
- Calculation method of voltage drops is explained and simple calculation of voltage drops using Excel is exercised by trainees.
- Power quality improvement refers to the enhancement of the electrical power supply to ensure it meets specific standards and requirements (IEC, EN, IEEE, etc.). Poor power quality can result in various issues, including voltage fluctuations, harmonics, sags, surges, transients, and interruptions, which can affect the performance and reliability of electrical equipment and systems.
- Mitigating power quality issues is explained that it involves a combination of techniques targeting specific components.



4. Project activities: Improve existing classroom training

④ Training demonstration

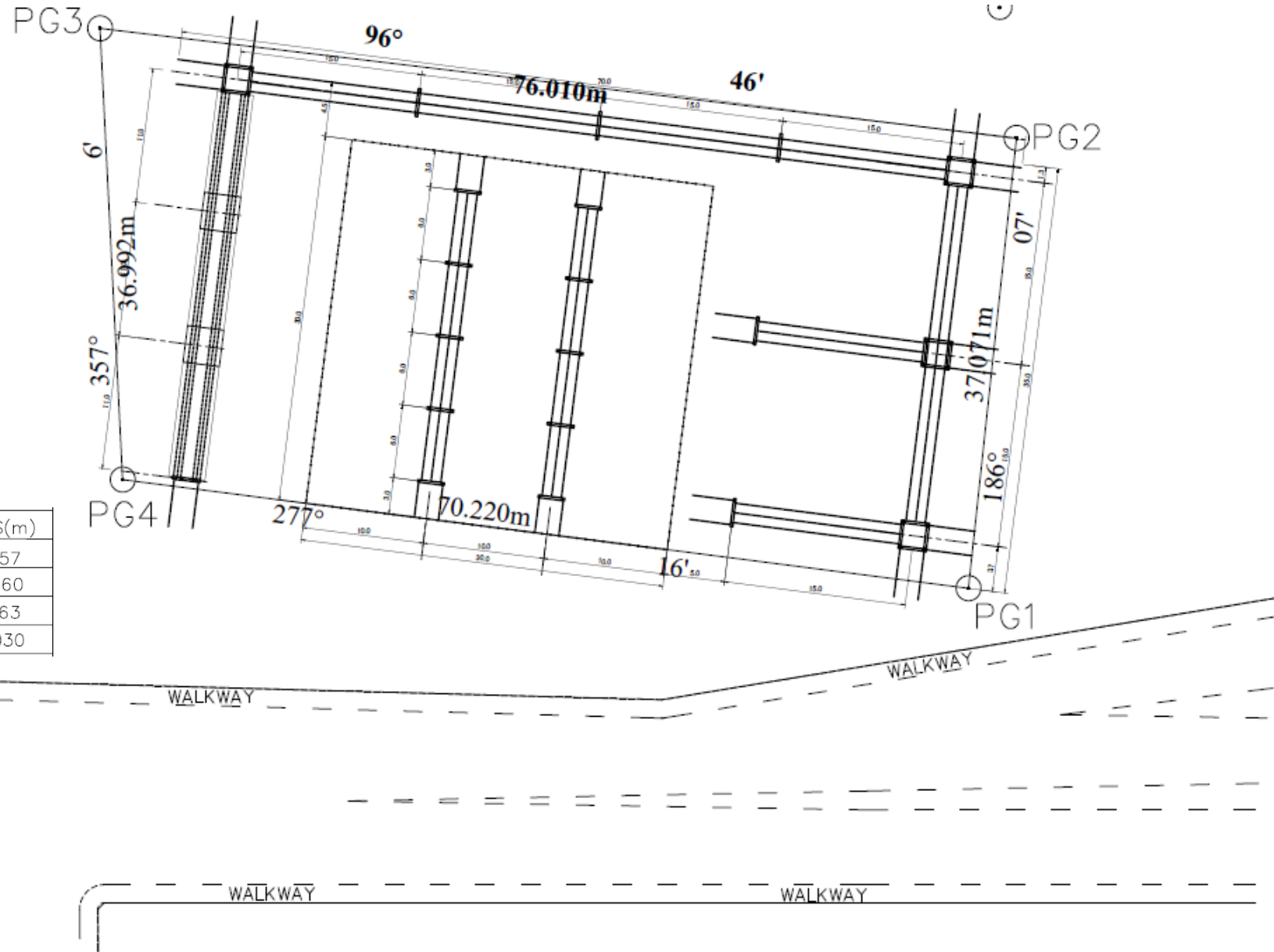
- As an opportunity to unveil improved NAPTIN training courses, the training demonstration has been conducted.
- Instructor(s) from each team gave the presentations based on the revised materials, and the feedbacks were given by model trainees which consist of AEDC engineers and NAPTIN instructors from other teams.
- This became a good chance for both NAPTIN and DisCos to start complementary interaction each other.



Team (date & time)	Samples of the constructive opinions
Reliability improvement (Thu, May 30, 2024 10:00-)	● Clear, concise, and explicit presentation. Professional and explanatory instructors. ● More illustrations and more physical, practical & detailed examples needed.
Quality improvement (Thu, June 6, 2024 10:00-)	● It is very educative and can help to improve the quality of work and knowledge by colleagues. ● More emphasis should have on local standards and specification (NEMSA and NERC).
Loss reduction (Thu, June 13, 2024 10:00-)	● Very clear and simple to understand. It would enable the knowledge be impacted to others quickly. ● I suggest block diagrams could be used to simplify and focus on the sequence of the calculations.

5. Distribution training facilities: Site location plan

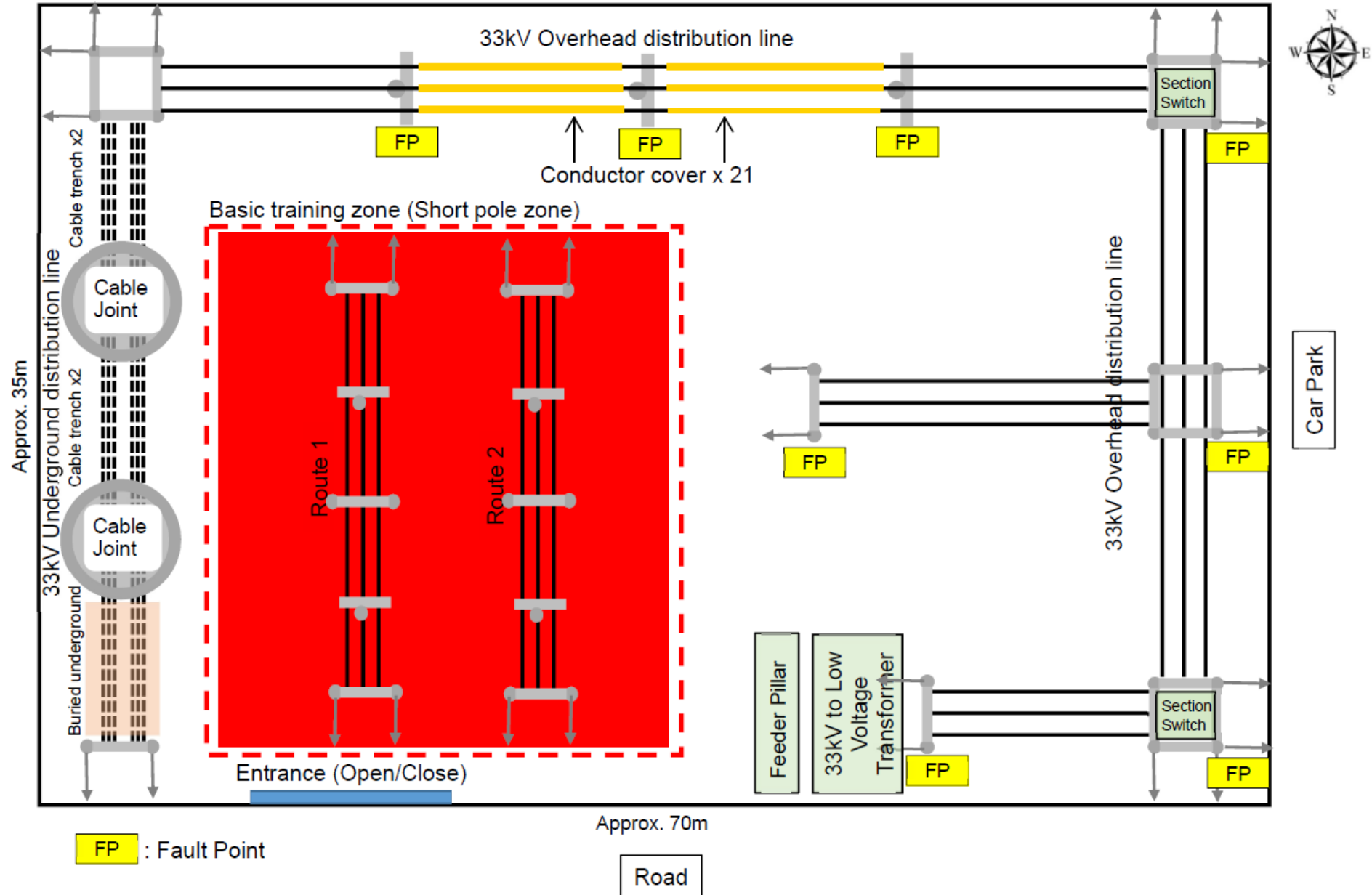
NAPTIN
HQ



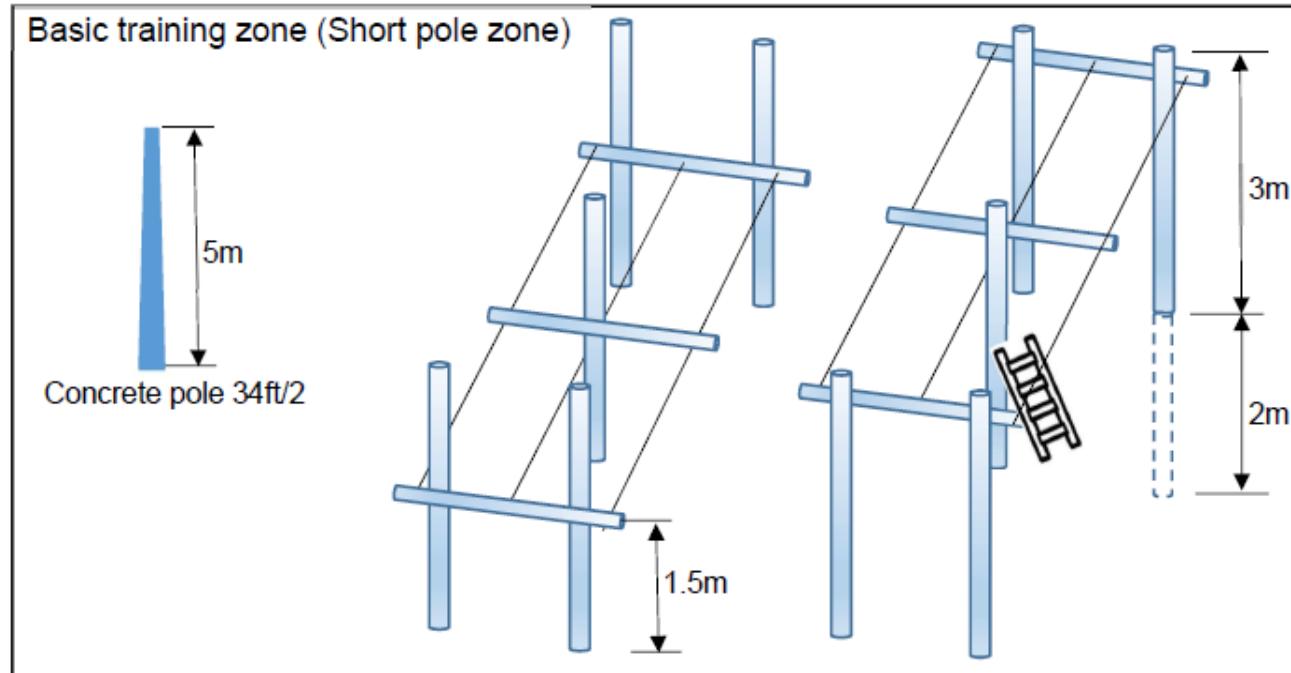
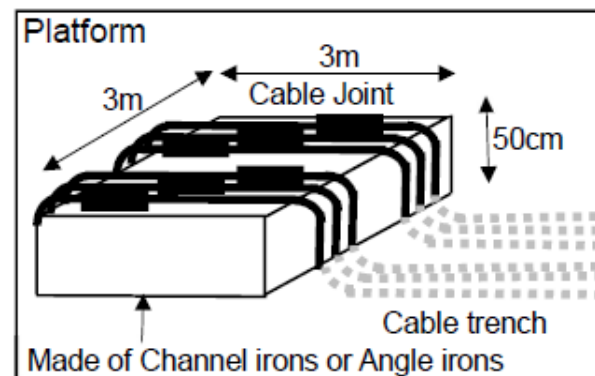
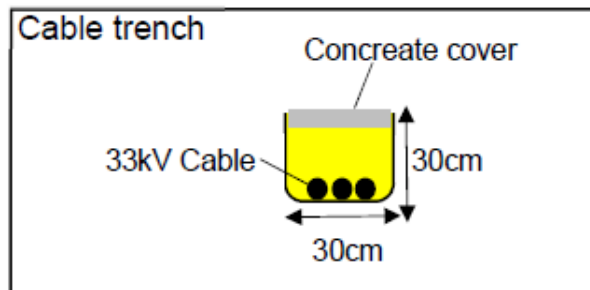
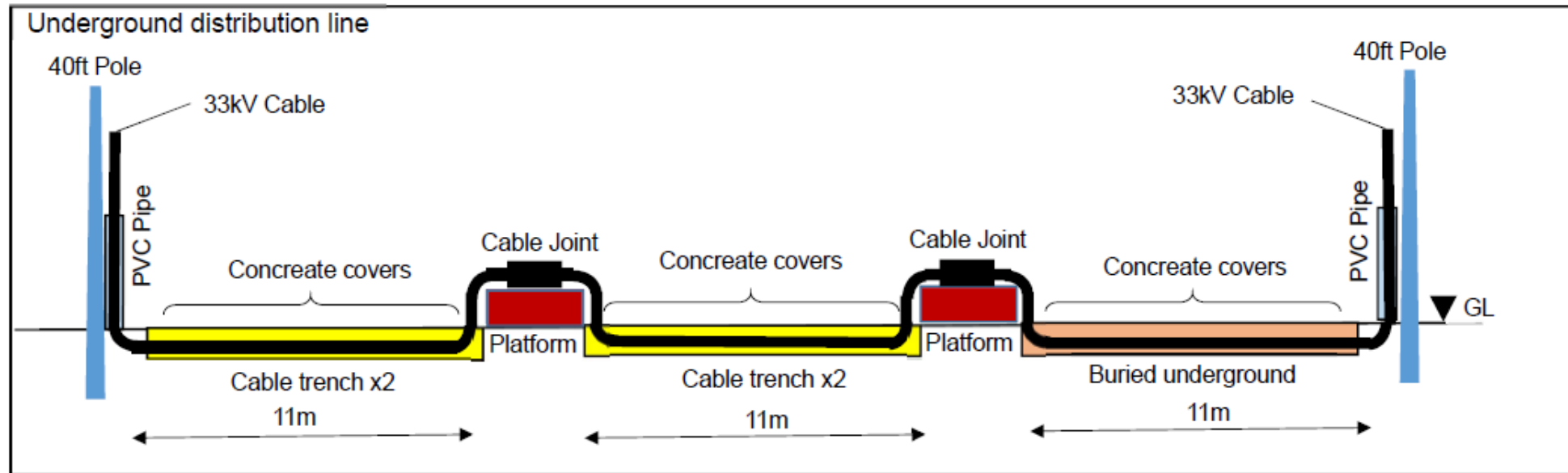
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5. Distribution training facilities: Layout plan (1)

Layout plan of the distribution training facility



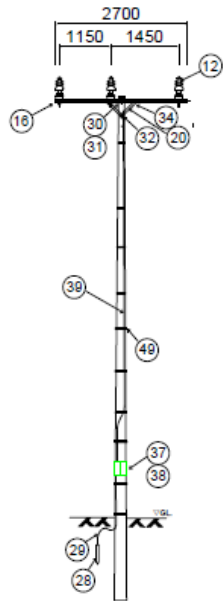
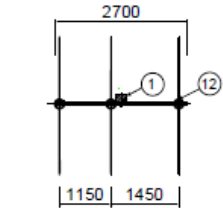
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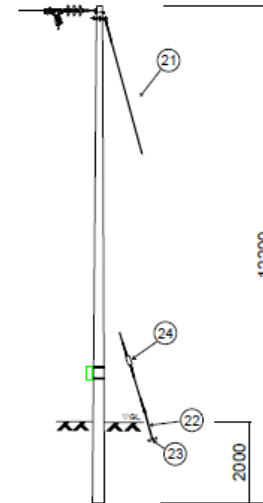
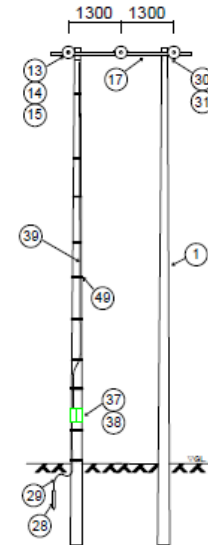
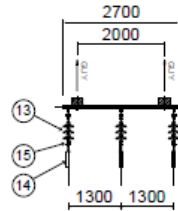
5. Distribution training facilities: Design and types of poles for training bay

33kV overhead distribution line

Type A

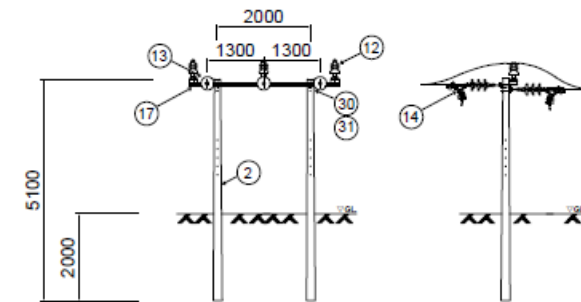
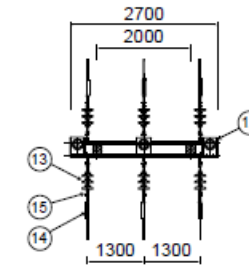


Type B



Basic training zone (Short pole zone)

Type J



The Project for Capacity Development of Power Distribution

Working Group-4

Human Resource Development and Training Deployment

22nd July 2025

Yachiyo Engineering Co., Ltd.
Kansai Transmission and Distribution, Inc.

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1. Expected outputs and activities
2. Previous discussion in 2024
3. Discussion in 2025

1. Expected outputs and activities

Outputs	Outline of Activities
<Output-1> Development and implementation of training for loss reduction measures	Preparatory Phase Activities (common to Output 1-4) 0-1 Baseline survey (field survey, update information) Activities related to Output 1-3 (N or A-X corresponds to Output 1-3) <Activities with NAPTIN> (TOT: Training Of Trainers) N-1 Planning training courses, teaching materials preparation, TOT N-2 Conducting training course N-3 Evaluating training courses and giving feedback N-4 Incorporating pilot results into training (Training improvement plans) N-5 Design and construction of training equipment for demonstration
<Output-2> Development and implementation of training to improve reliability	<Activities with AEDC> A-6 Field survey, Extracting issues in business operations A-7 Consideration and implementation of pilot project A-8 Incorporate pilot results into business operations [revising technical standards, SOP (standard operating procedure), etc.]
<Output-3> Development and implementation of training for quality improvement	<Activities with AEDC> A-6 Field survey, Extracting issues in business operations A-7 Consideration and implementation of pilot project A-8 Incorporate pilot results into business operations [revising technical standards, SOP (standard operating procedure), etc.]
<Output-4> Confirmation of the utilization of NAPTIN training in Discos	Activities related to Output-4 4-1 Collecting information, analysis, and presentation of improvement plans for Career framework in AEDC and application of NAPTIN training 4-2 Creating dissemination plans for other Discos

Activities for WG-4

Pervious discussion in 2024

2. Answer to questionnaire for AEDC regarding technical training (1)

- AEDC's Training Plan 2024 for technical has 38 courses of which 7 courses utilize external resource.
- Internal training courses cover various aspects of Discos' activities such as Standard Operation Procedures, Permit to Work System, maintenance, relay and protection, accident prevention, loss reduction, safety, metering, NERC regulation, etc.
- Major contents which utilize external resource are Smart Feeder Pillar, Power Protection System, Loss Calculation using NEPLAN, Switchgear and Transformer Maintenance and Cable Joint and Instrument Management of which 3 courses are conducted as E-Learning.
- AEDC has training facilities at Gwagwalada (overhead line training bay) and Garki training rooms.
- **Five (5) NAPTIN's training courses** are included in AEDC's training plan. However, taking part in NAPTIN's training is not a condition for promotion.
- AEDC's opinion: NAPTIN, through its various training modules, can contribute to the overall capacity building of AEDC. This includes training on new technologies, maintenance practices, and energy management systems, which can help AEDC optimize its operations and reduce losses.

2. Answer to questionnaire for AEDC regarding technical training (2)

Five NAPTIN's training courses included in AEDC's training plan

- (1) Basic Power protection Systems- **E-Learning**
- (2) Power Distribution Modelling and NEPLAN Loss Calculation- **E-Learning**
- (3) Energy Classes and Conservation- **E-Learning**
- (4) Cable Jointers, Fitter and Instrument Management Course
- (5) Switchgear & Transformer maintenance

2. Answer to questionnaire for AEDC regarding technical training (3)

- Question: Is there any promotion and advancement criteria for technical staff by job category and job description?
- Answer: None in place now

- Question: Is participation in NAPTIN training a requirement for advancement or promotion?
- Answer: Such policy does not exist now

- **Further question** to AEDC today: Is there any possibility for AEDC to set up criteria and requirements (such as participation in certain trainings) for advancement and promotion?
- Answer: Preparation of AEDC's career framework is ongoing.

⇒ One of the activities for WG4 is to examine AEDC's career framework, make recommendation and present improvement measures such as incorporating NAPTIN's training courses as a prerequisite for promotion and advancement. Since AEDC's career framework does not exist at this moment, WG4 will start working on it when it is completed.

WG4 will work on promotion and dissemination measures for NAPTIN's training courses which have been upgraded through JICA's Capacity Development Project prior to AEDC's career framework.

In order to understand the training plan and career framework of other Discos, the questionnaire sent to AEDC will be distributed to other 10 Discos through ANED.

3. How to promote NAPTIN's new training courses? (1)

Measures	How?	Who and When?
1. Advertise new training courses	① Organize an online workshop on new training courses ② Notification of a release of new training courses on NAPTIN's website ③ Use SNS and YouTube with the videos of training scenes for easy and better understanding on new training contents	① JICA Expert Team and NAPTIN in cooperation with FMP and ANED ② NAPTIN ③ NAPTIN
2. Trial training (full contents)	Invite Discos' trainees for trial training (full contents) for free	Training fee needs to be consulted with NAPTIN&FMP
3. Take measures to lower the hurdles of taking part in NAPTIN's training	Reduce training fee by the measures below ① Introduce E-learning (<u>No accommodation, meal and travel expenses</u> required) ② Make tailor-made training programs which exactly fit trainees' needs (<u>Minimize</u> training period)	①~② NAPTIN - The mode of E-Learning is an interactive online lecture. - Pros and cons of online/physical training need to be studied.
4. Promote the incorporation of new training courses into Discos' own training plan	① Succeed in incorporating new training courses into AEDC's training plan and implement the training plan ② Disseminate the experience of AEDC to other Discos	① AEDC, JICA Expert Team and NAPTIN ② NAPTIN and ANED

3. How to promote NAPTIN's new training courses? (2)

Measures	How?	Who and When?
5. Examine AEDC's career framework and propose improvement plan	① Develop career framework ② Examine developed career framework ③ Propose improvement plan for the career framework ④ Incorporate the proposal into AEDC's career framework	① AEDC ② JICA Expert Team ③ JICA Expert Team ④ AEDC

3. How to promote NAPTIN's new training courses? (3)

3 Take measures to lower the hurdles of taking part in NAPTIN's training

3-① Introduce E-Learning

Steps	Work procedure
Step-1 Select contents suitable for E-Learning	1. Classroom trainings (All or selected parts?) 1-1 Technical loss reduction 1-2 Reliability improvement 1-3 Quality improvement 2. Practical trainings (Explanation on theory only) 2-1 Fault exploration and restoration for overhead line 2-2 Fault exploration and restoration for underground line 2-3 Measuring work for power and phase detector
Step-2 Develop training materials for E-Learning courses	1. Modify developed training materials for the three classroom trainings above (1-1, 1-2 and 1-3) to fit E-Learning 2. Develop E-Learning contents of the practical trainings for three courses above (2-1, 2-2 and 2-3)
Step-3 Review and feedback from JICA Experts	JICA Experts will review the developed E-Learning contents and give feedback to NAPTIN.
Step-4 Finalize the E-Learning contents	NAPTIN will finalize the E-Learning contents incorporating feedback from JICA Experts.

3. How to promote NAPTIN's new training courses? (4)

3 Take measures to lower the hurdles of taking part in NAPTIN's training

3-② Make tailor-made training programs which exactly fit trainees' needs

Steps	Work procedure
Step-1 Itemize training contents for the ease of customization	1. Itemize contents of classroom trainings 1-1 Technical loss reduction 1-2 Reliability improvement 1-3 Quality improvement 2. Itemize contents of practical trainings 2-1 Fault exploration and restoration for overhead line 2-2 Fault exploration and restoration for underground line 2-3 Measuring work for power and phase detector
Step-2 Add explanation to the itemized training contents	Add detailed explanation, duration and training fees on the itemized training contents of the classroom and practical trainings above for trainees to easily pick up necessary training contents.
Step-3 Develop a consultation form for training customization	Develop an online consultation form to extract training needs from Discos and customize training contents

Discussion in 2025

4. Current situation and progress

1. Promotion of Disco's participation to the newly developed training courses

- ① Federal Ministry of Power (FMP) send letters to Discos to encourage their participation to newly developed NAPTIN's training courses.
- ② 21 employees of FMP will participate in the NAPTIN's training courses. Permanent Secretary already approved it.
- ③ AEDC incorporated three NAPTIN's classroom training courses developed through JICA project into its 2025 training plan.
- ④ Even though the 2025 training plan has not been approved by the group board, AEDC is willing to send it send its employees to NAPTIN for training within the financial authority of its CEO.

2. Development of e-learning courses

- ① Due to financial constraint of NAPTIN, the preparation of e-learning contents has not been commenced.
 - ② AEDC's HR raised concerns and pointed out inefficiency of e-learning
 - ③ NAPTIN recognizes the following challenges on e-learning
 - 1. Unstable Internet Connectivity, 2. Reduced Attention Span in Virtual Sessions
 - 3. Lack of Access to Suitable Devices, 4. Limited Digital Literacy
 - 5. Monitoring and Attendance Challenges, 6. Power Supply Interruptions
 - 7. Low Engagement and Interaction
- Red: Out of NAPTIN's control

5. Major challenges on e-Learning

Challenges of e-learning which can be addressed by NAPTIN

2. Reduced Attention Span in Virtual Sessions

Unlike physical sessions that typically last 6–7 hours with minimal distraction, it is significantly harder to maintain trainee focus for the same duration in virtual sessions. Online fatigue sets in quickly due to screen time, home distractions, and limited physical interaction, leading to reduced concentration, passive participation, and overall lower engagement levels. Trainees often multitask or drop off entirely during extended virtual sessions, which affects the quality of learning and retention.

5. Monitoring and Attendance Challenges

It is difficult to verify whether participants are actively engaging during online sessions, especially in the absence of cameras or interactive tools. This raises concerns about learning effectiveness and participant accountability.

7. Low Engagement and Interaction

E-learning sessions often lack real-time interaction, leading to passive learning. Participants have expressed a preference for face-to-face learning where they can ask questions freely and receive instant feedback. This is very key considering most of our trainings require some hands-on engagements.

6. How to address the challenges on e-Learning (1)

How can NAPTIN address the following challenges by improving e-learning contents and teaching methods?

2. Reduced Attention Span in Virtual Sessions

<Possible measures>

- Frequent interaction during the training
- More Q&A sessions during the training

5. Monitoring and Attendance Challenges

<Possible measures>

- Request trainees to turn on their cameras

7. Low Engagement and Interaction

<Possible measures>

Same as 2.

6. How to address the challenges on e-Learning (2)

Challenge: Reduced attention/ Low engagement and interaction

Proposed solution	Details
Incorporate group discussions	Enhance participation of trainees through exchange of opinions among participants
Insert quizzes and polls as appropriate.	Conduct quizzes and polls at short intervals to give participants time to think.
Take frequent breaks.	Take regular breaks during long training sessions to reset participants' concentration.
Lecturers actively engage with participants	Ask questions and provide feedback to participants to increase their sense of participation.
Use the survey function	Confirm understanding of content with short tests to maintain concentration.

6. How to address the challenges on e-Learning (3)

Challenge: Reduced attention/ Low engagement and interaction

Possible solution	Details
Accept questions in real time	Set aside time for questions and answers via chat or voice chat so that participants can immediately ask questions about points that concern them.
Utilize post-course questionnaires	Collect feedback and opinions from participants through questionnaires and reflect them in future training sessions.
Conduct a test	Conduct tests to measure understanding of the contents and provide participants with opportunities for self-assessment.
Set aside time for discussion.	Set aside time for participants to exchange opinions with each other and deepen their learning.
Utilize breakout sessions	Hold small group discussions and provide opportunities for participants to actively exchange opinions.

6. How to address the challenges on e-Learning (4)

Even though the following challenges are out of NAPTIN's control, still there must be something NAPTIN can do to overcome or ease the challenges.

1. Unstable Internet Connectivity
3. Lack of Access to Suitable Devices
4. Limited Digital Literacy
6. Power Supply Interruptions

<Possible measures for “1. Unstable Internet Connectivity”>

- Divide the e-learning contents into shorter sessions with highly concentrated contents and without redundant, less important explanation.

<Possible measures for “4. Limited Digital Literacy”>

- Build a user-friendly, self-explanatory e-learning platform

6. How to address the challenges on e-Learning (5)

Challenge: Unstable internet connectivity/ Limited digital literacy

Proposed solution	Details
Conduct a rehearsal in advance.	Before training, check connections and test tools to prevent problems before they occur.
Distribute clear operating guidelines.	Distribute materials explaining how to use the tools to participants in advance to reduce operational errors.
Utilizing recordings	Record the training session so that participants who were unable to attend due to connection problems, etc. can view it later.
Assign support staff	Have ICT staff available to respond quickly in the event of technical problems.
Prepare backup means of communication	Prepare alternative means of communication, such as email and chat, to ensure smooth response in case of trouble.

6. How to address the challenges on e-Learning (6)

Ideas to address challenges

- **Introduce on-site education.** Instead of having participants come to the facility, NAPTIN will dispatch instructors. By dispatching instructors, we can expect to reduce costs.
- **Introduce micro-learning.** E-learning content is usually 30 minutes to an hour long, while microlearning is 1 to 5 minutes-long. The advantage of microlearning is that even busy learners can use their spare time to study.
- **Utilize Video Materials,** instead of text. We use recorded lectures by instructors (currently in use) or animations featuring characters. The advantage of video materials is that they deepen learners' understanding through a **visual approach**.
- **Introduce Blended Learning.** Blended learning combines different types of learning methods, such as face-to-face instruction with e-learning, or e-learning with practical training. The advantage is that it allows for more efficient and deeper learning compared to focusing on a single type of learning method, such as face-to-face instruction alone.
- **Introduce “role-playing” contents.** Taking “learning how to handle troubles” as an example, students think for themselves about how to handle the trouble that has occurred, compare their answers with the correct way to handle it, and repeat this process for each prepared trouble case to learn how to smoothly resolve troubles. This helps them learn the steps to resolve troubles.

6. How to address the challenges on e-Learning (7)

Apart from the challenges on e-learning platform, NAPTIN's website needs to be improved in the following aspects to attract more participants from Nigerian Electricity Sector Industries.

- Course contents and course concepts should be easily viewed on NAPTIN's website, with review comments and rating by participants.
- All application procedures for training courses should be completed on the web-basis.
- Training calendar needs timely update if there is any change.

7. Plan of activities

Date of WG	Activities	
22 nd July	• Introduction of plan and activities • Fact finding on the challenges of e-learning	JET (JICA Expert Team) NAPTIN and JET
5 th of August	• Show example of current e-learning contents and teaching methods	NAPTIN
19 th of August	• Brain storming on counter measures (e-learning)	NAPTIN and JET
2 nd of September	• Narrow down and finalize counter measures	NAPTIN and JET
16 th of September	• Report the progress of preparing e-learning contents	NAPTIN
30 th of September	• Report the progress of preparing e-learning contents	NAPTIN

- NAPTIN will report the outcome of WG4 activities on the occasion of the final JCC meeting scheduled on the 30th of October 2025.



NATIONAL POWER TRAINING
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THE PROJECT FOR CAPACITY DEVELOPMENT OF POWER
DISTRIBUTION

**DISTRIBUTION TECHNICAL LOSS
REDUCTION: EVALUATION, CAUSES AND
MITIGATION**

COURSE CONCEPT

31/01/2025



NATIONAL POWER TRAINING
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(NAPTIN)

**DISTRIBUTION TECHNICAL LOSS
COURSE CONCEPT**



PREAMBLE

The objective of this project is to improve the capacity of engineers and technicians of the Distribution Companies (Discos) to plan, design, operate and maintain their distribution network through;

- i. direct technical transfer from JICA Experts to them and
- ii. developed/improve NAPTIN's training courses.



The specific outputs of the project are that Disco's engineers and technicians will acquire knowledge and capabilities related to (a) technical loss reduction, (b) reliability improvement, (c) quality improvement and to establish a framework to sustain the outcome of the project.



The project will help Discos achieve their proposed performance improvement targets in PIP.

Table 1 Planned Service Improvement Targets of AEDC

Items	Current	After 5 years
Energy delivered - GWh	4,128GWh/year	8,261GWh/year (+4,134GWh)
ATC&C Loss	45%	19.3% (Δ 26%)
Average Frequency of Interruptions	1.12 times/day	0.96 times/day (Δ 0.16 times)
Average Duration of Interruptions	6 hours/day	4 hours/day (Δ 2 hours)

Source: Yachiyo Engineering Company

COURSE DESCRIPTION

DISTRIBUTION TECHNICAL LOSS REDUCTION:

This highly-interactive course uses modern learning methodologies to teach Technical Loss for Power Distribution Networks.

The curriculum covers:

- **Introduction** for explaining the nature and classes of losses.
- **Technical Loss Evaluation** which describes how to calculate instantaneous technical loss using manual, PSAT software (NEPLAN), excel sheet and annual technical loss manually.
- **Causes and mitigation of technical loss** to identify and mitigate technical losses



DISTRIBUTION TECHNICAL LOSS REDUCTION– COURSE OBJECTIVES



- 1. Evaluate/calculate Technical losses; manually, using a Power System Analysis Tool (PSAT - NEPLAN), and using Excel sheet
- 2. Explain the major causes of technical losses in distribution network
- 3. Describe the strategies of mitigating losses
- 4. Apply various methods of mitigating losses in the distribution network

WHO SHOULD ATTEND?

Designed for:

- Distribution Engineers and technologist
- Senior Distribution Technicians
- Electricity energy audit officers



OUTLINE

Module I- Introduction on Losses

- Classification of Losses

Module II – Evaluation of Technical Losses

- Instant technical loss manual calculation
- Instant technical loss calculation via NEPLAN
- Annual technical loss calculation

Module III- Causes of Technical Losses and mitigation strategies

- Causes
- Mitigation

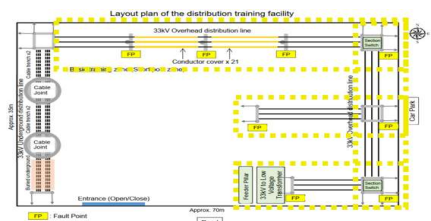
METHODOLOGY



DISTRIBUTION TECHNICAL LOSS REDUCTION:

Course Delivery Methodology:

- The course will be delivered through a combination of;
 - interactive lectures,
 - case studies,
 - group discussions,
 - simulations
 - workbook exercises, and field visits





COURSE DURATION



DAY	MORNING SESSION	AFTERNOON SESSION
DAY1	REGISTRATION/INTRODUCTION	NATURE OF LOSSES
DAY2	LOSS EVALUATION – Introduction	EVALUATION METHODS – Instantaneous Technical Loss (Manual)
DAY3	EVALUATION METHOD – Instantaneous Technical Loss (NEPLAN)	EVALUATION METHOD – Instantaneous Technical Loss (NEPLAN/Excel sheet)
DAY4	TECHNICAL LOSS CAUSES & MITIGATION	TECHNICAL LOSS CAUSES & MITIGATION
DAY5	EXERCISES/SCENARIOS	CONCLUSION/EVALUATION/CLOSING



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Thank you for listening!

DISTRIBUTION TECHNICAL LOSS COURSE CONCEPT

1. PREAMBLE

2. COURSE DESCRIPTION

3. COURSE OBJECTIVES

4. WHO SHOULD ATTEND



Kansai Transmission and Distribution
Kansai Electric Power Group

Kinden



5. COURSE CONTENTS

6. COURSE DURATION/PROGRAMME
SCHEDULE

7. METHODOLOGY

8. END



NATIONAL POWER TRAINING
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THE PROJECT FOR CAPACITY DEVELOPMENT OF
POWER DISTRIBUTION

RELIABILITY IMPROVEMENT *COURSE CONCEPT*



NATIONAL POWER TRAINING
INSTITUTE OF NIGERIA
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RELIABILITY IMPROVEMENT THE PROJECT FOR CAPACITY DEVELOPMENT OF POWER DISTRIBUTION

RELIABILITY IMPROVEMENT COURSE CONCEPT



PREAMBLE

RELIABILITY IMPROVEMENT THE PROJECT FOR CAPACITY DEVELOPMENT OF POWER DISTRIBUTION

The objective of this project is to improve the capacity of engineers and technicians of the Distribution Companies (Discos) to plan, design, operate and maintain their distribution network through;

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Source: Yachiyo Engineering Company

COURSE DESCRIPTION

RELIABILITY IMPROVEMENT THE PROJECT FOR CAPACITY DEVELOPMENT OF POWER DISTRIBUTION

RELIABILITY IMPROVEMENT:

This highly-interactive course uses modern learning methodologies to teach Reliability Improvement for Power Distribution Networks.

The curriculum covers **Fault Detection Methods** for safely identifying and addressing faults in the network, it simplifies strategies for **Reducing Forced Outages** towards improving or augmenting the performance of distribution networks, and expands contemporary practice for the **Maintenance of Overhead Lines** to prevent or quickly rectify failures in distribution networks



RELIABILITY IMPROVEMENT – COURSE OBJECTIVES

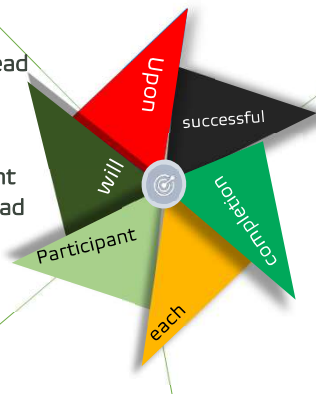


MAINTENANCE OF OVERHEAD LINES

- Identify some inspection techniques
- Carry out routine inspection of overhead lines
- Carry out preventive and corrective maintenance of overhead lines
- Understand Maintenance Management
- Identify faulty components of overhead lines

FAULT DETECTION METHODS

- Discuss the Causes of faults in Power Distribution Feeders
- Discuss the theory behind the Fault Detection Methods
- Prioritize safety and situational awareness while utilizing fault detecting equipment
- Effectively Communicate fault detection findings in a concise manner



Reducing Forced Outages

- list the key contributors to Reducing Forced Outages
- Discuss the importance of systematic outage recording
- Discuss the importance of Analysis of relevant Accumulated Data
- Recognize the importance of correctly identifying the damaged equipment
- Demonstrate the importance of applying appropriate countermeasures
- Recognize exogenous and endogenous cases
- Employ some typical countermeasures for identified root causes.
- identify the Key tasks/activities that reduce outage duration
- Discuss the performance of distribution networks

RELIABILITY IMPROVEMENT THE PROJECT FOR CAPACITY DEVELOPMENT OF POWER DISTRIBUTION

RELIABILITY IMPROVEMENT – COURSE OBJECTIVES

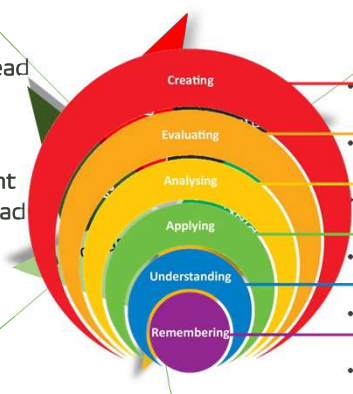


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- Discuss the performance of distribution networks

RELIABILITY IMPROVEMENT THE PROJECT FOR CAPACITY DEVELOPMENT OF POWER DISTRIBUTION



COUNTERMEASURES FOR REDUCING FORCED OUTAGES

- Conductor Cover
- Bolt Type Connector



Ongoing: Demonstration of installing Bolt Type Connector and Conductor Cover in the Nigerian Distribution Network at AEDC Gwagwalada injection Substation. Bolt Type Connector used to connect wires without tension. Conductor Cover prevents contacts with obstacles such as HV overhead powerlines and trees. 6th October 2022

WHO SHOULD ATTEND?

RELIABILITY IMPROVEMENT:

This course is ideal for

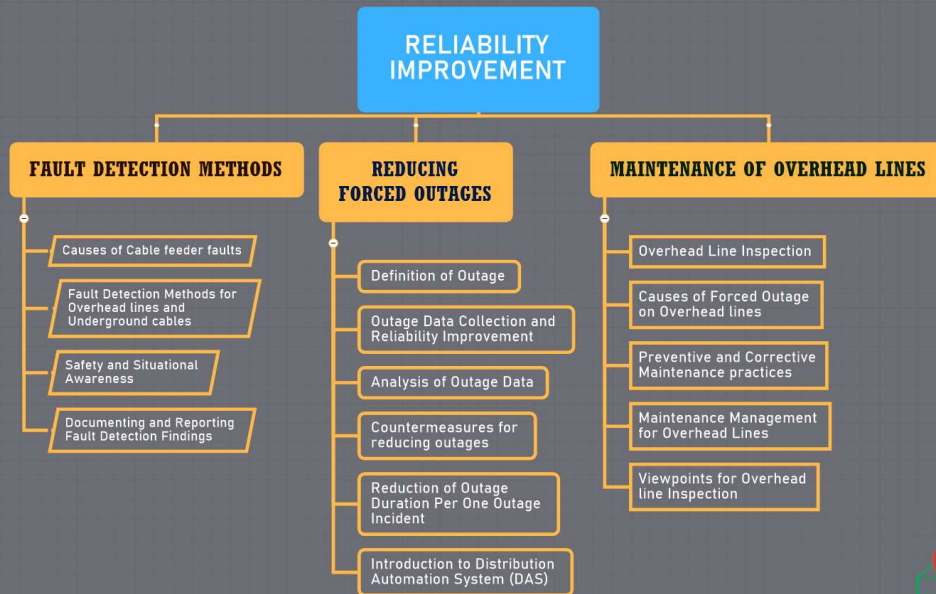
- **Linesmen** and
- **O&M Superintendents**

involved in the operation, maintenance, and management of Power Distribution Networks, as well as those looking to structure their knowledge of power system reliability for Power Distribution Networks



COURSE CONTENTS

RELIABILITY IMPROVEMENT THE PROJECT FOR CAPACITY DEVELOPMENT OF POWER DISTRIBUTION



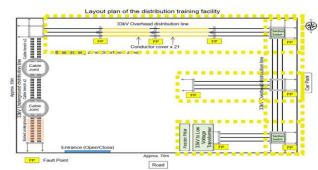
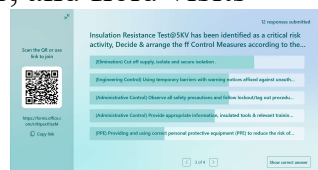
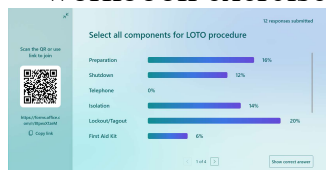
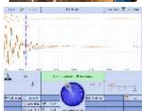
METHODOLOGY

RELIABILITY IMPROVEMENT THE PROJECT FOR CAPACITY DEVELOPMENT OF POWER DISTRIBUTION



RELIABILITY IMPROVEMENT: **Course Delivery Methodology:**

- The course will be delivered through a combination of;
 - Pre-diagnostic questionnaires,
 - interactive lectures
 - case studies
 - group discussions,
 - simulations
 - workbook exercises, and field visits





NAPTIN CHQ - Bolt-Type Connector
Connect Wires without tension



NAPTIN CHQ - Conductor Cover
Prevent contact with obstacles



NAPTIN CHQ - Pole yard and Training Substation



NAPTIN CHQ - cable trench
Cable jointing, hi-pot testing



KANSAT&D

COURSE DURATION

3 DAY SCHEDULE FOR RELIABILITY IMPROVEMENT

Schedule	Activities	Resource Person
WEDNESDAY		
FAULT DETECTION METHODS & REDUCING FORCED OUTAGES		
9.00 – 9.30	Arrival, Registration, Welcome	NAPTIN
9.30 – 10.30	Fault Detection Methods	
10.30 – 11.30	Tea Break	
11.30 – 13.00	Fault Detection Methods	
13.00 – 14.00	Lunch Break	
14.00 – 15.00	Fault Detection Methods	
15.00- 16.00	REDUCING FORCED OUTAGES	
16.00 – 17.00	Daily Summary	
THURSDAY		
MAINTENANCE OF OVERHEAD LINES		
9.00 – 10.30	REDUCING FORCED OUTAGES	NAPTIN
10.30 – 11.30	Tea Break	
11.30 – 12.00	MAINTENANCE OF OVERHEAD LINES	
12.00 – 13.30	Lunch Break	
14.00 – 14.30	MAINTENANCE OF OVERHEAD LINES	
15.00 – 16.00	CASE STUDY/GROUP DISCUSSION/OTHER METHODOLOGY/EVALUATION	
16.00 – 17.00	Daily Summary	
FRIDAY		
PRACTICAL/FIELD VISIT		
09.30 – 11.30	PRACTICAL	NAPTIN
11.30 – 12.30	Lunch Break	
12.30 – 13.00	PRACTICAL	
13.00 – 14.00	Lunch Break	
14.00 – 14.45	FIELD VISIT	
14.45 – 15.45	FIELD VISIT	
15.45 – 16.00	Daily Summary Wrap-Up and Closing	





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Thank you for listening!

RELIABILITY IMPROVEMENT COURSE CONCEPT



RELIABILITY IMPROVEMENT THE PROJECT FOR CAPACITY DEVELOPMENT OF POWER DISTRIBUTION



NATIONAL POWER TRAINING
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THE PROJECT FOR CAPACITY DEVELOPMENT OF POWER DISTRIBUTION

POWER QUALITY IMPROVEMENT COURSE

COURSE CONCEPT



NATIONAL POWER TRAINING
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POWER QUALITY IMPROVEMENT COURSE CONCEPT



PREAMBLE

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- ii. developed/improve NAPTIN's training courses.



The specific outputs of the project are that Disco's engineers and technicians will acquire knowledge and capabilities related to (a) technical loss reduction, (b) reliability improvement, (c) quality improvement and to establish a framework to sustain the outcome of the project.



The project will help Discos achieve their proposed performance improvement targets in PIP.

Table 1 Planned Service Improvement Targets of AEDC

Items	Current	After 5 years
Energy delivered - GWh	4,128GWh/year	8,261GWh/year (+4,134GWh)
ATC&C Loss	45%	19.3% (Δ 26%)
Average Frequency of Interruptions	1.12 times/day	0.96 times/day (Δ 0.16 times)
Average Duration of Interruptions	6 hours/day	4 hours/day (Δ 2 hours)

Source: Yachiyo Engineering Company

COURSE DESCRIPTION

POWER QUALITY IMPROVEMENT:

- This course provides a comprehensive understanding of power quality issues in electrical distribution networks.
- It covers the fundamental concepts, causes, mitigation strategies, and improvement measures for power quality.
- Through a blend of theoretical knowledge and practical applications, participants will learn to identify power quality problems and implement solutions to address real-world challenges and enhance the reliability and efficiency of electrical distribution systems.



POWER QUALITY IMPROVEMENT – COURSE OBJECTIVES



Course Objectives:

At the end of the course, the trainees shall be able to:

- ✓ Understand the basic concepts and importance of power quality in distribution networks.
- ✓ Identify and classify different types of power quality disturbances.
- ✓ Analyse the root causes of power quality issues.
- ✓ Calculate voltage drops in distribution networks.
- ✓ Identify the regulations, standards, and guidelines related to power quality in distribution systems.
- ✓ Implement mitigation strategies to address power quality problems.
- ✓ Propose and evaluate methods for improving power quality in distribution networks.

WHO SHOULD ATTEND?

Designed for:

- Electrical Engineers
- Power System Engineers
- Energy Managers
- Technical Consultants
- Graduate Students in Electrical Engineering
- Electrical Engineering Students
- Professionals involved in the design, maintenance, and operation of electrical distribution networks



OUTLINE

Introduction to Power Quality

- a) Fundamentals of Power Quality
- b) Definition and Importance
- c) Power Quality Standards (IEEE, IEC, NERC)
- d) Economic Impact of Poor Power Quality

Components of Power Quality and their Effects

- a) Transients
- b) Voltage Fluctuations and Interruptions
- c) Voltage Sag and Swell
- d) Overvoltage and Undervoltage
- e) Voltage Unbalance
- f) Harmonics Distortions
- g) Voltage Flickers
- h) Electromagnetic Interference (EMI)
- i) Voltage Drop
 - 1. Ferranti Effects

Causes and Sources of Power Quality Problems

- a) Load Variations
- b) Faults in the Network
- c) Switching Operations
- d) Non-linear Loads
- e) External Factors (Weather, Environment)

Calculation methods of voltage drops

Mitigation Techniques to Power Quality Problems

- a) Passive Filters
- b) Active Power Filters
- c) Uninterruptible Power Supplies (UPS)
- d) Dynamic Voltage Restorers (DVR)

Standards and Regulatory Compliance

- a) Ensuring Compliance with Industry Standards
- b) Regulatory Requirements and Guidelines

Voltage Management for Distribution Network

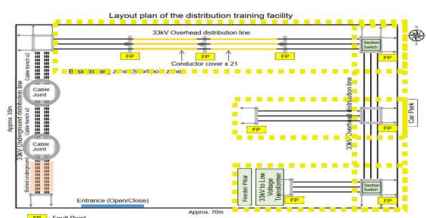
METHODOLOGY



POWER QUALITY IMPROVEMENT:

Course Delivery Methodology:

- The course will be delivered through a combination of;
 - interactive lectures,
 - case studies,
 - group discussions,
 - simulations
 - workbook exercises, and field visits





COURSE DURATION



DAY	MORNING SESSION	AFTERNOON SESSION
DAY1	INTRODUCTION TO POWER QUALITY	COMPONENTS AND CAUSES OF POWER QUALITY PROBLEMS
DAY2	MITIGATION TO POWER QUALITY PROBLEMS	STANDARDS AND REGULATORY COMPLIANCE
DAY3	VOLTAGE MANAGEMENT FOR DISTRIBUTION MANAGEMENT	CALCULATION OF VOLTAGE DROPS



NATIONAL POWER TRAINING
INSTITUTE OF NIGERIA
(NAPTIN)

Thank you for listening!

POWER QUALITY IMPROVEMENT COURSE CONCEPT



Comments on the contents of Power System Loss Reduction course on e-NAP (in



Category	Item	Value
Losses	Power System Loss Reduction	415,000.00
Savings	Power System Loss Reduction	100,000.00

1. Contents

(1) There are too many scenes where Engr. Khalil is speaking alone (without showing materials) (basic information is unnecessary). Basically, the content being explained should be explained in the materials.

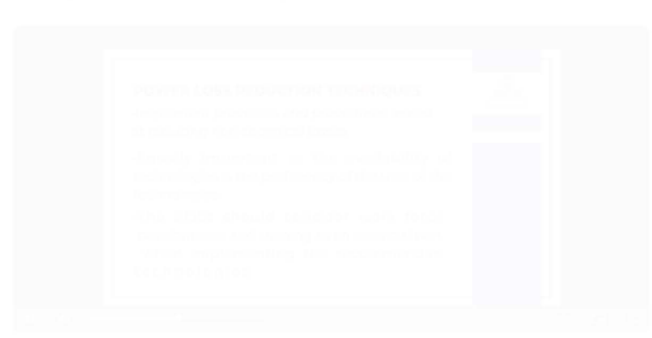
Power System Loss Reduction Techniques

相手国の意向により、本事業の協力対象外である情報が含まれるため非公開



(2) There are parts where it is difficult to understand which part of the materials is being explained, so the relevant parts of the materials should be highlighted, marked with circles, underlined, etc., in accordance with the explanation.

Power System Loss Reduction Techniques



(3) There are figures and photos included, but it is unclear what they are meant to convey. The purpose of including figures and photos should be considered more carefully.

(For example, in the 'Gauge Management System' structure diagram around the 23-minute mark of the 'Power System Loss Reduction Technologies' training content,

- ① the text is too small to read.
- ② It was only briefly shown, and no explanation was provided using diagrams or photos if there is nothing to explain, is it necessary?
- ③ Why is the content of 'Gauge Management System' being explained in the 'Power System Loss Reduction Technologies' content?

(The training title and content are still unclear.)

(4) There is a strong sense of information overload, so what is what? (what you want to convey) and how to convey it? (how to convey) are the two key points. Only the necessary content for each theme should be included.

(5) The content to be discussed should be prepared in advance as a scenario and

相手国の意向により、本事業の協力対象外である情報が含まれるため非公開

2. Structure of e-learning training

- (1) Can the materials displayed in the video not be downloaded?
- (2) The second content is 33 minutes long. The maximum length should be around 10 minutes.
- (3) As a measure to maintain the concentration of participants, a quiz should be incorporated to check understanding during the course?



YACHIYO
Engineering



Kansai Transmission and Distribution



Kansai Electric Power Group *power with heart*

THE PROJECT
FOR
CAPACITY DEVELOPMENT OF POWER DISTRIBUTION

Outline of project activities

31st May 2023

Yachiyo Engineering Co., Ltd.
Kansai Transmission and Distribution, Inc.

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yeo 八千代エンジニアリング株式会社

Contents	1. Objective of the project 2. Expected outputs and activities 3. Structure of project implementation organization 4. Activities with NAPTIN 5. Activities with AEDC
------------------------	--

1. Objective of the Project

The objective of this project is to improve the capacity of engineers and technicians of the Distribution Companies (Discos) to plan, design, operate and maintain their distribution network through;

- i. direct technical transfer from JICA Experts to counterparts and
- ii. developed/improved NAPTIN's training courses.

The specific outputs of the project are that Disco's engineers and technicians will acquire knowledge and capabilities related to (a) technical loss reduction, (b) reliability improvement, (c) quality improvement and to establish a framework to sustain the outcome of the project.

The project will help Discos achieve their proposed performance improvement targets in PIP.

Planned Service Improvement Targets of AEDC

Items	Current	After 5 years
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Average Frequency of Interruptions	1.12 times/day	0.96 times/day (Δ 0.16 times)
Average Duration of Interruptions	6 hours/day	4 hours/day (Δ 2 hours)

2. Expected outputs and activities

Outputs	Outline of Activities
<Output-1> Development and implementation of training for loss reduction measures	Preparatory Phase Activities (common to Output 1-4) 0-1 Baseline survey (field survey, update information) Activities related to Output 1-3 (N or A-X corresponds to Output 1-3) <Activities with NAPTIN> (TOT: Training Of Trainers) N-1 Planning training courses, teaching materials preparation, TOT
<Output-2> Development and implementation of training to improve reliability	N-2 Conducting training course N-3 Evaluating training courses and giving feedback N-4 Incorporating pilot results into training (Training improvement plans) N-5 Design and construction of training equipment for demonstration
<Output-3> Development and implementation of training for quality improvement	<Activities with AEDC> A-6 Field survey, Extracting issues in business operations A-7 Consideration and implementation of pilot project A-8 Incorporate pilot results into business operations [revising technical standards, SOP (standard operating procedure), etc.]
<Output-4> Confirmation of the utilization of NAPTIN training in Discos	Activities related to Output-4 4-1 Collecting information, analysis, and presentation of improvement plans for Career framework in AEDC and application of NAPTIN training 4-2 Creating dissemination plans for other Discos

2. Plan of operation (Implementation schedule)

Inputs			FY2022				FY2023				FY2024			
			4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3
<Output-1 to Output-3>														
Activities with NAPTIN														
1	Planning training courses, teaching materials preparation, TOT	Plan												
		Actual												
2	Conducting training courses	Plan												
		Actual												
3	Evaluating training courses and giving feedback	Plan												
		Actual												
4	Incorporating pilot results into training (Training improvement plans)	Plan												
		Actual												
5	Design and construction of training equipment for demonstration	Plan												
		Actual												
Activities with AEDC														
6	Field survey, Extracting issues in business operations	Plan												
		Actual												
7	Consideration and implementation of pilot proposal	Plan												
		Actual												
8	Incorporate pilot results into business operations (revising technical standards, SOP, etc.)	Plan												
		Actual												
<Output-4>														
4-1	Collecting information, analysis, and presentation of improvement plans for Career framework in AEDC and application of NAPTIN training	Plan												
		Actual												
4-2	Creating dissemination plans for other Discos	Plan												
		Actual												

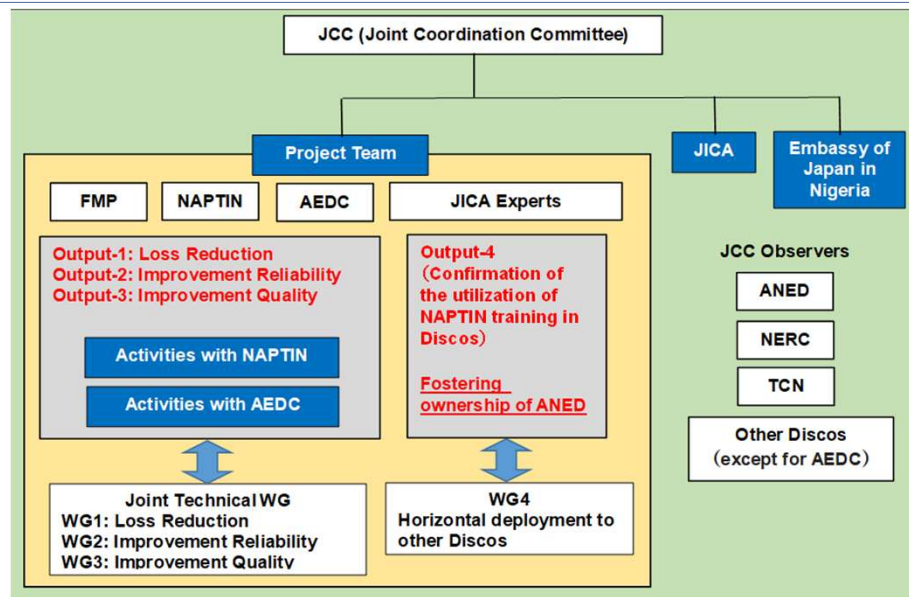
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2. Plan of operation (Implementation schedule)

Inputs		FY2022				FY2023				FY2024					
		4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3		
Training in Japan															
Training in Japan	Plan						■								
	Actual														
Equipment															
Equipment necessary for pilot project	Plan					Design & procurement									
										Manufacturing & shipping					
	Actual					Design & procurement									
										Manufacturing & shipping					

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3. Structure of project implementation organization



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3. Structure: Working groups and members

Working Groups	WG Members	Advisor (JICA Experts)
Technical WG 1-3	AEDC 1. Engr. Taofeeq Kola Rufai 2. Engr. Fredrick Obuye. 3. Engr. Andy C. Mba 4. Engr. Yusuf Mudi	-Distribution Planning -Distribution Design -Distribution Maintenance and Management
	NAPTIN 1. Engr. KHALIL Yusuf A. 2. Engr. Bawa G. Gamiya 3. Engr. Murtala Y. Lawal	
Human Resource Development and Training Deployment WG4	AEDC (Human Resources) 1. Henry Owonubi 2. Fatima Hassan	-Leader/Distribution Business Operation -Training Courses Planning
	NAPTIN 1. Engr. Abdullahi Aliyu 2. Engr. Chinyere B. Igbokwe 3. Engr. Lynda Iledare	

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4. Activities with NAPTIN



- (1) Baseline survey
- (2) Improve existing training courses and materials
- (3) Training of Trainers
- (4) Procurement and installation of distribution training facilities
- (5) Develop and conduct new training courses

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4.1 Results of the First Field Work and Baseline Survey

Kansai Transmission and Distribution
Kansai Electric Power Group power with heart



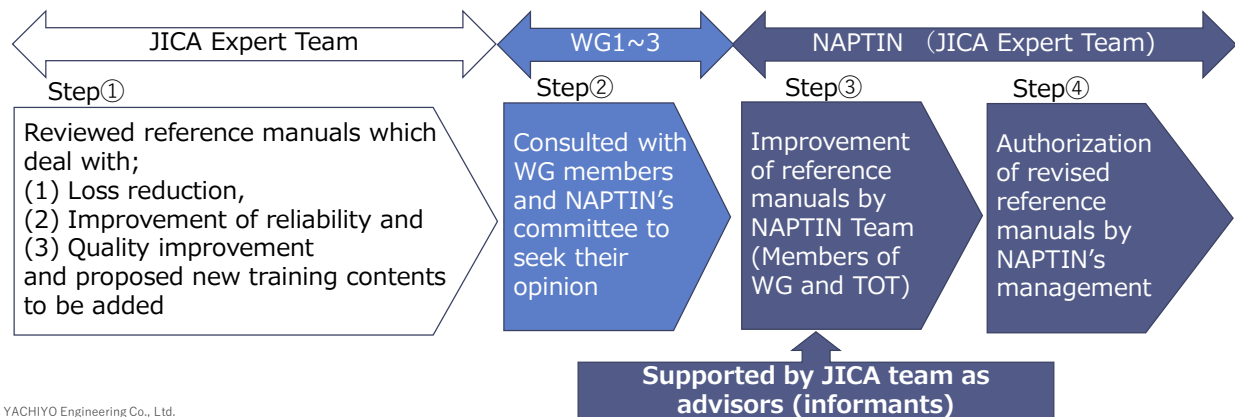
During the first field work in Nigeria, JICA Expert Team collected information on (1) loss reduction, (2) reliability improvement, and (3) quality improvement, and reviewed NAPTIN's existing training courses for distribution sector as baseline survey. 20 courses in the table below which deals with technical aspects of distribution are the target of improvement.

NO	Course title	Loss Reduction	Quality Improvement	Reliability Improvement	Fault Point Location	Others	Target of improvement
1	Basic Power Relaying Protection Course			○			◎
2	Cable Jointing Mod. I			○			
3	Cable Jointing Mod. II			○			
4	DISTRIBUTION LINES Mod. I		○		○		◎
5	DISTRIBUTION LINES Mod. II		○		○		◎
6	Distribution Maintenance And Repairs Manual		○				
7	Distribution Network Loss Management	○			○		◎
8	DISTRIBUTION OPERATIONS Mod. I			○			◎
9	DISTRIBUTION OPERATIONS Mod. II			○			◎
10	ELECTRICAL FITTERS Mod. I	○					
11	ELECTRICAL FITTERS Mod. II	○					
12	ENERGY AUDIT.	○					
15	MAINTENANCE OF TRANSFORMER AND SWITCHGEAR			○	○		
NO. 13.14.16~20						○	

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4.2 How to proceed with improving NAPTIN's training courses

JICA Expert Team reviewed reference manuals No. 1, 4, 5, 7, 8, and 9 out of 13 ones which deal with (1) loss reduction, (2) reliability improvement, and (3) quality improvement. Then, JICA Expert Team proposed new training contents which should be added to the existing training courses to improve the capacity of Discos' engineers in terms of (1), (2) and (3) above. The proposed contents were consulted with Joint Technical WG 1-3 which consists of NAPTIN and AEDC and reviewed by NAPTIN's training committee for further consideration.



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4.3 Works to be done at each step

Steps	Work contents	Responsible
Step①	JICA Expert Team reviewed reference manuals No. 1, 4, 5, 7, 8, and 9 out of 13 ones which deal with (1) loss reduction, (2) reliability improvement, and (3) quality improvement. Then, the Team proposed new training contents to be added to the existing ones.	JICA Expert Team
Step②	The proposed contents were consulted with Joint Technical WG 1-3 which consists of NAPTIN and AEDC and reviewed by NAPTIN's training committee for further consideration. The contents finally agreed by the WG and committee will be added to the existing textbooks.	WG1~3:NAPTIN and AEDC (JICA Expert Team)
Step③	Reference Manual Review Team of NAPTIN which consists of trainers who belong to the WG and TOT is in charge of the revision of reference manuals. Each content to be added is allocated to each trainer or pair of trainers for revision work. JICA Expert Team and trainers will discuss and agree on the policy of revision and detailed contents to be added. JICA Expert Team will provide necessary information and instruction to the NAPTIN Team for the revision work if required. Online meetings will be held in every two weeks to monitor the progress and exchange opinion.	NAPTIN (JICA Expert Team)
Step④	Revised reference manuals shall be authorized by NAPTIN's management	NAPTIN (JICA Expert Team)

4.4 Details of contents to be added to the existing courses (1)



	Theme	Detail of contents	NAPTIN's course title	Contents added to existing courses
Loss Reduction	Specific and concrete calculation method and calculation example of technical loss	(Classroom) Loss calculation methods based on various load distributions (Classroom) Transformer loss (copper loss, iron loss) calculation methods using transformer data	POWER SYSTEM NETWORK LOSS MANAGEMENT (ATC&C LOSSES)	- Transformer loss (copper loss, iron loss) calculation methods using transformer data - Loss calculation methods based on various load distributions
	Technical loss reduction method and evaluation of effect	(Classroom) Types of loss reduction methods by improving the load flow in distribution system, such as splitting feeder and improving connection of distribution line (Classroom) Selection method of the efficient implementation of them (Classroom) How to grasp and understand the effects of the countermeasures	POWER SYSTEM NETWORK LOSS MANAGEMENT (ATC&C LOSSES)	Types of loss reduction methods
	Example of loss reduction implementation by splitting distribution lines	(Classroom) As an example of the above measures, an example of a pilot project is introduced along with technical data.	POWER SYSTEM NETWORK LOSS MANAGEMENT (ATC&C LOSSES)	Loss reduction implementation by splitting distribution lines (AEDC-JICA Case study)
	The necessity of phase testing	(Classroom) Explanation of defects by phase unmatch, such as reverse rotation of a motor (Practical) How to use phase tester	PROTECTION CONTROL & METERING (P C & M) COURSE	—
Improvement of Quality	Voltage drops, Ferranti effects	(Classroom) Explanation of the calculation method of voltage drops, the Ferranti effects, and the voltage rise principle by distributed generators, and explanation of general countermeasures	POWER SYSTEM NETWORK LOSS MANAGEMENT (ATC&C LOSSES)	Explanation of the calculation method of voltage drops, Ferranti effects, and voltage rise principle by distributed generators
	Harmonics, Flickers	(Classroom) Explanation of the reason why harmonics and flickers occur (Classroom) Explanation of harmonics and flickers mitigation measures	POWER SYSTEM NETWORK LOSS MANAGEMENT (ATC&C LOSSES)	Harmonics & flickers

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4.4 Details of contents to be added to the existing courses (2)



	Theme	Detail of contents	NAPTIN's course title	Contents added to existing courses
Improvement of Reliability	Fault detecting method (for overhead line)	(Classroom) Theory of detecting (Classroom) Detecting Device (Practical) Fault detecting training using Hipotronics and 10kV megger	Overhead line maintenance	Theory of fault detection and detection device
	Fault detecting method (for underground line)	(Classroom) Theory of detecting (Classroom) Detecting Device (Practical) Fault detecting training using Hipotronics and 10kV megger	Cable jointing and termination	Fault detecting training using Hipotronics and 10kV megger
	Failure cause and inspection method of distribution equipment	(Classroom) Mechanism of failure of distribution equipment (Classroom) Efficient way of inspection (Classroom) Where to look with attention on patrol (Practical) Inspection training (Practical) Patrol training	Already embedded in our Distribution Line Maintenance course	—
	Analysis of outage record and countermeasure	(Classroom) Way of outage recording, so that the analysis can be done easily and effectively (Classroom) Analysis of root cause based on the outage record (Classroom) Appropriate countermeasure based on the analysis result	Already embedded in Distribution Substation Operation course	—
	Preventive Maintenance Concept	(Classroom) Planned and regular work according to predetermined standards and procedures (Classroom) Objectives include not only preventing machinery and equipment from breaking down, but also extending the life of machinery and other equipment, reducing downtime, and preventing losses due to sudden breakdowns. (Classroom) Repair or replacement of parts that make up machinery and equipment	Already embedded in Distribution Line Maintenance course	Preventive maintenance of distribution transformer is to be added

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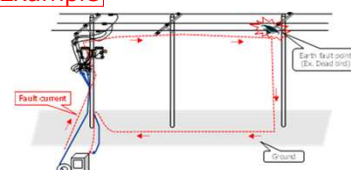
1. Calculation of technical loss

- ## 2. Causes of technical loss and countermeasures

- ### 3. Power phase detection

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Example



10.2 Supports

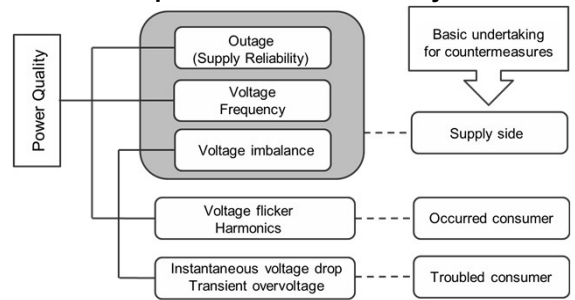


4.5 New training contents on power quality improvement

Theme: Voltage drops, Ferranti effects, Harmonics and Voltage flickers

- Electricity should be supplied within the voltage range. It is very important to recognize the supply voltage range. Voltage drop is also a quantity associated with voltage, but it is not the same as voltage. In AC system, the voltage drops are due to the combined effects of resistance, inductance and capacitance. Calculation method of voltage drops is explained and simple calculation of voltage drops using Excel is exercised by trainees.
- The effect in which the voltage at the receiving end of the transmission/distribution line is higher than the sending voltage is known as the **Ferranti effect**. Such type of effect mainly occurs because of light load or open circuit at the receiving end. Causes, influence and countermeasures of Ferranti effects are described.
- The fundamental waveform is altered by harmonics, which are undesirable higher frequencies overlaid on it. A harmonic is a wave or signal whose frequency is an integral (whole number) multiple of the frequency of the same reference signal or wave. Causes, influence and countermeasures of Harmonics are described.
- Voltage flicker is a phenomenon in which the distribution voltage continuously repeats periodic fluctuations for a short time due to load fluctuations and may cause adverse effects such as flickering of lighting and malfunction of equipment. Causes, influence and countermeasures of Voltage flickers are described.

Outline Components of Power Quality



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4.6 Schedule of improving NAPTIN's training courses

Activities	Responsible		2022		2023				2024				2025
	NAPTIN	JET	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3
Finalize training contents to be added	◎	◎	←→										
Revision work of training materials	◎		←→										
Develop teaching methods and curriculum for revised training courses	◎	◎				←→	←→						
Pre-training①	◎					←→	←→						
Training course evaluation and feedback		◎						←→					
Pre-training②	◎							←→					
Training course evaluation and feedback		◎							←→				
Launch new training courses	◎											←→	

←→ JET (JICA Expert Team)

←→ NAPTIN

Second trip

Third trip

Fourth trip

Fifth trip

Sixth trip

Seventh trip

About 1.5 months/ trip

About 1.0~0.5months

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4.7 Distribution training facilities for practical training (1)

Facilities/ equipment	Quantity	Training contents (Proposed)
33kV overhead distribution line	1+3 Lines	Exploration of a fault point Line construction, Line stringing, Line maintenance, Line replacement, Line patrol Replace and maintenance work of equipment (Cross arm, Insulator, Conductor, etc.) Trial use of bolt-type connectors and conductor covers
33kV underground distribution line	1 Line	Exploration of a fault point Cable Jointing, Cable laying techniques, Cable maintenance, Cable replacement, Cable termination
33kV to Low voltage transformer	1 Unit	Maintenance, Testing, Measurement, Assembly of transformer, feeder pillar and lightning arrester Line construction, Line stringing, Line maintenance, Line replacement, Line patrol
33kV section switch (Load breaking switch)	2 Units	Maintenance, Replacement, Operation (Fault tracing needs sectionalizing using section switches.)
33kV overhead distribution line (Short pole zone)	2 Lines	Basic training for replace work and maintenance work of equipment repeatedly (This will enable work on the ground without using a ladder.)

4.7 Distribution training facilities for practical training (2)

Facilities	Quantity	Training contents (Remarks)
Hipotronics (Cable fault locator)	1 Unit	Training in the use of instrument (High-end portable standalone cable fault location unit) Exploration of a fault point for overhead distribution line and underground distribution line
Phase detector	1 Unit	Training in the use of instrument (using a live line nearby)

< Hipotronics >

STX40-P

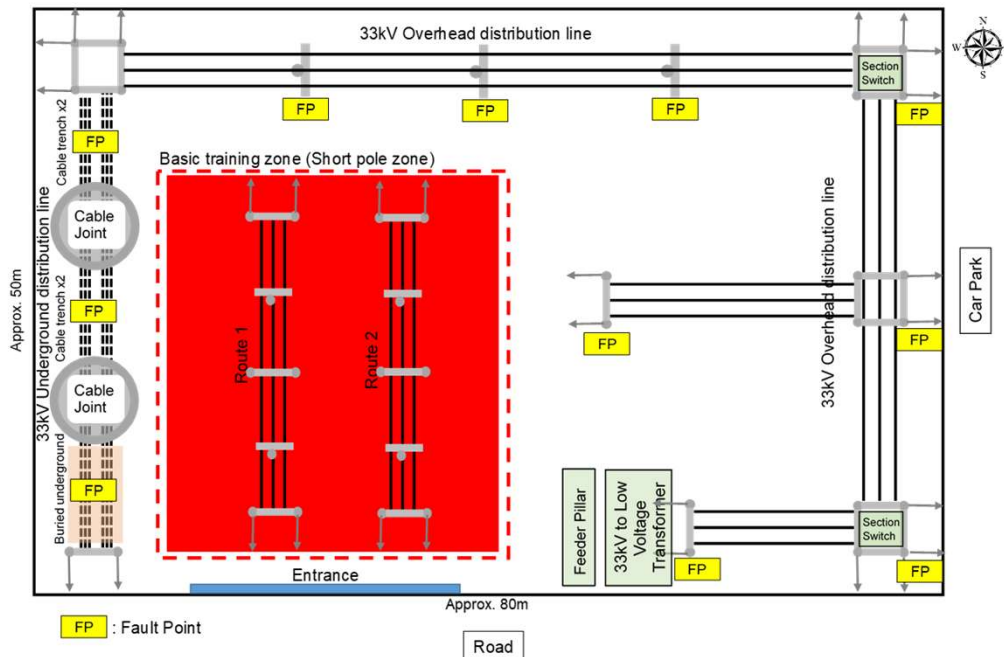
High-end portable standalone
cable fault location unit

Megger

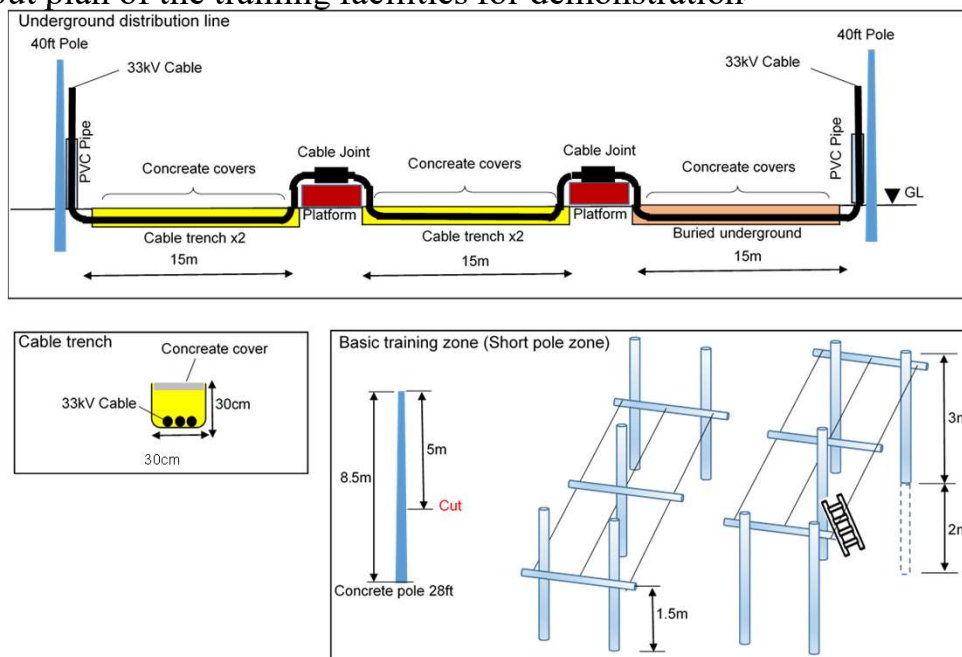


- Field-ready design, IP 43
- Software-based user interface with single "turn & click" rotary knob control
- Fully automatic operation of all modes via motorised switching
- Physically and functionally integrated Radar/TDR (Teleflex® RDR)
- Prelocation methods: ARM, ICE and DECAY
- Best Picture Multishot technology: 32 HV fault traces per ARM shot and instant display of the best trace
- DC test and burning up to 40 kV, surging (thumping) up to 32 kV, delivers 2,000 J
- Safety interlocks for monitoring of station earth and touch potentials (F-U), as well as earth connections (F-Ohm)

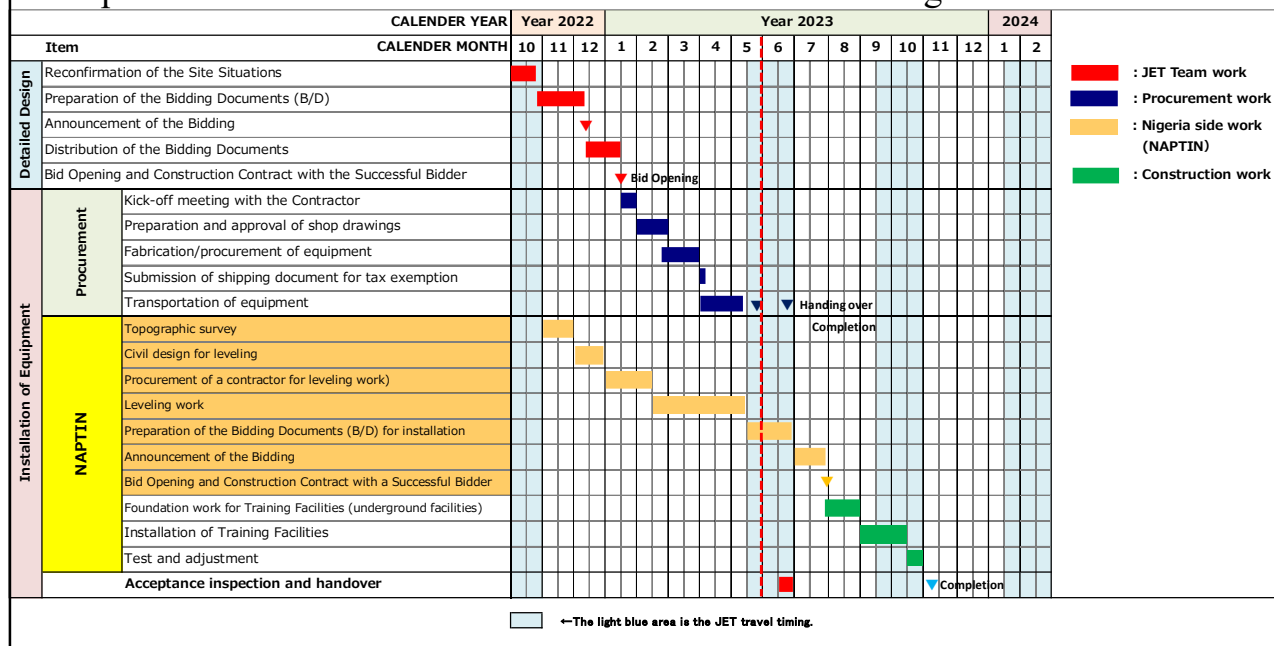
< Layout plan of the distribution training facilities>



< Layout plan of the training facilities for demonstration>



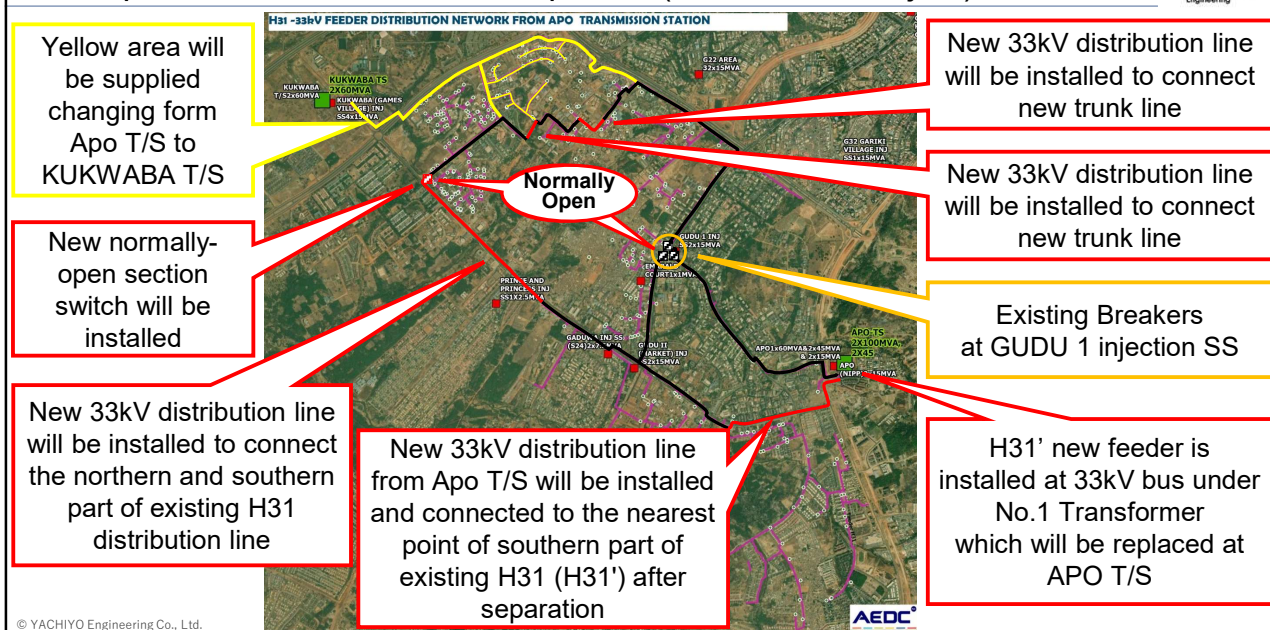
< Implementation schedule for NAPTIN distribution training facilities>



5. Activities with AEDC

- (1) Baseline survey
- (2) Pilot project→ 5.1
- (3) Improvement of AEDC's business operation →5.2
- (4) Incorporate pilot results into business operation

5.1 Separation of H31 Feeder in Apo T/S (AEDC Pilot Project)



5.1 Effect of the Pilot Project

1. Technical loss reduction

- > Improvement (reduction) of load flow by separation of H31 feeder in Apo T/S
- > A source of power supply to some area such as Durumi area, Anebo Okekenta Street will be switched from Apo T/S to KUKWABA T/S which is close to the demand area
- * Conductors of H31 feeder from Apo T/S to GUDU1 Injection Substation have already been replaced from ACSR 70mm² and 100mm² to 150mm² by the original PIP Project.

2. Quality improvement

Voltage drop, one of the critical challenges in terms of quality, will be improved at the same time by implementing technical loss reduction measures.

3. Reliability improvement

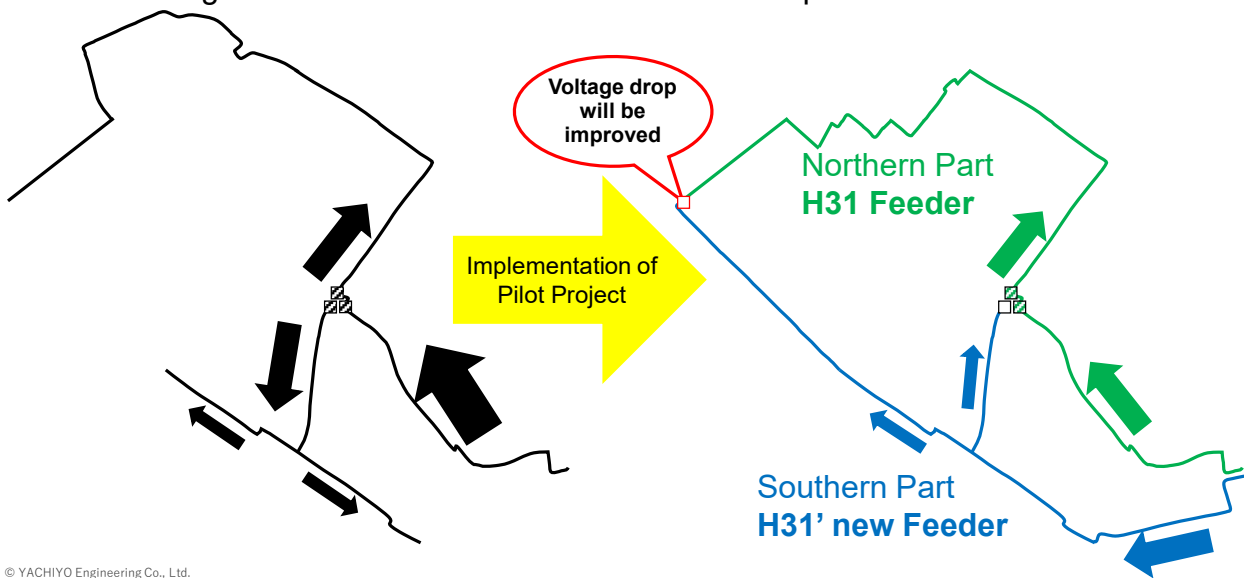
- (1) Reduction of outage frequency
 - > Reduction of forced outages due to vegetation by introducing conductor covers
 - > Reduction of forced outages due to Jumper cut by introducing Volt type connectors
- (2) Reduction of outage duration
 - > Acceleration of partial charging in outages by introducing section switches
 - > Reduction of time for fault point detection by introducing the volt type connectors

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5.1 Image of technical loss and voltage drop reduction

<<Existing H31 Feeder>>

<<After separation of H31 Feeder>>

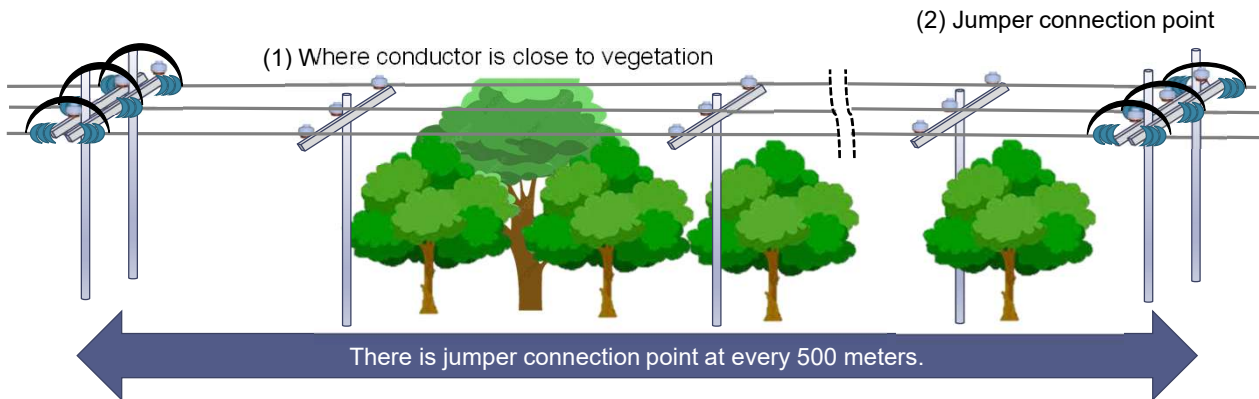


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5.1 Reliability improvement (1) Reduction of outage frequency

Our proposal is... to install some equipment which will help to improve the reliability at

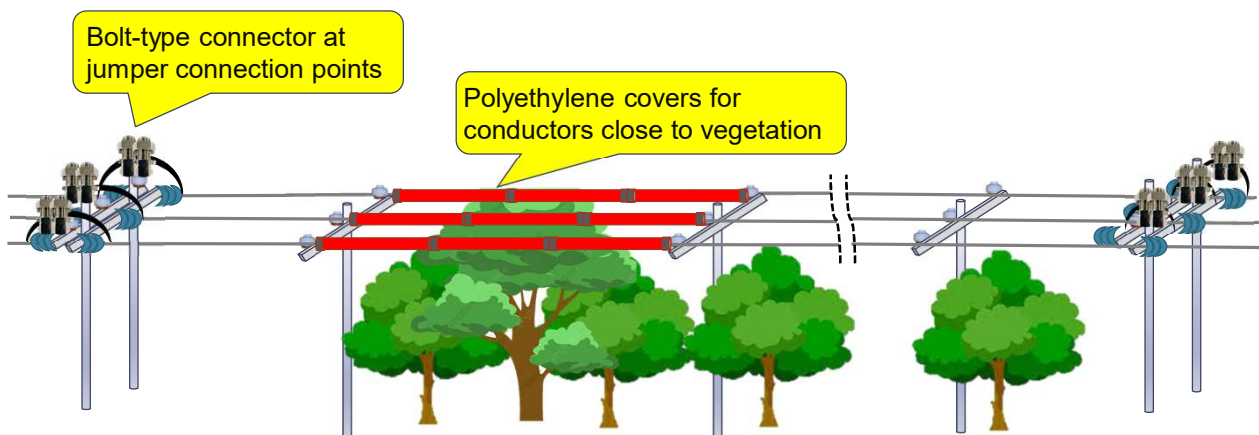
- (1) Where conductor is close to vegetation
- (2) Jumper connection points



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5.1 Reliability improvement (1) Reduction of outage frequency

Image of installation



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NEMSA's provisional approval for Split Bolt Connector and Conductor Cover



NEMSA/TS/004/III/233
24th May, 2023.

The Chief Advisor,
JICA Expert Team,
Yachiyo Engineering Company
Tokyo, Japan.

**RE: REQUEST FOR CAPACITY DEVELOPMENT APPROVAL FOR THE
USE OF CONDUCTOR COVERS AT 33KV DISTRIBUTION NETWORK
(AT JICA PROJECT)**
PROVISIONAL Approval of:

I am directed to refer to our earlier provisional approval No: NEMSA/TS/TS&IS/0146/S.1/III/T1/6 dated 6th January, 2023 on the above subject matter and to inform you that we have reviewed your last submission containing the test conducted on the conductor cover which aligns with the prescribed 32kV as the minimum withstand test voltage by the American society of testing and materials (ASTM-F712-06) and IEC 61479 for conductor covers to be deployed for use in 36.6kV networks.

2. In view of the foregoing, a Provisional Approval is hereby granted for the use of the 33kV conductor covers and split Bolt connector in your pilot project only and this provisional approval supersedes the earlier approval No: NEMSA/TS/TS&IS/0146/S.1/III/T1/6 dated 6th January, 2023 granted for the material.

3. Kindly note that, you are to provide permanent engrave marking on the conductor covers to indicate its operational voltage and a sample be brought to the Agency for sighting.

4. Having regard to the above, the issuance of the final certification will be carried out on compliance with the recommendation highlighted at paragraph (3) above.

5. Grateful, take note of the above for your information and necessary action.

Engr. Shuaibu Usman
Executive Director, Technical Services.
**For: Managing Director /CEO &
Chief Electrical Inspector of the Federation.**

JICA Expert Team conducted voltage withstand tests for conductor covers to prove its adequacy for 33kV distribution network in Nigeria.

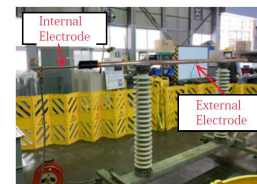
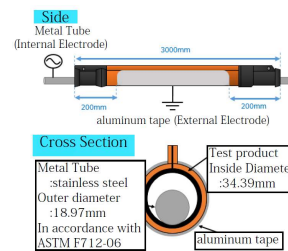


Figure 1 Installation condition of test product

Photo 1 Test Scene

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5.1 Reliability improvement (1) Reduction of outage frequency

Polyethylene covers for conductors close to vegetation

[What is it?]

- This cover prevents conductor from hitting or making contact with the vegetation or branches of trees.
- 1 piece of it can be tightly connected to another one.
- Made of polyethylene, it is light and robust.
 - Weight: 1kg/piece
 - Length: 3m/piece



In Japan, this kind of cover is also used to inform that there is high voltage conductor at construction sites and to prevent workers or cranes from getting closer to the conductor.

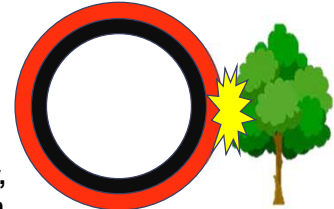
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5.1 Reliability improvement (1) Reduction of outage frequency

Polyethylene covers for conductors close to vegetation

[When it has to be replaced]

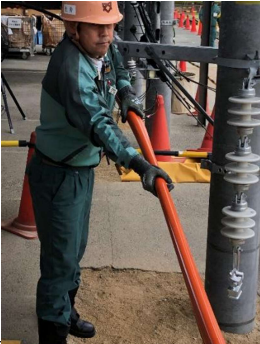
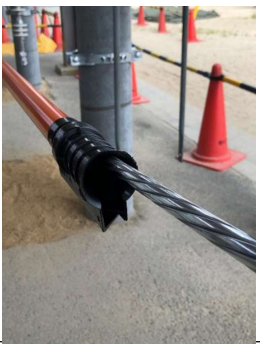
- Since this cover has “double-layer” structure (as shown on the right), and they are colored differently.
- The outer layer will be worn out due to friction with vegetation.
- When inner layer, of which color is different from that of outer layer, can be seen from outside (as shown below), it means the insulation performance is significantly reduced. Therefore it is time for the cover to be replaced.



Inner layer that can be seen from outside

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5.1 Workability verification at Gwagwalada for polyethylene conductor cover

Step	1) Make it “bite”	2) Install	3) Connect	4) Finish
Photo				
Remark	Open the insertion point wide, and make it “bite” the conductor	Install the cover to the conductor, like holding the conductor with the cover.	Connect them tightly.	Inner diameter is 35mm, which is enough for 150mm ² conductor.
Result of Workability	Good	Good	Good	Good

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5.1 Reliability improvement (1) Reduction of outage frequency

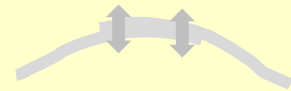
Connection and disconnection at Jumpers by bolt type connector

<<Status quo (Binding connection)>>

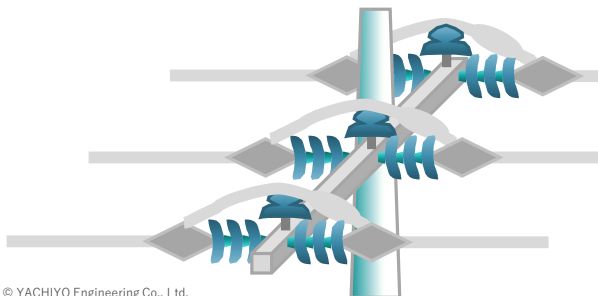


Using at all
or part
jumpers

<<Bolt type connector>>



Bolt type connectors
are installed at two points
to connect Jumpers



Advantage of Bolt type connector

- > Can repeatedly disconnect and connect without replacing a jumper
- > Anyone can do this work (Skill less)
- > Stable the joint quality
- > No special tools required to work
- > Specification
Weight: 693g/piece, Length: 70mm/piece

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5.1 Measurement of working times to disconnect and connect jumpers

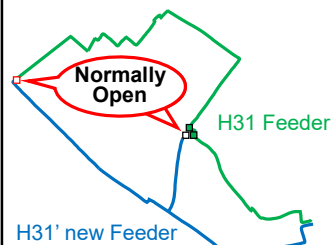
Contents of works		Working times (second)				Result of Workability	Remarks
		Over Jumper		Under Jumper			
Jumper using conventional connectors	Disconnecting Jumper	1min. 30sec.	1min. 3sec.	1min. 8sec.	1min. 43sec.	Good	Measurement was conducted at training pole yard of AEDC at Gwagwalada on 14 th October 2022
	Connecting Jumper	1min. 1sec.	1min. 9sec.	1min. 43sec.	1min. 40sec.	Good	
Jumper using bolt type connectors	Disconnecting Jumper	15sec.	20sec.	16sec.	32sec.	Good	Measuring working times are two times for each condition. Jumper connecting and disconnecting works were carried out by two linesmen standing on the ground.
	Connecting Jumper	32sec.	42sec.	36sec.	1min. 15sec.	Good	

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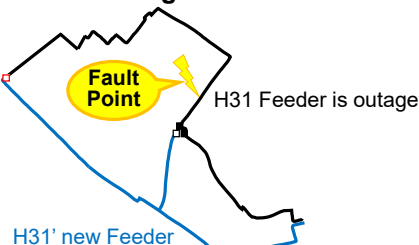
5.1 Reliability improvement (2) Reduction of outage duration

Partial charge for healthy sections when outage was occurred

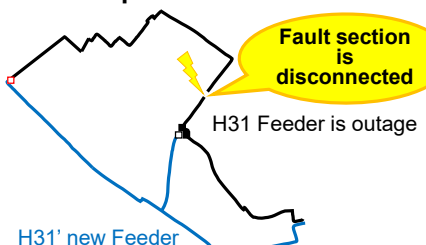
<<0. Normal state>>



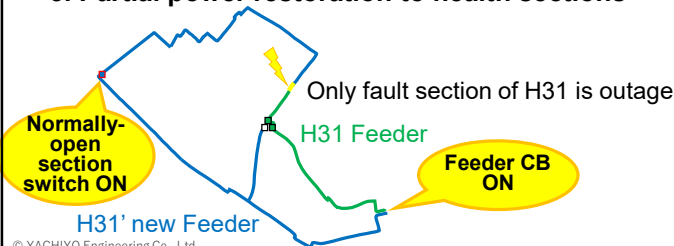
<<1. When outage occurred>>



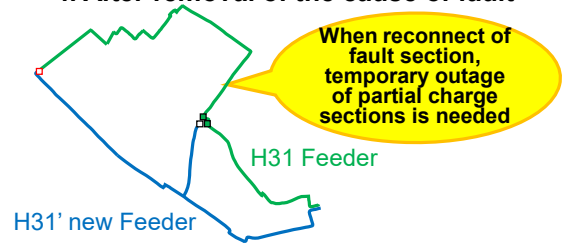
<<2. Fault point was detected>>



<<3. Partial power restoration to health sections>>



<<4. After removal of the cause of fault>>



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5.1 Indicators to assess the effect of Pilot Project

In order to grasp and understand the effect of the pilot project, the following items will be carried out.

	Method	Remarks
For technical loss	I. Calculation of the technical loss of H31 feeder in APO T/S by NEPLAN modeling software before and after pilot project	The before state of the pilot project is the state after implementation of the original PIP project.
For quality improvement	II. Measurement of the voltage at the end of H31 distribution line before and after pilot project (The detail is explained in next slide)	
For reliability improvement	III. Confirmation and analysis of outage data such as frequency and duration before and after pilot project.	III. and IV.
	IV. Recording the fault points of outages on distribution line map based on GIS data to prevent repeated outages occurred by similar fault causes.	Data collection period before pilot project is from November 2022 to April 2023, and after pilot project is from June to November 2023.
	V. Calculating "Converted duration" using transformers data (capacity and location) in injection substations and H31feeder collected from inventory and field. (The detail is explained in the other slides later.)	V. Investigation of Transformers should be done by April 2023. And calculating "Converted duration" should be done from June to November 2023.

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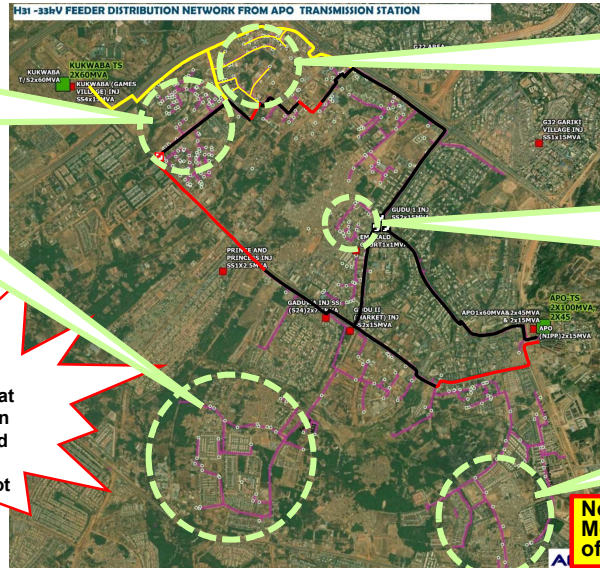
5.1 Measurement of voltage at the end of feeder

II. Measurement area of the distribution voltage (Measuring at a transformer in each five area)

Confirming voltage change at the end of distribution line

Confirming voltage change at the end of distribution line

Voltage measurements should be taken at the peak hours in same power load season before and after the pilot project.



Grasp and understand the effect of load transfer in this area from Apo T/S to KUKWABA T/S

Grasp and understand the effect only of separation of trunk distribution line from Apo T/S to GUDU1 INJ SS

Confirming voltage change at the end of distribution line

Note: Measuring should be done a few points of each five measuring spot.

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5.1 Suggestion and Proposal for improvement

IV. Introduction of the new indicator: "Converted duration"

- If some healthy sections were energized before the complete restoration, this action does reduce the number of your customers that suffer from the outage. This new indicator "Converted duration" reflects such an action.

- Converted duration is defined as follows:

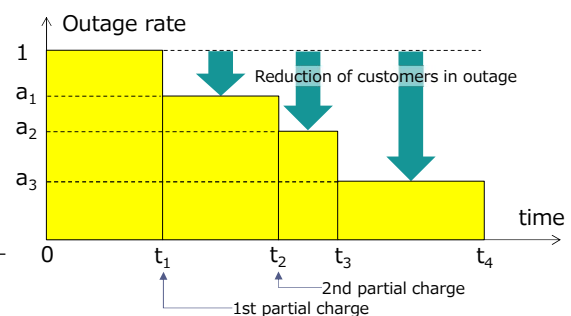
$$\text{Converted duration} := t_1 + a_1(t_2 - t_1) + a_2(t_3 - t_2) + a_3(t_4 - t_3) + \dots$$

- $a_1, a_2, a_3, \dots$
mean Outage rate*
- $t_1, t_2, t_3, \dots$
mean the time of energizing partially
- Converted duration is equal to the area of the yellow region in the right graph.

*Outage rate is defined as follows:

$$\text{Outage rate} := \frac{\text{Number of customers in outage}}{\text{Number of all customers}}$$

Let's see a concrete example from the next page.



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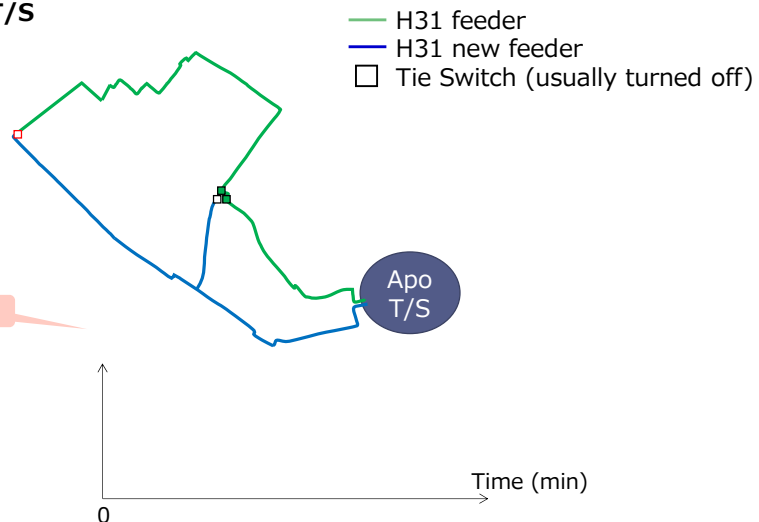
5.1 Suggestion and Proposal for improvement

IV. Introduction of the new indicator: "Converted duration"

Example: Pilot project at Apo T/S

Step 0) Usual state

No outage has occurred.



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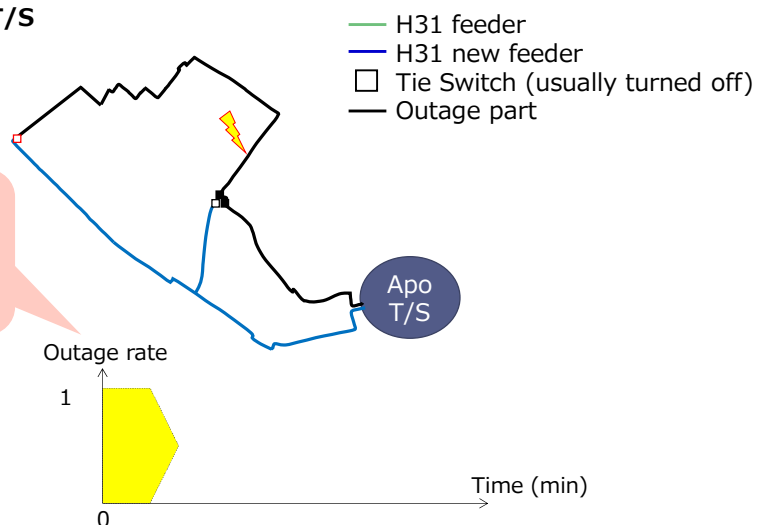
5.1 Suggestion and Proposal for improvement

IV. Introduction of the new indicator: "Converted duration"

Example: Pilot project at Apo T/S

Step 1) Outage occurs, CB at T/S turned off and whole the H31 feeder is in outage.

Outage occurred. Now the whole feeder is in outage, therefore the outage rate is 1 (that means 100% of the customers is in outage).



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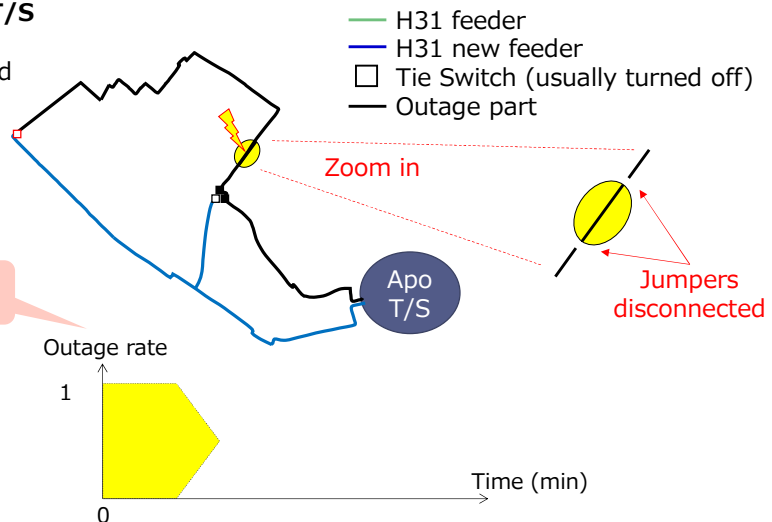
5.1 Suggestion and Proposal for improvement

IV. Introduction of the new indicator: "Converted duration"

Example: Pilot project at Apo T/S

Step 2) Fault point is detected and isolated.

Outage remains, so the outage rate is still 1 (100%).



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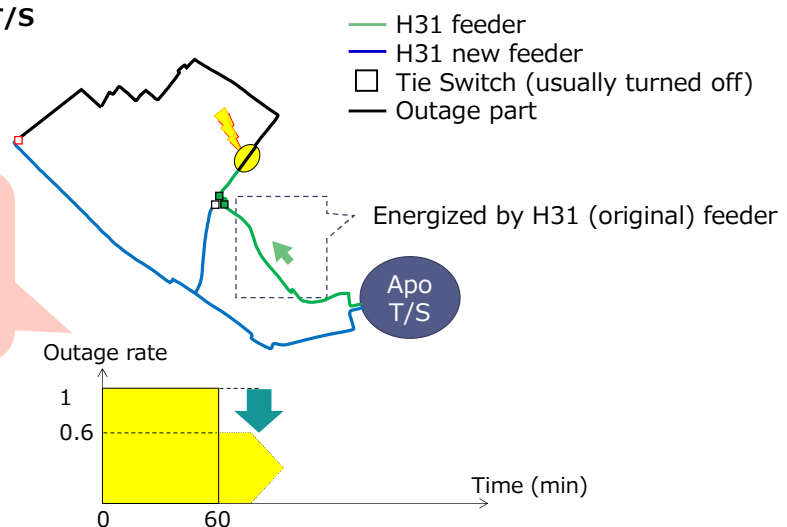
5.1 Suggestion and Proposal for improvement

IV. Introduction of the new indicator: "Converted duration"

Example: Pilot project at Apo T/S

Step 3) Healthy sections on the **source side** are energized by the current of the **original** direction.

Assume that it was 60min after the outage occurred that T/S CB was turned on, and outage rate became 0.6. (that means 40% of the all customers was restored)



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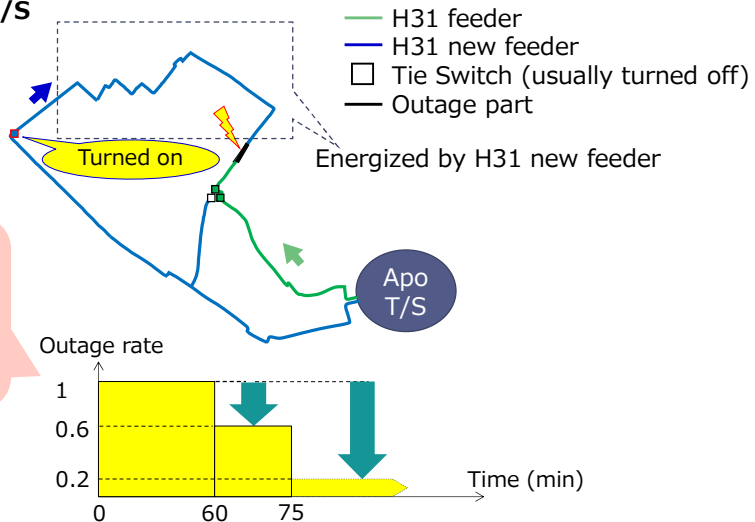
5.1 Suggestion and Proposal for improvement

IV. Introduction of the new indicator: "Converted duration"

Example: Pilot project at Apo T/S

Step 4) Healthy sections on the **load side** are energized by the current from the H31 **new** feeder, by turning on the tie switch. **Now the outage area is minimized.**

Assume that it was 75min after the outage occurred that the tie switch was turned on, and outage rate became 0.2. (that means 80% of the all customers was restored)



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5.1 Suggestion and Proposal for improvement

IV. Introduction of the new indicator: "Converted duration"

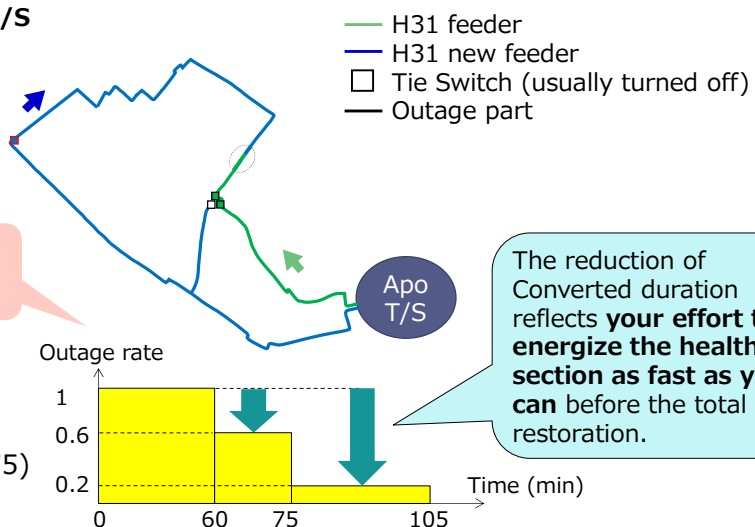
Example: Pilot project at Apo T/S

Step 5) Fault point was removed and the whole the H31 feeder is energized. (Then the current direction becomes back to the original state.)

Assume that the whole feeder was energized after 105min after the outage occurred

■ **Total duration = 105min.**

■ **Converted duration**
= $60 + 0.6 \times (75 - 60) + 0.2 \times (105 - 75)$
= **75min.**



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5.1 Suggestion and Proposal for improvement

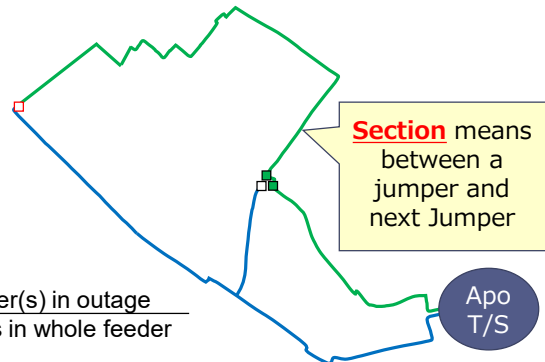
Calculation method of Outage rate

Usually Outage Rate is defined as follows:

$$\text{Outage Rate} := \frac{\text{Number of customers in outage}}{\text{Number of all customers}}$$

However, since it is difficult to ascertain the number of customers in each **section**, the following calculation is performed as an alternative index.

$$\text{Alternative Outage Rate} := \frac{\text{Subtotal capacity of transformer(s) in outage}}{\text{Total capacity of all transformers in whole feeder}}$$



<Investigation Sheet of the capacity of transformers >

Investigation Sheet of 33kV transformers which are located in H31 distribution line and in injection substations supplied from H31 feeder

Must (Mandatory input item)			If possible	Must	If possible (If data are readily available in the field)				If possible			
Section No.	Location	Target Transformer or Substation	Installation Point (GIS data)	Capacity (kVA)	Manufacture name	Product Year	Number of Tap	Current Tap	Primary Voltage	Secondary Voltage	Remarks	
1	H31 distribution line	33kV/LV Transformer					3-7?		33kV			
1	H31 distribution line	33kV/LV Transformer							33kV			
	H31 distribution line	33kV/LV Transformer							33kV			
	H31 distribution line	33kV/LV Transformer							33kV			
	H31 distribution line	33kV/LV Transformer							33kV			

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< Implementation schedule for AEDC pilot project >

<Note>
 Field Work of JICA Expert Team (JET)
 Procurement of some equipment by JET
 Bidding for construction by AEDC

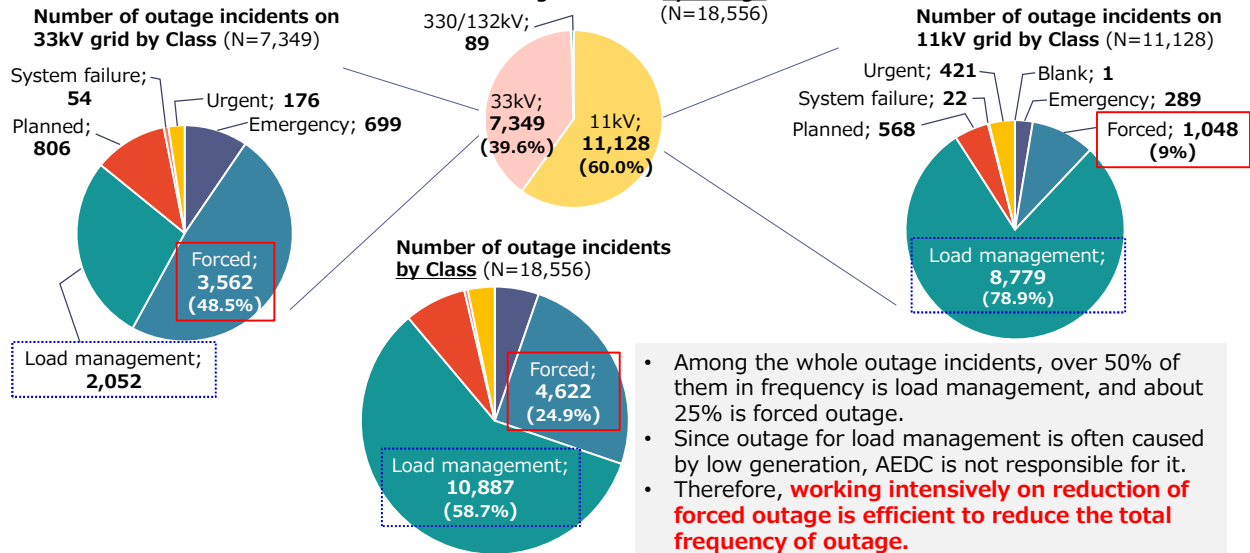
Activities	Responsible		2022			2023				2024				2025
	AEDC	JET	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q
Selection	○	○	↔											
Basic design	○	○		↔										
Preparation of BD	○	○		↔	↔									
Agreement by JCC	○	○		▲		↔	↔							
Bid announcement	○	○			↔	↔	↔							
Bid opening	○	○				↔	↔							
Procurement	○	○					↔	↔						
Handover of equipment	○	○					▲							
Construction	○	○					↔							
Monitoring	○	○			↔	↔	↔	↔	↔					
Incorporation into training	○	○								↔	↔	↔	↔	

Partial schedule of Selection period of Pilot Project

			Year 2022			Year 2023					
	AEDC	JET	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	
Preparation of Bidding document	○	○									
Bid announcement and Bid opening	○	○									
Manufacturing and handover of equipment	○	○									
Construction	○	○									
Calculation and measurement of indicators	○	○									

5.2 Outage data analysis

[Analysis of outage data]



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5.2 Outage data analysis

~Identification of feeders suffering frequent outage~

[Analysis of outage data] Example of outage analysis from perspective of "FREQUENCY"

Top 5 feeders of Forced outage (33kV)

	Region	Station	33kV Feeder	Freq.	Ratio
1	FCT South-South	Kukwaba	KUKWABA_L32_PL_PL	512	14.4%
2	FCT South-South	Gwagwalada	GW_L31_PL_PL	349	9.8%
3	FCT South-South	Gwagwalada	GWAGWALADA TS_L36	339	9.5%
4	FCT South-East	Kukwaba	KUKWABA_L31_PL_PL	317	8.9%
5	FCT South-South	Apo	AT3_H21	190	5.3%

47.9%

Intensive countermeasures over these feeders might reduce the FREQUENCY of the entire forced outage efficiently.

Top 5 feeders of Forced outage (11kV)

	Region	Station	33kV Feeder	11kV Feeder	Freq.	Ratio
1	FCT Central	Apo	AT3_H1	FD2	116	11.1%
2	FCT North	Suleja	AT6 SULEJA TS_JIWA FDR	FD1	82	7.8%
3	FCT Central	Katampe	AT2_MBP	RM 1A	60	5.7%
4	FCT Central	Katampe	AT2_WUSE 11 FDR	RM 3B	45	4.3%
5	FCT Central	Central Area	AT5_CENTRAL AREA_FD3	FD3	44	4.2%

33.1%

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5.2 Outage data analysis

~Identification of feeders suffering long outage duration~

[Analysis of outage data] Example of outage analysis from perspective of “**DURATION**”

Top 5 feeders (33kV) of Forced outage

	Region	Station	33kV Feeder	Ave. duration (H)
1	Kogi	Lokaja	AJAOKUTA_ANYIGBA_PL_PL	11.1
2	FCT South-South	Apo	AT3_H21	8.9
3	FCT East	Karu	AT9 KARU TS_K5	8.1
4	FCT North	Suleja	AT6 SULEJA TS_JIWA FDR	6.4
5	FCT South-South	Apo	AT3_H23_PL_PL	5.5

Intensive countermeasures over these feeders might **reduce the DURATION** of the entire forced outage efficiently.

Top 5 feeders (11kV) of Forced outage

	Region	Station	33kV Feeder	11kV Feeder	Ave. duration (H)
1	FCT East	Apo	AT3_H5	FD 6A	649.8
2	FCT North	Central Area	AT5_FDR 8	RM 5B	11.2
3	FCT Central	Central Area	AT5_CENTRAL AREA_FD3	FD4	10.1
4	Niger	Minna	MINNA TS_MAIKUNKELE	TUDUN FULANI	9.3
5	Niger	Minna	MINNA TS_POWER HOUSE	MAITUMBI	8.0

5.2 Outage data analysis

~Improvement of Outage Management System~

CURRENT CIRCUMSTANCE (1)

- There were two different systems that AEDC uses to register the outage incidents, namely, **Fault Reporting Dashboard**, and **Outage Management System**.

	Fault Reporting Dashboard	Outage Management System
Voltage	Only 33kV	11kV, 33kV, 132kV, and 330kV
Class of Outage	Forced and Established (Transient is not involved)	Forced, Planned, Load shedding, and any other
Registered by	HQ	Region
Nature of fault can be exported to Excel?	Yes	No
Root cause can be exported to Excel?	Yes	No

From perspective of quantitative and efficient analysis, it is very important for us to be able to **deal with data on Excel** or any spreadsheet.

5.2 Outage data analysis

~Improvement of Outage Management System (2)~

CURRENT CIRCUMSTANCE (2)

- Among the **4,274** incidents from **Fault Reporting Dashboard**, "Nature of Fault" of **4,228** were "**OTHER**". This is **98.9%** indeed, as the right table shows.
- Looking at Root Cause of those 4,228 incidents whose "Nature of Fault" is "OTHER", there are **over 500 Cable problems, over 300 Jumper problems, over 300 Vegetation and Animal bridges, over 100 Wire problems**, and so on.

Proposed improvement

- To modify Outage Management System so that "Nature of Fault" and "Root Cause" can be exported to Excel format.
- To change options of "Nature of Fault" and "Root Cause" in their drop down menu so that operators can chose the most suitable answer from the menu and avoid selecting "Other".
- AEDC has developed new Outage Management App.

Nature of Fault	Num.
TRANSFORMER FAULT	16
CIRCUIT BREAKER FAULT	11
CABLE FAULT	5
JUMPER CUT	4
WIRE CUT	3
POLE BROKEN	2
TRANSFORMER OIL LEAKAGE	1
INST. E/F	1
SHATTERED LIGHTNING ARRESTERS	1
RING MAIN UNIT (RMU) FAULT	1
OTHER	4,228
(blank)	1
TOTAL	4,274

Thank you very much for your attention!

ナイジェリア国配電分野能力向上プロジェクト(第 1 回技術研修) 実施報告書

1. 研修の概要

(1) 研修名称及び研修期間

研修名称	ナイジェリア国配電分野能力向上プロジェクト(第 1 回技術研修)
研修期間	2023 年 7 月 23 日 (日) から 8 月 5 日 (土) まで (移動日含む)
研修員人数	13 名

(2) 研修目的

研修目標：配電分野の業務体制、業務実施方法等に係る知識・スキルの向上を図る。

- ①ロス低減・信頼度向上・品質改善を図るため具体的にどのような業務があり、どのように行われているかを理解し、今後のナイジェリアでの電気事業の改善に反映する。
- ②日本の電力会社において業務を的確に遂行するための人材育成の仕組みがどのようになっているか、スキル向上をどのように行っているかを理解し、ナイジェリアで NAPTIN 研修コースを通じた Disco の人材育成に反映させる。
- ③日本の電力会社の配電研修設備及び研修内容を理解することにより、NAPTIN の配電研修設備の設置および研修への活用が適切に実施される。
- ④日本の電力会社での停電縮小への取組み（区分開閉器による停電縮小、配電線自動運用の仕組み、運用方法等）を理解することにより、AEDC パイロットプロジェクトの効果、Outage Management System (OMS)の改善の効果をより具体的に理解し、AEDC パイロットプロジェクト、OMS の改善が適切に実施される。

(3) 研修日程

研修を表 1 の研修日程で実施した。（資料 1 参照）

表 1 研修日程表

日付	時間	研修内容	場所
7/25 (火)	9:00-10:00	JICA ブリーフィング	JICA 関西
	10:00-12:00	プログラム・オリエンテーション	
	13:00-17:00	事前課題発表	
7/26 (水)	9:15-11:45	配電会社の社員育成計画策定の考え方と概要	関西電力送配電 (株) 配電研修センター[茨木]
	14:30-17:30	配電資機材の品質管理と不具合原因調査	関西電力送配電 (株) 技術試験センター
7/27 (木)	10:00-12:00	配電営業所(主に信頼度向上)の業務内容	関西電力送配電 (株) 阪神配電営業所
	13:00-16:20	配電営業所での現場作業(伐採、巡視) 質疑応答、意見交換	
7/28 (金)	12:00-13:20	伝統建築物見学による日本文化理解	彦根城
	14:00-16:00	日本メーカーの製造技術と製造品質管理	大東電材 (株) 彦根事業所

7/31 (月)	9:00-12:00	配電エンジニアリングセンターでの配電技術者育成および広域応援の役割と業務	関西電力送配電（株） 大阪南エンジニアリングセンター
	14:00-17:30	配電研修センターでの実技訓練設備と訓練方法	関西電力送配電（株） 配電研修センター[住之江]
8/1 (火)	9:00-12:00	工事会社の施工品質 (特別高圧地中ケーブル工事現場視察) ・工事内容：特高ケーブル取替工事	(株) きんでん 尼崎市および三田市内(現場)
	13:30-16:30	工事会社の施工品質 (架空配電線工事現場視察) ・工事内容：河川横断電線張替工事、常開区分開閉器吊り替え工事	
8/2 (水)	9:00-12:00	工事会社における技能維持・向上教育 教育訓練施設の視察	(株) きんでん きんでん学園
	14:00-17:00	成果発表資料準備	JICA 関西
8/3 (木)	10:00-12:00	成果（アクションプラン）発表	JICA 関西
	13:00-17:00	成果（アクションプラン）発表	
	17:00-17:40	閉講式	

(4) 参加者

a. ナイジェリア側研修員

ナイジェリア側研修員を表2に示す。

表2 研修員一覧

写真	氏名	組織	役職
	Mr. OKEKE Chukwudum Arinze	NAPTIN	Training Programme Technical Assistant to the Director General
	Mr. BAWA Garshima Gamiya	NAPTIN	Training Programme Senior Instructor
	Ms. ILEDARE Lynda Oifo	NAPTIN	Training Programme Senior Instructor (Electrical)
	Mr. KHALIL Yusuf Adamu	NAPTIN	Training Programme Chief Instructor (Electrical)

写真	氏名	組織	役職
	Mr. LAWAL Murtala Yabo	NAPTIN	Training Programme Principal Instructor (Electrical)
	Mr. AMOBI Ifeanyi Chinedu	AEDC	MD / Office – Technical / Commercial Technical Assistant to MD
	Mr. RUFAl Taofeeq Kola	AEDC	Network Planning and Investment Senior Officer (System Performance)
	Mr. OBUYE Frederick	AEDC	Technical services (Operation and Maintenance) Assistant Manager
	Mr. AWONIYI Olumuyiwa Ajibola	AEDC	Technical Deputy Head, Network Planning Construction and Investment
	Mr. MBA Andy Chinenye	AEDC	Technical Services / Operations and Lines Assistant Manager
	Mr. KADIRI Abu	NERC	Engineering and Performance Monitoring Division Assistant General Manager
	Mr. DAVID Joshua	FMP	Distribution Service Department Senior Technical Officer
	Mr. ODIDI Christopher	FMP	Distribution Service Department Principal Technical Officer

b. 講師（研修受け入れ先機関）

研修受け入れ先機関の講師担当者（代表者）を表3に示す。

表3 研修受け入れ先講師担当者（代表者）一覧

氏名	組織	役職	講座等担当日
富田 有修	関西電力送配電（株） 配電研修センター[茨木]	配電研修センター所長	7/26AM
立花 裕也	関西電力送配電（株） 配電研修センター[茨木]	配電研修センター副長	7/26AM
稲井 学	関西電力送配電（株） 技術試験センター	技術試験センター所長	7/26PM
丹羽 厚太	関西電力送配電（株） 技術試験センター	技術試験センター係長	7/26PM
湯出口 幸久	関西電力送配電（株） 阪神配電営業所	配電営業所所長	7/27
大石 千亜生	関西電力送配電（株） 阪神配電営業所	配電営業所係長	7/27
土田 高志	大東電材（株）	社長	7/28
山口 卓弥	大東電材（株） 彦根事業所	彦根事業所所長	7/28
森口 健司	関西電力送配電（株） 大阪南配電エンジニアリング センター	大阪南配電 EC 所長	7/31AM
足立 努	関西電力送配電（株） 大阪南配電エンジニアリング センター	大阪南配電 EC 主任	7/31AM
穂塚 明久	関西電力送配電（株） 配電研修センター[住之江]	配電研修センター課長	7/31PM
光藤 隆二	関西電力送配電（株） 配電研修センター[住之江]	配電研修センター講師	7/31PM
伊藤 正征	（株）きんでん 電力本部 業務企画部	リーダー	8/1
池永 伊奈生	（株）きんでん 電力本部 業務企画部	副長	8/1
小林 光広	（株）きんでん 人材開発部	次長	8/2
黒田 吉彦	（株）きんでん 人材開発部	副長	8/2

c. コンサルタント

コンサルタントの参加者を表4に示す。

表4 コンサルタント参加者一覧

氏名	組織	役職	参加日
不二葦 教治	八千代エンジニアリング（株）	海外事業部 副事業部長	7/25、8/3
小枝 一彦	八千代エンジニアリング（株）	プロジェクトマネージャー	7/25、8/3
青柳 拓希	八千代エンジニアリング（株）	シニアアソシエイト	7/26～7/28
Agoboola Adebanke Monsurat	八千代エンジニアリング（株）	現地プロジェクトコーディネーター	7/25～7/28、 7/31～8/3

柏木 章弘	関西電力送配電（株）	マネジャー	7/25～7/28、 7/31～8/3
西木 清朗	関西電力送配電（株）	担当	7/25～7/28、 7/31～8/3
土井 和紀	（株）きんでん	課長	7/25、7/28、 8/1～8/3

（５）研修内容（概要）

研修内容を表５に示す。

表５ 研修内容

日付	場所	研修内容
7/26 (水)	関西電力送配電（株） 配電研修センター[茨木]	1. 配電部門の人財育成について ① 配電部門の教育体系 ② 配電部門のスキル管理 ③ 訓練設備の紹介 2. 新入社員教育施設、教育内容の視察 ① 外線実習場 ② 内線実習場 ③ 研修員寮
	関西電力送配電（株） 技術試験センター	1. 技術試験センターの概要 ① 技術試験センターの業務内容 ② 試験装置の紹介 2. 試験装置の実演 ① 商用周波数耐電圧試験装置 ② 碍子用高周波発生装置 ③ 衝撃電圧発生装置
7/27 (木)	関西電力送配電（株） 阪神配電営業所	1. 配電営業所の業務概要と停電の早期復旧 ① 配電部門の設備概要 ② 故障停電を発生させないための取組み ③ 故障停電を早期に復旧するための取組み ④ 配電自動化システム（DAS）の概要 2. 倉庫と工事車両の視察 ① 故障復旧用資材、機材、機器倉庫の見学 ② 保守業務用工事車両の見学 3. 現場作業視察 ① 樹木の伐採作業 ② モバイル端末を用いた配電設備巡視の方法
7/28 (金)	大東電材（株） 彦根事業所	1. 会社説明と取り扱い製品の紹介 2. 製品製作工程の説明 ① 射出成形 ② 押出成形 ③ 高周波ウエルダー加工
7/31 (月)	関西電力送配電（株） 大阪南エンジニアリング センター	1. 大阪南配電エンジニアリングセンターの概要と役割 ① 技能・技術の維持向上の取組み ② 中堅社員の育成 ③ 新入社員の育成 ④ 災害復旧応援 2. 作業訓練の視察 ① 保護具の点検

		② 台風を想定した高圧線断線修理 ③ 高所作業車を用いた変圧器の取替 ④ 工事車両の紹介、穴掘建柱車による掘削実演 ⑤ 電動工具の使用例
	関西電力送配電（株） 配電研修センター[住之江]	1. 研修設備の紹介 ① 訓練設備の概要 ② 配電線の事故事例、停電原因 2. 配電線事故のシミュレーション ① 事故時の自動区分開閉器の動作 ② 配電自動化システム（DAS）故障区間特定デモ 3. 訓練設備の視察 ① 架空配電訓練設備の紹介 ② 課電探査装置による配電線事故探査 ③ 地中配電訓練設備の紹介 ④ PV 連系設備の紹介 ⑤ 実際の低圧計器の紹介
8/1 (火)	(株) きんでん 尼崎市および三田市（現場）	1. 工事会社の施工品質 ① 特別高圧地中ケーブル工事現場視察 ・ 工事内容：特高ケーブル取替工事 ② 架空配電線工事現場視察 ・ 工事内容：河川横断電線張替工事、常開区分開閉器吊り替え工事
8/2 (水)	(株) きんでん きんでん学園	1. 人材開発部長挨拶と教育の紹介 2. 実習場概要および内容の説明

2. 実施結果についての所見

(1) プログラム・オリエンテーション、事前課題発表

a. プログラム・オリエンテーション

第1回技術研修の開講にあたって不二葦業務主任から挨拶を行った。研修員へ期待することを伝え、帰国後の「変革」への動機付けを行った。研修受け入れ先である関西電力送配電（株）（以下、「関西送配電」という。）、（株）きんでん（以下、「きんでん」という。）の会社概要説明（会社規模、組織、人員等）、及びナイジェリア（AEDC）と関西送配電の設備等事業環境の違いについて説明し、質疑応答、意見交換を実施した。研修員から関西送配電における送配電ロスの実績（5.3%:2021 年）について多くの質問があり、非常に関心が高いことが伺えた。また、柱上変圧器、地上変圧器の設備の詳細や電源構成、東日本と西日本の周波数が違う理由など、多くの質問があり、研修の予備知識として研修員の理解が深まった。

b. 事前課題発表

2023 年 5 月 18 日、本プロジェクトの第三次渡航中に AEDC 本社において第1回技術研修への参加者を対象として事前説明会を開催し、全研修員に対する事前課題として次の項目を記載したインセプションレポートを作成し、6 月 16 日までに提出するよう依頼した。（資料2 参照）

- ① 自身のバックグラウンドと本プロジェクトへの関わり、将来の目標・その理由
- ② ロス低減・信頼度向上・品質改善について学びたいこと

- ③日本の電力会社の人材育成の仕組み、スキル向上について学びたいこと
- ④日本の電力会社の研修設備やプラクティカルな研修コースについて学びたいこと
- ⑤日本の電力会社の停電回数および停電時間短縮への取組みについて学びたいこと
- ⑥その他、本邦研修で学びたいこと

各研修員のインセプションレポートに記載された項目について確認し、一部、配電部門で対応できない変電設備に関する要望などもあったが、ほとんどの項目は第1回技術研修プログラムの講義・視察に含まれていることを確認した。

2023年7月25日の午後、各研修員が作成したインセプションレポートについて、研修員1人当たり発表10分、質疑応答5分として全研修員が発表を行った。活発な質疑応答、意見交換を行うことができ、研修員が研修に臨む意欲、研修への期待、できるだけ多くのものをナイジェリアへ持ち帰って展開したいという意識が高いことを確認した。また、意見交換が白熱し、ナイジェリアの電気事業の在り方に関する議論にも発展し、電気事業を発展させるため「研修」による人材育成が非常に重要であるという認識を改めて共有することができた。さらに、研修員相互のコミュニケーションの促進、組織間の連携強化にもつながったと思われる。

(2) 講義・視察内容

a. 関西送配電 配電研修センター[茨木]

【目的】教育体系やスキル管理、新入社員研修について学習する。

【所見】SRS(スキルレコードシステム)を使用することにより、社員個人毎の技能・業務スキルを詳細に管理できることを確認した。また、電柱、電線、変圧器、計器等の配電線の建設・保守に関わる基本作業を新入社員が学ぶための研修設備を視察した。視察では、指導員2名と新入社員数名を1グループとする研修を、実際の研修風景を確認しながら学習した。

特にSRSとファン付きの空冷作業着に興味を示している様子だった。

【主な質疑応答】

Q: 新入社員は、研修期間には実際の業務を行うのか？

A: 新入社員研修期間は研修に専念するため、業務は行わない。必要なスキルを研修期間中に付与した後に、各事業所へ配属となる。

Q: SRSにはどのような機能があるか？

A: 各社員が習得したスキルを記録する。スキルは種類毎に体系的に分けられており、代表スキル、詳細スキルの項目毎に習得レベルを記録する。また、個人毎に不足するスキルを分析する機能もある。

Q: 社員教育に関し、政府の介入や関連する法律はあるか？

A: 法令で規定されている特別教育がいくつかあり、それらを当研修センターにて行っている。

Q: どのような人材が指導員になるか？

A: 各事業所の技能段階がマスタークラスの社員の一部分が、研修センターに配属となり指導員に

なる。指導員になる前には、指導員のための教育（より良い教育を行うための教育）も行っている。

b. 関西送配電 技術試験センター

【目的】配電資材の品質管理や不具合原因の概要やその調査方法について学ぶ。

【所見】技術試験センターは配電機材の品質評価、試験に関する ISO 認証（ISO9001）を取得しており、受入試験や不具合品の原因調査などにおいて精度の高い性能試験を行うことで配電用品の品質管理を行っている。配電用品の品質管理が、電気の安全安定供給につながることを学習した。特にナイジェリア導入予定の特高用防護管の性能試験については、高い興味を示した。

【主な質疑応答】

Q: 配電資機材の開発支援とは、具体的にはどのようなことを行うか？

A: 一例として、既存の製品に不具合が発見された際、不具合原因やメカニズムを調査し、用品開発部署やメーカーにフィードバックするというような業務である。

Q: ポリマー碍子を導入した経緯は？

A: ポリマー碍子は、磁器碍子よりも信頼性が高く、軽量で扱い易い。しかし、コストが高い。このため、関西電力送配電では 22/33kV 級配電線で優先的に導入している。6.6kV 級配電線への導入は検討中である。

Q: 試験装置の操作方法是どのようにして学ぶのか？

A: 技術試験センターに配属になってから、OJT にて学ぶ。

c. 関西送配電 阪神配電営業所

【目的】実現場でのモバイル端末を用いた巡視業務の実演を通じて、日常の信頼度向上(故障停電回数の削減)の取組みを学ぶとともに、配電自動化システム（DAS）や復旧資材倉庫の管理状況の視察を通じて、配電線事故停電時における停電時間短縮に関する具体的な取組みを学ぶ。

【所見】設備老朽化や樹木接触、自然災害による停電を未然に防ぐための手法（設備巡視、点検、樹木伐採）を学習し、それらの重要性を学習した。また、配電線事故が起こった際の DAS による健全区間早期送電の概要や流れを学習した。また、倉庫にどのような資機材をどの程度保管しているかを確認し、停電の早期復旧のための在庫保管の重要性を学習した。

【主な質疑応答】

Q: スマートメーターの故障はどのようにして把握し改修するのか？

A: スマートメーターシステムにてデータ取得エラーや電圧異常を感知すると故障があると判断する。電圧異常を検知すれば、作業員が現地に行き取替する。

Q: 配電線に接近する樹木の伐採に関連する法律等は日本にあるか？

A: 伐採には樹木の地主の許可が必要。また、伐採に使用する工事車両(高所作業車等)を車道に設置する際には道路管理者の許可が必要。

Q: 伐採を拒否された場合にはどのように対応するのか？

A: 耐摩耗性の防護管を電線に取り付けする。

Q: 組立鋼管柱はどのような場合に使用するのか？

A: 道路幅員が狭く、コンクリート柱を運搬する工事車両が通行できない箇所に電柱を設置する際に使用する。（組立鋼管柱は人力での運搬が可能であるため）

Q: 配電自動化システムで配電線事故を検出した後の対応はどのように行うか？

A: 工事車両で作業員が現場に行き復旧作業を行う。工事車両にはサイレンが備え付けられており、緊急走行も可能。

d. 大東電材 彦根事業所

【目的】プロジェクトに導入される防護管の製作工程および品質について学ぶ。

【所見】大東電材では、会社の概要説明にはじまり製品説明と製品製作工場の視察をした。押出成形・射出成型といった特殊な製法による作業工程や手順について学び、製品の管理や作業安全への取り組みについて関心を示し、特に絶縁カバーの成形時に発生するランナー（ポリエチレン）の再利用について、高い関心を示していた。絶縁資材の耐電圧等についての質問があり、今回のパイロットプロジェクトにおいて、導入される防護管を紹介し、将来的にはナイジェリアでも広く展開されることを期待している。

【主な質疑応答】

Q: 建設工事用防護管の使用環境温度は最大どの程度か？

A: 本製品はポリエチレン製になるので、材料の特性として 90℃辺りから製品の変形が始まり、120℃付近で溶け出す。但し、これは防護管の取り付けられている環境（電線の温度、外気温の変化状況、など）により変化する。

Q: この建設工事用防護管を電線に取付けた状況で電圧の急上昇が発生した際、この防護管はどこまでの電圧に耐えることが可能か？

A: NEMSA への試験施設申請において耐電圧試験（32kV）を実施し、ナイジェリアサイドにも共有し承認頂いている。

e. 関西送配電 大阪南エンジニアリングセンター

【目的】実現場での OJT を中心とした、新入社員や中堅社員への技能・技術の維持向上のための取り組みや、災害時の復旧応援の方法等を学習する。

【所見】技能・技術の維持向上の取り組みである高圧線断線修理と高所作業車を用いた柱上変圧器取替訓練において、作業指揮者⇄作業員間の連携による迅速かつ安全な工事方法を学習した。特に、柱上変圧器の取替では、トヨタのカイゼン方式による効率的な作業手順により、作業指揮者含め 3 名で、停電時間 8 分、合計作業時間 17 分で取替完了しており、工夫と訓練により停電時間や工事時間が安全に短縮できることを学んだ。

【主な質疑応答】

Q: 競技式の技能発表会を行う目的は何か？

A: 社員の技能育成を主な目的としており、競い合うことで育成効果が高まると考えている。

Q: 電柱から作業員が墜落する災害が発生したことがあるか？

A: 近年では電柱の頂上付近からの墜落災害は発生していない。昇柱途上での地面から低い位置からの墜落災害は近年 1 例発生した。

Q: 作業前ミーティングでは危険に関する評価を行うのか？

A: 作業員の体調確認や、作業環境を考慮した危険予知等を行っている。

Q: 作業において、スーパーバイザー（作業指揮者）が特定の作業員を注視していた場面があったがなぜか？

A: 関西送配電において、作業指揮者による作業員の重点監視を必要とする作業を規定しているからであり、今回の場合は重量物（変圧器）の吊り上げが該当する。

f. 関西送配電 配電研修センター[住之江]

【目的】 配電技術者教育のための実技訓練設備、訓練方法の視察

【所見】 研修センター内の屋内 1,120 m²、屋外 15,000 m²の研修設備において、模擬設備での配電線故障区間特定方法や DAS での自動故障区間特定の実演、パルス電圧を配電線の故障区間内に印加して行う課電探査装置による故障点探査などにより、具体的な故障点探査の方法を学んだ。

【主な質疑応答】

Q: 配電線事故があった際、何時間程度で復旧するか？

A: 停電が発生してから 2 時間半以内に復旧することを目標にしている。

Q: 課電探査装置による事故点探査の際、CT アンテナはどの位置に取り付けるのか？

A: 事故停電区間中、パルス電流が流れている箇所を事故原因がある箇所、流れていない箇所を事故原因が無い箇所と判定できるため、CT アンテナの取付位置を順々に変えながら探査するものである。

Q: 顧客の種類はどのように分けられるか？

A: 主に電圧毎に 33kV, 22kV, 6.6kV, 低圧(200/100V)に分けられる。

Q: スマートメーターの設置率はどの程度か？

A: 現時点ではほぼ 100%である。

g. きんでん 神戸電力営業所・三田営業所（現場視察）

【目的】 日本の安全・品質への取り組みと無停電による工事方法の紹介

【所見】 きんでんの現場視察では、設備の更新工事について学んだ。地中線工事及び外線工事については、配電線の切替えや負荷を救済することで、一時的に異なった送電ルートを構築しお客様の電気を止めることなく工事区間のみを停電にすることで、安全に工事ができる無停電工法を視察し

た。工事中の第三者危害防止の徹底や安全・品質への取り組みについて高く評価していた。どのような考え方にに基づき設備更新の頻度や更新個所の優先順位を決定しているかについて、高い関心を示していた。

【主な質疑応答】

Q: ケーブルの 1L、2L の意味を説明してほしい。

A: 常予備で 2 回線あり、1L が常時側、2L が予備側で、1L 側で事故・故障があった場合、2L 側に自動で切り替える。L は Line の頭文字。

Q: 常予備としてのバックアップは、全ての設備に備わっているのか？

A: 送電先のお客様との契約による。

Q: 銅線とアルミ線がなぜ混在しているのか？

A: 現在順次取替えを行っているが、予算も工事力も限られているため、計画的に順次取り換え工事を進めている状況であるため混在している。

Q: 取り換えの優先度はどのように決めているのか？

A: 優先順位は断線時の影響が大きい場所や河川横断など落線防止工事が難しいところなどを優先的に取り換えしている。

Q: 電線のサイズはどのように決めるのか？

A: 元々施設されている銅電線の許容電流を確保できるアルミ電線を選定している。

Q: 品質管理(Quality Assurance)は具体的に何をしているのか？

A: 主に工事会社からのセルフチェック結果を基に書類で検査をしているが、抜き打ちで現場検査も行っている。

Q: 典型的なチーム編成は？

A: 指揮者：1 名、副指揮者：1 名、作業員 3 名が平均的なチーム構成である。

f. きんでん 人材開発部（きんでん学園）

【目的】 教育内容やスキルアップの資格取得について学ぶ。

【所見】 きんでん人材開発部では、人材開発部の教育内容や社内資格への認定制度等について学び、施設設備の見学では、日本国内の工事方法、使用資材および今後 NAPTIN に導入される訓練施設同様の設備に興味を示し、様々な訓練を展開できる可能性について大変参考になったようだ。研修員の技能習得の度合いについて、誰がどのように評価しているかについて関心を示していた。NAPTIN 訓練設備として導入予定の短い電柱での作業訓練は非常に見やすいと好評であった。

【主な質疑応答】

Q: どのように研修員を集めるのか？

A: 基本的には研修員は全て社員であるが、協力会社などの研修員も参加する研修はある。

Q: 座禅やジョギング、筋トレにはどういう意味があるのか？（宗教的な意味？）

A: 宗教的なものではなく、伝統的・精神的な意味。心技体の考えに基づいた教育体系としている。

Q: 採用について。外国人でもきんでん学園へ入学し、訓練することは可能か？

A: 社員になれば、全員きんでん学園で訓練を受ける。外国人は永住権があれば採用可能。

Q: 技能資格は国が求めているのか？

A: 関西送配電の配電工事を請け負う中で国家資格も取得するが、それ以外は関西送配電が承認する社内資格となっている。

Q: どのように指導員を育成するのか？

A: 外部による指導員育成研修を受けさせたのち、現場で指導経験を積ませるためにジョブローテーションによるステップアップを実施している。

(3) 成果（アクションプラン）発表

全研修員に対して次の項目を記載したアクションプランを作成し、8月2日までに提出するよう依頼した。（資料3参照）

- ①本研修における自身の役割・責任
- ②本研修において学んだこと
- ③本研修に関連する課題認識（QC手法（MECE、SWOT分析）の資料を参考にして記載）
- ④具体的なアクションプラン（学んだことを帰国後どのように活用するのか：5W1Hで記載）
- ⑤本研修に対するコメント、提言

2023年8月3日、各研修員が作成したアクションプランについて、研修員1人当たり発表15分、質疑応答5分として全研修員が発表を行った。アクションプランは研修のためだけのものではなく、各研修員がナイジェリア帰国後に発表頂いた内容を実際に行動に移して頂くための決意表明であり、具体的で、実現性があり、効果的なものを検討のうえ、自身のアクションプランとして発表するよう依頼した。

しかし、多くのアクションプランは自身が行動することについて記載されてなく、今回の研修の内容を同僚、上司に伝え、提言を行うというものであった。例えば、AEDCの複数の研修員が老朽化設備の改修等について記載しているが、実態の把握、分析、対策の立案、設備の改修には多額の費用や人手が必要であるが、リソースをどのように確保するのか等は全く記載されてなく、現実的な提案とは言い難いものも多かった。また、課題とアクションプランの内容が総花的に幅広く記載されおり、今回の研修で学んだことを活用し、自身の課題として具体的に記載されていなかった。課題の分析については、事前にQC手法（MECE、SWOT分析）の資料を参考にするよう送付していたので、MECE、SWOT分析を用いている研修員が多かった。

質疑応答、意見交換は、事前課題発表と同様に活発に行われた。アクションプランの具体的内容や、優先順位に関する質問、FMPの研修員が提案した設備の品質向上に関する質問が主なものである。発表会の総括として、帰国後、各自のアクションプランをより具体的かつ詳細にブレークダウンし、アクションプランに基づいて行動するよう依頼した。

(4) カリキュラムの評価・改善点等

- ・研修当初、研修員に時間を守るという意識が希薄であったが、次第に改善した。
- ・カリキュラムは、パイロットプロジェクトの成果等をより向上させ、本プロジェクトの目標を達成するために設定したものであり、限られた日程の中で、より多くの施設、設備を視察して頂いた。本プロジェクト、パイロットプロジェクトに取り組む背景をより具体的に理解して頂いたと考えている。
- ・事前課題発表会、アクションプラン発表会は、活発な質疑応答、意見交換の場になった。アクションプランの作成にあたって実現性がある内容で自身の決意表明として記載されなかったという反省点はあるが、今回の研修をきっかけに意識改革、行動改革につながることを期待する。

(5) 研修員からの評価

- ・ほとんどの研修員が研修目標を研修参加前に明確に理解することができ、研修目標を達成し、研修で得た知識や経験は自身の業務に活用できると回答した。
- ・各カリキュラムの時間、研修期間が短いという意見が多かった。
- ・各カリキュラムの資料や説明等は概ね理解され、大変有用であったという意見が多かった。また、通訳を含めて日本側の対応は大変良かったという意見が多かった。
- ・アンケートに回答した全員が研修に大きく満足していると回答した。

(6) その他気付き

- ・研修員への査証発給手続きが遅れ、発給が渡航直前となった。貴機構において再発防止策をご検討の上、実施していただきたい。

3. 別添資料

資料1 研修詳細計画書（研修日程表）

資料2 事前課題のプレゼンテーション資料

資料3 アクションプランのプレゼンテーション資料

資料4 本邦研修に関するアンケート調査結果

資料5 写真

研修詳細計画書

研修コース名		ナイジェリア国配電分野能力向上					研修プログラム名		
研修コース番号		201902974J001					研修プログラム番号		
研修期間		2023/7/25 ～ 2023/8/3 （2023/7/24（来日）～2023/8/4（離日））					受入形態		国別研修
							研修員数		13
日付	時刻	形態	研修内容	講師又は見学先担当者等		講師 使用 言語	都道府県	研修場所	備考
				氏名 （敬称略）	所属先及び職位名				
7/23(日)	13:25 ～ 20:15	移動	移動（アブジャ→アディスアベバ）ET0950						
7/23(日)	22:35 ～ 15:45 (7/24)	移動	移動（アディスアベバ→仁川）ET0672						
7/24(月)	19:20 ～ 21:05	移動	移動（仁川→関西）ET1290						
7/25(火)	09:00 ～ 10:00	挨拶 説明	JICAブリーフィング	石川 莉子 後藤 綾那	JICA関西	英語	兵庫県	JICA関西BR	
	10:00 ～ 10:10	挨拶	業務主任挨拶	不二 葦 教治	八千代エンジニアリング 海外事業部 副事業部長	英語		JICA関西BR	
	10:10 ～ 10:50	説明	関西電力送配電およびきんでんの会社説明 （組織、人員等）	柏木 章弘 土井 和紀	関西電力送配電㈱ ㈱きんでん	英語/ 日本語		JICA関西BR	
	10:50 ～ 11:30	説明	ナイジェリア(AEDC)と関西電力送配電の設備 等事業環境の違い	西木 清朗	関西電力送配電㈱	英語/ 日本語		JICA関西BR	
	11:30 ～ 11:50	説明	視察日程およびカリキュラム(第三回渡航で 事前説明)の再説明	西木 清朗	関西電力送配電㈱	英語/ 日本語		JICA関西BR	
	11:50 ～ 13:00	食事	昼食（JICA関西食堂）						
	13:00 ～ 17:00	発表	【事前課題発表】 事前課題発表および成果発表の進め方説明 各研修生発表（10分×14名＝140分） 発表後の好評・質疑応答（5分×14名＝70分）	小枝 一彦	八千代エンジニアリング	英語/ 日本語		JICA関西BR	
	17:00 ～ 17:10	説明	明日からの視察予定と集合場所、注意事項等	西木 清朗	関西電力送配電㈱			JICA関西BR	
7/26(水)	08:00 ～ 9:15	移動	移動（JICA関西より）				大阪府	関西電力送配電㈱ 配電研修センター（茨 木） 大阪府茨木市清水2-5-5	
	09:15 ～ 11:45	座学	配電会社の社員育成計画策定の考え方と概要 ・各種教育の目的、内容、体制、指導方法等 ・訓練設備・訓練状況の見学	富田 有修 立花 裕也	関西電力送配電㈱ 配電研修センター所長 配電研修センター副長	日本語			
	11:45 ～ 14:30	食事	移動&昼食（大阪ハラルレストラン）				兵庫県	関西電力送配電㈱ 技術試験センター 兵庫県尼崎市若王寺3- 11-20	
	14:30 ～ 17:30	座学 講義	配電資機材の品質管理と不具合原因調査 ・品質管理業務、不具合原因調査業務の概要 ・特高用防護管耐電圧試験他試験装置デモ	稲井 学 丹羽 厚太	関西電力送配電㈱ 技術試験センター所長 技術試験センター係長	日本語			
	17:30 ～ 18:10	移動	移動（JICA関西へ）						
7/27(木)	09:00 ～ 10:00	移動	移動（JICA関西より）				大阪府	関西電力送配電㈱ 阪神配電営業所 兵庫県尼崎市西長洲町2- 33-60	
	10:00 ～ 12:00	座学	配電営業所の業務内容 ・停電を発生させない、迅速に復旧する取組 み ・資材倉庫、作業用車両等の視察	湯出口 幸久 大石 千亜生	関西電力送配電㈱ 阪神配電営業所所長 配電営業所係長	日本語			
	12:00 ～ 13:00	食事	昼食（大阪ハラルレストランからデリバ リー）					関西電力送配電㈱ 阪神配電営業所	
	13:00 ～ 15:50	実習	配電営業所での現場作業 ・樹木伐採現場視察 ・樹木、設備巡視模擬	大石 千亜生	配電営業所係長	日本語		兵庫県川辺郡猪名川町広 根轟 1～1 付近	
	15:50 ～ 16:20	座学	質疑応答&意見交換	大石 千亜生		日本語		関西電力送配電㈱ 阪神配電営業所	
	16:30 ～ 17:15	移動	移動						
	17:15 ～ 18:00	手続き	三井住友銀行御影支店					兵庫県神戸市東灘区御影 本町4-10-4	
	18:00 ～ 18:30	移動	移動（JICA関西へ）						
7/28(金)	08:30 ～ 11:00	移動	長距離移動【休憩含む】（JICA関西より）				滋賀県		
	11:00 ～ 11:50	食事	昼食（インド・ネパール料理 サブナ彦根 店）			日本語			
	11:50 ～ 12:00	移動	移動						
	12:00 ～ 13:20	視察	日本文化理解			日本語		彦根城 滋賀県彦根市金亀町 1	
	13:20 ～ 14:00	移動	移動						
	14:00 ～ 16:00	視察	日本メーカーの製造技術と製造品質管理 ・特高用防護管製造ライン視察 ・製造(製品)品質管理の状況	竹原 林太郎	大東電材㈱副支店長	日本語		大東電材㈱彦根工場 滋賀県彦根市野口町1	
	16:00 ～ 19:10	移動	長距離移動【休憩含む】（JICA関西へ）						
	07:35 ～ 9:00	移動	移動（JICA関西より）					大阪府	
09:00 ～ 12:00	座学 実習	配電エンジニアリングセンターの役割と業務 ・中堅および新入社員 の O J T 教育 ・配電営業所サポート業務	森口 健司 足立 努	関西電力送配電㈱ 大阪南配電 E C 所長 大阪南配電 E C 主任	日本語	関西電力送配電㈱大阪南 配電エンジニアリングセ ンター 大阪府大阪市住之江区北 加賀屋5丁目8-102			
12:00 ～ 14:00	移動	昼食（大阪ハラルレストランからデリバ リー）				配電研修センター（住之 江） 同上（大阪南配電 E C に 同じ）			
14:00 ～ 17:30	座学 実習	配電研修センターの人材育成業務 ・技能研修設備視察 ・負荷開閉器の有用性と事故点評定の仕組み ・事故点探査演習視察	徳塚 明久 光藤 隆二	関西電力送配電㈱ 配電研修センター課長 配電研修センター講師	日本語	配電研修センター（住之 江） 同上（大阪南配電 E C に 同じ）			
17:30 ～ 18:55	移動	移動（JICA関西へ）							
8/1(火)	9:00 ～ 9:30	座学	諸連絡	伊藤 正征 池永 伊奈生	株式会社きんでん 業務企画部リーダー 業務企画部副長	日本語	兵庫県	JICA関西SR33+34	
	9:30 ～ 12:00	実習	工事会社の施工品質 ・特別高圧地中ケーブルの取替え工事			日本語		尼崎市次屋3丁目5	
	12:00 ～ 13:00	食事	移動&昼食（デリバリー）						

日付	時刻	形態	研修内容	講師又は見学先担当者等		講師 使用 言語	都道府県	研修場所	備考
				氏名 (敬称略)	所属先及び職位名				
	13:00 ～ 16:30	実習	工事会社の施工品質 ・河川横断箇所の電線張替え工事 ・区分開閉器の取替え工事	伊藤 正征 池永 伊奈生	株式会社きんでん 業務企画部リーダー 業務企画部副長	日本語		兵庫県三田市東本庄 兵庫県三田市テクノパーク	
	16:30 ～ 17:30	座学	意見交換、質疑応答			日本語		JICA関西SR33+34	
8/2(水)	08:05 ～ 9:00	移動	移動				兵庫県		
	09:00 ～ 12:00	座学 講義	工事会社における技能維持・向上教育 ・新入社員技能育成教育 ・安全および施工品質教育	小林 光広 黒田 吉彦	株式会社きんでん 人材開発部次長 人材開発部副長	日本語		きんでん学園 兵庫県西宮市今津久寿川 町12-77	
	12:00 ～ 12:55	移動	移動						
	12:55 ～ 14:00	食事	昼食 (JICA関西食堂)						
	14:00 ～ 17:00	自習	成果発表資料準備 (研修生自室内作業)	石川 莉子 後藤 綾那	JICA関西			JICA関西 (研修生自室)	
8/3(木)	10:00 ～ 10:20	発表	成果発表の進め方説明	小枝 一彦	八千代エンジニアリング	英語/ 日本語	兵庫県	JICA関西SR33+34	
	10:20 ～ 12:00	発表	成果(アクションプラン)発表 研修生発表 (15分×5人＝75分) 発表後の好評・質疑応答 (5分×5人＝25分)	小枝 一彦	八千代エンジニアリング	英語/ 日本語		JICA関西SR33+34	
	12:00 ～ 13:00	食事	昼食 (JICA関西食堂)						
	13:00 ～ 17:00	発表	成果(アクションプラン)発表 研修生発表 (15分×9人＝135分) 発表後の好評・質疑応答 (5分×9人＝45分)	小枝 一彦	八千代エンジニアリング	英語/ 日本語		JICA関西SR33+34	
	17:00 ～ 17:40	式典	閉講式	石川 莉子 後藤 綾那	JICA関西			JICA関西 SR42	
8/4(金)	17:05 ～ 19:00	移動	移動 (関西→仁川) ET1297						
8/5(土)	1:05 ～ 7:20	移動	移動 (仁川→アディスアベバ) ET0673						
8/5(土)	9:20 ～ 12:00	移動	移動 (アディスアベバ→アブジャ) ET0951						

Inception Report for Training in Japan

1. Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.
- 2) Understand the human resources development system in place to accurately carry out business in the Japanese electric power company to see how skills are improved; and reflect them in Disco's human resources development program through the NAPTIN training courses in Nigeria.
- 3) By understanding the distribution training facilities and training contents in the Japanese electric power company, the installation of NAPTIN's distribution training facilities will be implemented appropriately.
- 4) By understanding the efforts of the Japanese electric power company to reduce power outages. (Reduction of power outages by section switches, mechanism and operation method of automatic operation of distribution lines, etc.) The effect of the AEDC pilot project and the effect of the Outage Management System improvement will be understood more concretely, and the AEDC pilot project and the Outage Management System improvement will be implemented appropriately.

2. Background and Challenges

What are you currently experiencing as problem(s) in your organization or your country's distribution?

- 1) **Current challenges in the organization in relation to the objectives of this program:** Describe the issues that your organization/department intends to tackle by participating in this program.

The issues faced by NAPTIN include:

- i. **lack of capacity of instructors in the key areas of technical loss reduction, reliability improvement and Power Quality Improvement for Power Distribution.** JICA experts are working with NAPTIN Training of Trainers (TOT) group in the key areas, to make recommendations and advise NAPTIN instructors on the addition of helpful content to existing NAPTIN Distribution courses and curriculum. By experiencing the Japanese Power Distribution Network, NAPTIN instructors gain new perspectives for building capacity in the technicians and engineers in our home distribution network.
- ii. **lack of infrastructure for training and research in technical loss reduction, reliability improvement and Power Quality Improvement.** As NAPTIN is a vocational training institute, it is vital that its curriculum is based on vocational activities that engage and involve technicians and engineers from the Nigerian Discos. As a training facility (substation with overhead and underground distribution lines) is being built at NAPTIN HQ in Abuja, therefore, the Training for Capacity Development of Power Distribution program is very important to NAPTIN. This training facility is to provide a simulation environment which is necessary to complement: 1) the experience provided by participating in this program 2) the content added to improve NAPTIN Distribution courses and curriculum.
- iii. **lack of project opportunities for NAPTIN instructors to participate in, where they could gain field experience in the key areas of technical loss reduction, reliability improvement and Power Quality Improvement.** The NAPTIN Working Group is able to work with Yachiyo engineering in the Pilot Project to develop capacity for Abuja Electricity Distribution Company (AEDC). Through meeting the working group members and the key actors during this program, it is expected that, project experience and relationships will be gained by NAPTIN instructors. This aspect of the program will help to sustain the experiences and lessons learned in the key areas.
- iv. **Lack of workplace culture that enhances knowledge transfer.** In relation to its focus industry, NAPTIN is developing slowly in this area. The initial workshops given to NAPTIN instructors by JICA experts, have highlighted the importance of the key issue of having a progressive workplace culture. By experiencing within the program, the tools and ideas for: practicing ownership, personal competence, Goal setting, work

place safety (pointing and shouting), and new ways to analyze problems, NAPTIN instructors can gain confidence to grow a culture that sustains knowledge transfer.

2) Main duties of Participant: Describe your main duties and responsibilities in relation to this program.

- I study technical material for addition to NAPTIN curriculum and Training Manuals.
- Improving NAPTIN Capacity for Distribution sector related upskilling by the addition of descriptions, pictures and technical content to existing NAPTIN Power Distribution curriculum and Power Distribution Training Manuals.
- Facilitation of training courses that teach new techniques and concepts
- Developing annual Training programmes and calendars of such programmes under supervision

3) Relevant Experience of Participant: Describe previous occupational experiences that is highly relevant in this program.

Development of Power Plant Automation (PPA) course with GIZ

In the aftermath of my training at the GIZ sponsored **Training of Trainer (TOT) on Basic Automation with SIEMENS SIMATIC S7-1200 and Pedagogy** at Hessische Landesstelle für Technologiefortbildung (HLFT) in Germany, I worked with Engr. Micah Nwogu, former CEO of Afam Power PLC and a NAPTIN Adjunct Faculty, and also, GIZ Consultant Ing. Uwe Graune, GIZ, to develop the Hands-on segment and curriculum for NAPTIN's Power Plant Automation (PPA) course. This course was developed by GIZ and I am currently the lead facilitator. GIZ bought six (6) Siemens PLCs and six (6) Siemens HMIs for NAPTIN which I use to facilitate NAPTIN trainings in PPA and PPA related courses.

Development of GIZ clean energy courses

I worked with Engr. Yusuf Khalil as part of NAPTIN's contribution to GIZ's development of clean energy courses for the Nigerian Energy Support Programme. Subsequently, I was nominated to attend a training at SMA Solar Academy, Kassel, Germany. This was a product training to familiarize NAPTIN instructors with Operation & Maintenance of Kainji's 26KW Hybrid PV/Wind Mini-Grid System and take ownership of the concepts needed to facilitate the clean energy courses developed in collaboration with GIZ.

Baseline Survey of NAPTIN for the Capacity Development of Power Distribution Project

I assisted Engr. Khalil Yusuf Adamu in responding to the JICA consultants during the Baseline Survey of NAPTIN.

4) Your individual Goal: Elaborate on your plans to apply the lessons learned from this program to your organization.

Presently, NAPTIN instructors are able to deliver lectures to address various training needs in the power sector. However, there is not a strong and detailed adherence to the Plan-Do-Check-Act (PDCA) principle for quality management and improvement. The program is an opportunity to create a reference point for using PDCA in my future training and facilitation engagements with NAPTIN.

I intend to create a schedule for periodic review of the training material with my colleagues. As part of the periodic review, facilitators will prepare the material and deliver to the NAPTIN instructors who are their peers. This is important as my colleagues are constantly switching contexts between their roles as training administrators and training facilitators. If there is no intentional commitment to periodically review the material and training methods, the aspects of training administration in their job schedule can overtake and overwhelm the experiences and lessons learned.

The program is a unique opportunity to upgrade my existing knowledge of lesson planning whilst simultaneously planning for lessons in my segment of the project (improvement of reliability in Power Distribution). The programme will also afford me the opportunity to prepare teaching materials using methods learned from JICA Experts. I also intend to improve my ability to prepare and conduct training courses that utilize demonstrations with training equipment. As a side project, I intend to create ANKI flash cards to help trainees better assimilate the course material.

Ultimately, with the lessons learned from participating in the program, I want to inspire and impact distribution sector practitioners and my colleagues, with the right attitude and skills that will bring hope and action in the journey to power sector reform in Nigeria.

5) Area of Interest and/or your expectation: Specify your particular interest with reference to the contents of this program.

My Area of interest with the program is on Reliability Improvement for Power Distribution and my expectations are:

- I hope to gain an insight into the functioning and financing of Distribution Automation Systems, and to learn how DAS serves to improve reliability.
- I expect to see firsthand, how Japanese distribution companies make digitized recordings of the outage incidents and to experience the methods for analysing the recorded outages towards prescribing the appropriate countermeasures.
- I expect to see how the outage incidents are acquired by the outage management systems
- I hope to experience the developments in Preventive maintenance practices especially in the area of scheduling.

3. Learning through Training

What are you willing to learn in this training in Japan in order to solve the problem(s)?

1) Please describe what you would like to learn regarding the human resources development system and skill improvement in the Japanese electric power company.

- I look forward to gaining firsthand experience with workplace culture that can improve knowledge transfer, and make it efficient to communicate ideas and opinions for knowledge transfer.

- I would like exposure to Japanese methods of setting goals at different organizational levels and how to make people work in teams to achieve such goals
- I would like exposure to policies concerning sharing of work planning by teams
- I would like to experience how Japanese electric power companies utilize eLearning to develop competencies for their employees as well as keep them updated in their specific roles.
- I would like exposure to the mentorship schemes that are utilized by Japanese electric power companies.
- I would like to learn about the different departments that make up Japanese Distribution Companies

2) Please describe what you would like to learn regarding the training facilities and practical training courses in the Japanese electric power company.

- I would like exposure to sample trainees workbook used by Japanese Distribution Companies to train their employees
- I would like to learn how to use appropriate fault detection equipment in a safe and reliable manner
- I would like to learn about the system for purchasing new equipment and for managing the spares of new and existing equipment

3) Please describe what you would like to learn regarding the efforts for outage frequency and outage duration reduction in the Japanese electric power company.

- I hope to gain first hand understanding and experience of converted duration and how it scales up in the Japanese Power System Network. It will be a worthwhile experience to undergo an exploration where we compare the converted duration in the Japanese Power System Network with what is planned in the JICA pilot project for Abuja Electricity Distribution Company (AEDC) as well as some AEDC networks too.
- I would like to observe and document the procedures used to back-feed/supply a healthy section with power from a neighboring feeder.
- I would also like to learn about Outage Management Systems and how analysis of recorded data is done on Japanese Distribution Grid
- I would like exposure to case studies that take an in-depth look at Reliability KPIs other than converted duration.
- I would like to learn about how patrol of distribution assets is planned and if there is a briefing after the patrol.

4) Please describe anything else you would like to learn in this program.

- I expect to learn about and experience the practical uses of protection coordination to improve reliability for power distribution. I also expect to see how cold-load pickup is handled in Japanese Power Distribution
- I hope to get the exposure to some small sample projects and data that I can translate and model in PSS SINCAL. It will be helpful to teach using models to simulate some concepts of reliability improvement in Power Distribution.
- I want to learn about the Japanese Distribution Companies role in the integration of renewable energy

By Participant

Date	13 th June, 2023
Name	CHUKWUDUM ARINZE OKEKE

To be answered by the 16th of June 2023.

Thank you for your kind cooperation.

Inception Report for Training in Japan

1. Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.
- 2) Understand the human resources development system in place to accurately carry out business in the Japanese electric power company to see how skills are improved; and reflect them in Disco's human resources development program through the NAPTIN training courses in Nigeria.
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- 4) By understanding the efforts of the Japanese electric power company to reduce power outages. (Reduction of power outages by section switches, mechanism and operation method of automatic operation of distribution lines, etc.) The effect of the AEDC pilot project and the effect of the Outage Management System improvement will be understood more concretely, and the AEDC pilot project and the Outage Management System improvement will be implemented appropriately.

2. Background and Challenges

What are you currently experiencing as problem(s) in your organization or your country's distribution?

- 1) **Current challenges in the organization in relation to the objectives of this program:** *Describe the issues that your organization/department intends to tackle by participating in this program.*

The Nigerian Electricity Supply Industry (NESI) has extremely large aggregate technical and commercial (AT&C) losses, which are impeding the expansion of the economy. Through this program, NAPTIN will strengthen and expand the expertise of its power loss reduction technology trainers, who in turn will train staff members at NESI and elsewhere.

- 2) **Main duties of Participant:** *Describe your main duties and responsibilities in relation to this program.*

*Training programme Facilitation/instruction in power transmission and distribution loss reduction
Training Programme reports; status, evaluation and completion reports on the areas stated above
Developing course materials for facilitation of training programmes in power transmission and distribution.
Design course materials for training programme in power distribution loss reduction.*

- 3) **Relevant Experience of Participant:** *Describe previous occupational experiences that is highly relevant in this program.*

I briefly worked as a project staff member for the Federal Capital Development Authority on the design and oversight of the electrical engineering infrastructure of the Federal Capital City, Abuja, before joining NAPTIN in 2014 as an electrical instructor. I then moved to Nigerian Communication Satellites Limited (Nigcomsat) as an electrical engineer in charge of the power section of the National Public Security

Communication System (NPSCS). I worked on installing conventional power and solar photovoltaic panels for our switch rooms and CCTV, respectively. I made sure that power was optimized for maximum performance in each of these areas.

4) Your individual Goal: *Elaborate on your plans to apply the lessons learned from this program to your organization.*

I want to gain cutting-edge knowledge and learn from the experience of Japanese utilities how they were able to achieve 4.33% transmission and distribution losses so that I can return and share the knowledge by conducting training and seminars for electricity employees and citizens in order to reduce transmission and distribution losses. I am an electrical instructor and trainer in NAPTIN charged with the responsibility of facilitating training in power loss reduction and other related transmission and distribution courses in NESI.

5) Area of Interest and/or your expectation: *Specify your particular interest with reference to the contents of this program.*

*My areas of interest are as follows: Power loss reduction, power quality improvement, cable jointing and termination, reliability improvement and voltage profile.
Distribution planning, design and operation.*

3. Learning through Training

What are you willing to learn in this training in Japan in order to solve the problem(s)?

1) Please describe what you would like to learn regarding the human resources development system and skill improvement in the Japanese electric power company.

I would like to learn about the human resources development system employed by Japanese electric power companies, specifically in relation to skill improvement for power loss reduction. This includes understanding the training programs, methodologies, and strategies utilized to enhance the technical abilities and knowledge of employees in identifying and addressing power loss issues within the electrical power systems. Additionally, I am interested in discovering any strategies or techniques employed by the company to enhance efficiency and minimize power loss throughout their infrastructure. By gaining insights into the human resources development system and skill improvement efforts, I hope to understand how the company addresses power loss reduction and promotes a culture of continuous improvement in this critical aspect of their operations.

2) Please describe what you would like to learn regarding the training facilities and practical training courses in the Japanese electric power company.

I would like to learn about the training facilities and practical training courses offered by Japanese electric power companies in the field of power distribution. Specifically, I am interested in understanding the infrastructure and resources available at the training facilities, such as simulation labs and equipment. Additionally, I would like to know the nature of the practical training courses offered, including the topics covered, duration, and hands-on experience provided. Understanding these aspects would help me gain insights into the training programs available and the opportunities to acquire practical skills in power

distribution within Japanese electric power companies.

3) Please describe what you would like to learn regarding the efforts for outage frequency and outage duration reduction in the Japanese electric power company.

I would like to learn about the strategies and initiatives undertaken by the Japanese electric power company to reduce outage frequency and duration. Specifically, I'm interested in understanding the technological advancements and infrastructure improvements implemented to enhance the reliability and stability of the power grid. Additionally, I would like to explore any collaborative efforts with other stakeholders, such as government agencies or research institutions, to develop innovative solutions for minimizing outages. It would be beneficial to delve into the company's maintenance practices, investment in renewable energy sources, and the deployment of smart grid technologies to improve outage response and minimize customer inconvenience.

4) Please describe anything else you would like to learn in this program.

I am interested in finding out how training facilities are set up in Japan. I will undoubtedly gain from the Japanese power utility operators' strict behavior. Automation systems used in Japan It is crucial for me to comprehend how the grid works as well as how artificial intelligence is used to enhance maintenance procedures.

By Participant

Date	15 th June 2023
Name	Bawa Garshima Gamiya

To be answered by the 16th of June 2023.

Thank you for your kind cooperation.

Inception Report for Training in Japan

1. Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.
- 2) Understand the human resources development system in place to accurately carry out business in the Japanese electric power company to see how skills are improved; and reflect them in Disco's human resources development program through the NAPTIN training courses in Nigeria.
- 3) By understanding the distribution training facilities and training contents in the Japanese electric power company, the installation of NAPTIN's distribution training facilities will be implemented appropriately.
- 4) By understanding the efforts of the Japanese electric power company to reduce power outages. (Reduction of power outages by section switches, mechanism and operation method of automatic operation of distribution lines, etc.) The effect of the AEDC pilot project and the effect of the Outage Management System improvement will be understood more concretely, and the AEDC pilot project and the Outage Management System improvement will be implemented appropriately.

2. Background and Challenges

What are you currently experiencing as problem(s) in your organization or your country's distribution?

- 1) **Current challenges in the organization in relation to the objectives of this program:** Describe the issues that your organization/department intends to tackle by participating in this program.

- Retention and turnover: Power distribution organizations/Utility companies may struggle with retaining skilled employees, leading to turnover and loss of knowledge and expertise. This can make it challenging to maintain a consistent level of training across the organization.
- Inability to Reduce Aggregate Technical, Commercial and Collection.
- Utility companies are unable to recover cash as a result of a large amount of customers who are not metered.
- High level of Electricity theft by the Metered and Un-Metered customers.

- 2) **Main duties of Participant:** Describe your main duties and responsibilities in relation to this program.

- I Facilitate technical training in area of expertise which includes, Distribution substation operation & maintenance, Transformer & switchgear, Utility metering and safety operations)
- Develop training materials.
- Research on topic of expertise and update on new technology
- Assess and evaluate trainees
- Coordinating trainings and report writing on trainings conducted.

- 3) **Relevant Experience of Participant:** Describe previous occupational experiences that is highly relevant in this program.

- Planning and construction Engineer on 33kv/11kv distribution network with Achief Electrical Engineering company for 5 years (2009-2014) .
- A Trainer on Utility metering and Transformers & Switchgear in National Power Training Institute of Nigeria.

4) Your individual Goal: Elaborate on your plans to apply the lessons learned from this program to your organization.

- Apply the new knowledge and skills gained during the training to improve the efficiency and reliability of the power distribution system in the Power Sector of Nigeria
- Share the knowledge gained with colleagues and stakeholders to enhance their understanding of power distribution and how to improve it.
- Collaborate with other professionals in the power distribution industry to identify and address common challenges, such as improving energy efficiency or reducing the technical & non technical losses in the distribution industry.

5) Area of Interest and/or your expectation: Specify your particular interest with reference to the contents of this program.

- To understand how Japan developed her power infrastructure with a reliable grid system
- Power quality improvement
- Japan's power sector is highly efficient and well-organized, with low transmission and distribution losses, will want to know how this was achieved in the country.
- Distribution planning, design and construction

3. Learning through Training

What are you willing to learn in this training in Japan in order to solve the problem(s)?

1) Please describe what you would like to learn regarding the human resources development system and skill improvement in the Japanese electric power company.

- Technical Expertise: I want to learn from Japan how they provide comprehensive training to ensure employees possess the necessary competencies for their respective roles on their technical skills relating to power generation, transmission, distribution, renewable energy sources, smart grid technologies, and energy management.
- I want to learn Japan teaching methods with respect to power distribution.
- Knowledge on management of technical skill and training plan.

2) Please describe what you would like to learn regarding the training facilities and practical training courses in the Japanese electric power company.

- I want to learn about reliability and stability in Japan electric power company.
- How to improve on the reliability of distribution grid
- Technical tools that can enhance smart work on the grid in order to reduce outage time.

3) Please describe what you would like to learn regarding the efforts for outage frequency and outage duration reduction in the Japanese electric power company.

- How to prevent outage incidents
- Patrol and inspection
- Process from discovery of defect(s) to the repair or replacement
- Quick outage restoration
- How to Automate Distribution System
- How an outage incident occurs
- Process of restoration of outage incident
- Preparation for large-scaled disasters
- Improvement of reliability of distribution grid (quality of construction and reduction of power outage duration)
- How to inspect protection instruments

4) Please describe anything else you would like to learn in this program.

- I want to learn Japan structure of Technological Advancements in respect to distribution system.
- I want to be expose to any soft ware that the Japan electric company uses in problem solving.
- I want to learn with a case study on how Japan electric company was able to reduce her technical and non-technical loss to the bearest minimum.
- How to Search for fault point on training facility with detecting equipment in training yard

By Participant

Date	15 th June, 2023.
Name	LYNDA OIFO ILEDARE

To be answered by the 16th of June 2023.

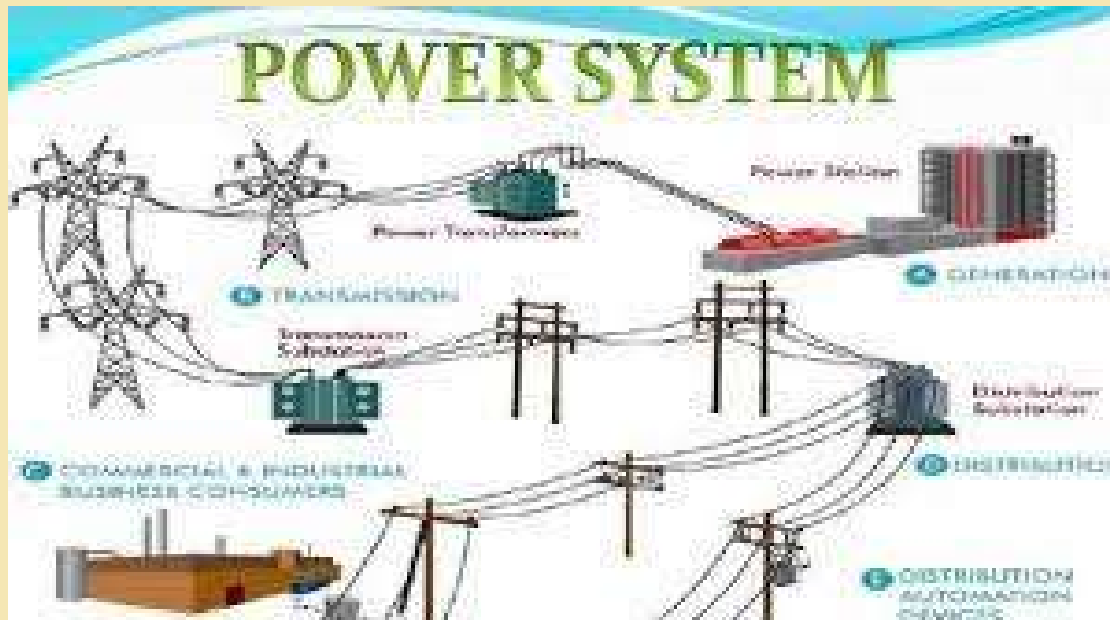
Thank you for your kind cooperation.



**THE PROJECT
FOR
CAPACITY DEVELOPMENT OF POWER
DISTRIBUTION**

**Inception Report for Training in
Japan**

KHALIL Yusuf Adamu



Training Objectives

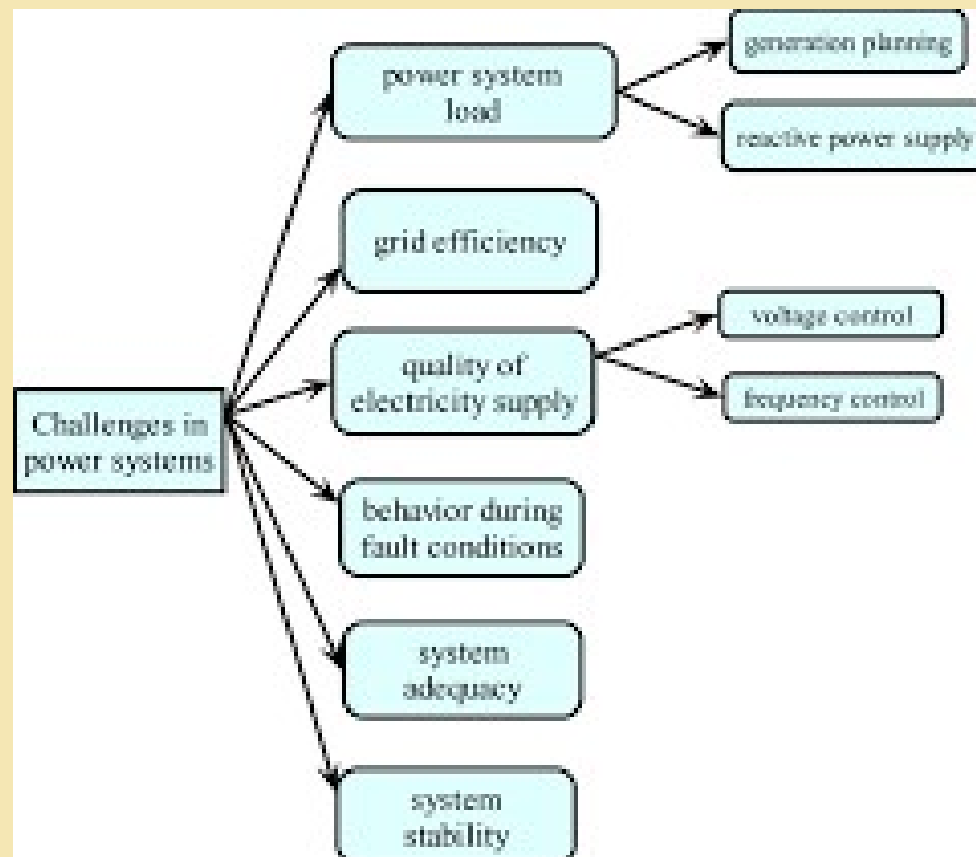


1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.

2) Understand the human resources development system in place to accurately carry out business in the Japanese electric power company to see how skills are improved; and reflect them in Disco's human resources development program through the NAPTIN training courses in Nigeria.

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Background and Challenges



1) Current challenges in the organization in relation to the objectives of this program

- The Nigerian power distribution companies are experiencing huge technical and non-technical losses amounting to about 40% in average.
- The downtime of feeders and lines restoration at an event of any fault is too high
- The reliability of the distribution networks is very challenging as there are numerous unnecessary outages in the systems
- The level of the training of the maintenance personnel is very low resulting to a lot of issues left un-attended to or takes a lot of time before they are been attended to
- Serious problem relating to electricity theft, hence inability of utilities to collect the commensurate revenue to the energy delivered.

2) Main duties of Participant

- I work with the training institute of the Nigerian power sector as Instructor.
- In the light of the above, I am training the Distribution utilities on courses relating to Distribution Network operations and maintenance, including the following to improve their performance
 - Power loss reduction
 - Network reliability
 - Power quality
 - Distribution network maintenance and stable operations
 - Etc.

3) Relevant Experience of Participant

- I worked in the Nigerian power sector as Transmission and Distribution operator for 2 years.
- I then moved to the Distribution value chain as Maintenance officer for 3 years
- I became the Maintenance and operations supervisor for 5 years
- I held the position of Planning and construction manager of the distribution utility for 2 years.
- I became a trainer with NAPTIN for Transmission and Distribution engineers and technicians for about 10 years now.
- My facilitation cuts across operations, maintenance, protection, loss reduction, energy management, health and safety, as well as renewable energy



**Learning through
Training**



1) Please describe what you would like to learn regarding the human resource development system and skill improvement in the Japanese electric power company.

- I want to see and understand the teaching methodology in Japan and learn from it
- It is important for me to identify the techniques of improving loss and reliability of distribution systems in Japan with respect to the human resource development



2) Please describe what you would like to learn regarding the training facilities and practical training courses in the Japanese electric power company.

- I want to see and realize the kind of equipment and tools used in developed networks like Japan to better their systems
- The practical aspect of training relating to power loss reduction and network reliability in Japan is an important aspect for me to understand and replicate in Nigeria



3) Please describe what you would like to learn regarding the efforts for outage frequency and outage duration reduction in the Japanese electric power company.

- Developed country like Japan do not experience outages like we do in Nigeria. I want to understand the secret behind their success.
- I also want to understand the techniques of easy restoration of faulty sections of the network within short time, as it happens in Japan.



4) Please describe anything else you would like to learn in this program.

- I want to learn the set up of training facilities in Japan
- The discipline of power utility operators in Japan will definitely add value to me
- Utilitization of automation systems in Japan Grid operations and use of Artificial intelligence to improve maintenance practice is also important for me to understand.



THANK YOU AND BEST REGARDS

Inception Report for Training in Japan

1. Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.
- 2) Understand the human resources development system in place to accurately carry out business in the Japanese electric power company to see how skills are improved; and reflect them in Disco's human resources development program through the NAPTIN training courses in Nigeria.
- 3) By understanding the distribution training facilities and training contents in the Japanese electric power company, the installation of NAPTIN's distribution training facilities will be implemented appropriately.
- 4) By understanding the efforts of the Japanese electric power company to reduce power outages. (Reduction of power outages by section switches, mechanism and operation method of automatic operation of distribution lines, etc.) The effect of the AEDC pilot project and the effect of the Outage Management System improvement will be understood more concretely, and the AEDC pilot project and the Outage Management System improvement will be implemented appropriately.

2. Background and Challenges

What are you currently experiencing as problem(s) in your organization or your country's distribution?

- 1) **Current challenges in the organization in relation to the objectives of this program:** Describe the issues that your organization/department intends to tackle by participating in this program.

- **The Distribution sector of the Nigerian Electricity Supply Industry is facing significant Aggregate Technical and Commercial Losses (ATC&C) amounting to around 40%**
- **The reliability of the distribution feeders in the network is also very poor, it takes a long time for a feeder to be restored after a fault,**
- **The power quality of the supply is equally bad,**
- **I expect the program to equip me with the necessary competency and technical know-how to be able to provide a skilled workforce to the Nigerian power sector, especially in the areas of power loss reduction, reliability, and power quality.**

- 2) **Main duties of Participant:** Describe your main duties and responsibilities in relation to this program.

- **Designing technical trainings**
- **Developing training manuals and schedules**
- **Facilitating Trainings in own area of expertise (Power System Planning, Protection and Maintenance)**
- **Assessing and evaluating trainees**
- **Coordinating trainings and writing training reports**

3) Relevant Experience of Participant: Describe previous occupational experiences that is highly relevant in this program.

- I rise from being a trainee Instructor in the Institute to become a Principal Electrical Instructor, facilitating several trainings in power system protection, transformer and switchgear maintenance, renewable energies, energy audit, and many more.
- I as well coordinated besides facilitating several other training programs.
- I also participated in product development and reviews of many instructional materials

4) Your individual Goal: Elaborate on your plans to apply the lessons learned from this program to your organization.

- Improve myself continuously through Continuous Professional Development (CPD)
- Transferring knowledge and knowledge sharing
- Always be better than what I was yesterday

5) Area of Interest and/or your expectation: Specify your particular interest with reference to the contents of this program.

- Power System Planning, Protection, and Maintenance
- Power loss reduction techniques in the developed part of the world like Japan
- Rubbing minds and experience sharing among the stakeholders

3. Learning through Training

What are you willing to learn in this training in Japan in order to solve the problem(s)?

1) Please describe what you would like to learn regarding the human resources development system and skill improvement in the Japanese electric power company.

- As an Instructor, I want to explore new methods and strategies that will help me in delivering my responsibilities
- I want to know how the Japanese electric sector manages its ATC&C
- I also want to understand the level of reliability and quality of supply in the Japanese electricity distribution so as to know how I will transfer that to my country

2) Please describe what you would like to learn regarding the training facilities and practical training courses in the Japanese electric power company.

- I would like to understand the practical facilities Japan use and how they are able to attain the level and quality of power supply
- The courses and trainings that are thought in Japan with these practical training facilities will help me in designing and organizing similar courses to be delivered in my training institute

3) Please describe what you would like to learn regarding the efforts for outage frequency and outage duration reduction in the Japanese electric power company.

- I want to learn from the experience of Japan on how they are able to maintain a continuous electric supply despite natural disasters like earthquakes that happened in the country

4) Please describe anything else you would like to learn in this program.

- I would like to learn the Japanese philosophy of hard work and dedication

By Participant

Date	13/06/2023
Name	MURTALA YABO LAWAL

To be answered by the 16th of June 2023.

Thank you for your kind cooperation.

Inception Report for Training in Japan

1. Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.
- 2) Understand the human resources development system in place to accurately carry out business in the Japanese electric power company to see how skills are improved; and reflect them in Disco's human resources development program through the NAPTIN training courses in Nigeria.
- 3) By understanding the distribution training facilities and training contents in the Japanese electric power company, the installation of NAPTIN's distribution training facilities will be implemented appropriately.
- 4) By understanding the efforts of the Japanese electric power company to reduce power outages. (Reduction of power outages by section switches, mechanism and operation method of automatic operation of distribution lines, etc.) The effect of the AEDC pilot project and the effect of the Outage Management System improvement will be understood more concretely, and the AEDC pilot project and the Outage Management System improvement will be implemented appropriately.

2. Background and Challenges

What are you currently experiencing as problem(s) in your organization or your country's distribution?

- 1) **Current challenges in the organization in relation to the objectives of this program:** Describe the issues that your organization/department intends to tackle by participating in this program.

- Manpower: Inadequate skilled personnel to handle major and multiple breakdown within the network. Lack of skilled fault men engineers to quickly trace fault and resolve it within the shortest possible time in order to restore supply to our customer, reduce down time and also engage in preventive maintenance of the network.
- Materials: Unavailability and Low quality of fast moving materials is really hampering operational maintenance, delay in restoration after repairs, frequent fault tripping because of sub-standard materials used in maintenance.
- Mobility: Unavailability of operational vehicles, Drivers. Frequent breakdown of aged vehicles affect the job because of long network coverage.

Poor Distribution Network: Currently our network is bad, constructed with substandard materials etc. long distribution network without isolation switches which prolonged power outages during network disturbances.

- Poor quality of grid supply to our customers within AEDC Franchise areas due to frequent tripping on our grid supply, which is negatively affecting quality of supply to our customers.
- Unstable and unreliable network infrastructure across our distribution network.
- Very low voltage distribution across our distribution network
- Frequent transformer failures as a result of transformers oil leakages, poor insulation and non-use of right tools and lack of proper maintenance culture.
- Inadequate power and transmission capacity from the grid
- High Aggregate Technical, Commercial and Collection Losses (ATC&C) etc.

- 2) **Main duties of Participant:** Describe your main duties and responsibilities in relation to this program.

- Coordinate and liaise with all technical teams on daily technical status of all our distribution network and update the AEDC's Managing Director on real time.

- Interface between customers and our technical teams to ensure timely resolution of complaints.
- Ensure that all our distribution feeders are circuit with quality supply distributed to our customer with minimum of hours of supply based on their tariff bands.
- Ensure that all AEDC high profile customers with huge commercial value have improved quality power supply with minimal tripping and outages.
- Ensure that technical team have the right knowledge on maintenance and resolution of faults within the shortest possible time to reduce customer complaints and dissatisfaction.
- Advise MD/CEO on all technical issues, recommend solutions for quick resolution, in order to improve quality of grid supply.
- Liaise and work with Chief technical Officer (CTO) for timely resolution of all technical related issues that affect quality, improve supply to our customers.

3) Relevant Experience of Participant: Describe previous occupational experiences that is highly relevant in this program.

- Worked as DSO – Distribution substation Operator; Management of supply distribution within AEDC network.
- Operating of breakers (isolators), to restore supply and to avoid break down of heavy equipment's.
- Supervisor Operations and maintenance team on network distribution maintenance for improved supply, timely resolutions of faults for improved revenue.
- Supervised timely maintenance of equipment to avoid damage or break down.
- Initiated, plan and supervised installation of pole mounted transformers on IHS telecoms masts within Aedc franchise areas; Abuja, Nasarawa, Kogi & Niger state.
- As Manager Revenue Protection Unit (RPU) during Meter audit and management, I supervised and ensured that all point load transformer are properly installed, earthed to avoid damage to our customer meters and appliances.
- As Technical Assistant to MD AEDC/CEO, I have been engaging and working with all technical Team leads (Hub), O & M team for fault clearing, maintenance works to restored supply to our customers.
- Prepare technical report on special project under TASMU for MD/CEO.
- Liaise and work with CTO on deployment of relief transformers to customers with high commercial value and supervise the installation.
- Review all technical complaints that comes directly to MD/CEO Office and recommend resolution action accordingly.

4) Your individual Goal: Elaborate on your plans to apply the lessons learned from this program to your organization.

- This program will greatly equip me to ensure practical understanding of Japanese technology and application of same in the AEDC distribution network for network improvement. That the right tools & methods are used in network distribution lines and maintenance for improved quality supply.
- It will equip and guide me to ensure proper planning, coordination and application of right mentality on maintenance of distribution network.
- Will use the lesson learnt and apply it as one of the KPI for technical monitoring and evaluation on improve quality network Distribution.
- It will help in reducing high number of tripping which is currently affecting our grid network distribution and constantly damaging equipment.
- It will also equip me to ensure that all safety and maintenance process & procedures are followed and not bridged.

5) Area of Interest and/or your expectation: Specify your particular interest with reference to the contents of this program.

- Quality control in network distribution standard.
- Equipment repairs and Maintenance.
- Operations and Network Maintenance.
- Technical Loss reduction in distribution network.
- Fault Resolution Time Management.
- Human Resource Skill management.
- Metering.

We expect practical introduction of Japanese technology on the above mentioned areas for possible utilization in our network to improve power reliability, Quality, Safety and Manpower productivity at reduced cost.

3. Learning through Training

What are you willing to learn in this training in Japan in order to solve the problem(s)?

1) Please describe what you would like to learn regarding the human resources development system and skill improvement in the Japanese electric power company.

- I would like to learn about various aspects of human resources development such as performance management, employee engagement, talent development, appraisal management and succession planning.
- I would also like to learn latest trends in training and skill improvement, including e-learning, gamification and on the job training. Additionally I would like to have insight on how to measure the effectiveness of the training programs and how to design customized training plans for technical employees.

2) Please describe what you would like to learn regarding the training facilities and practical training courses in the Japanese electric power company.

- I would expect to be expose to training facilities and practical on-site training courses that can

positively impact our learning processes that can ensure improvement in our distribution network.

- I would expect to get insights on standards, procedure and technical approach to work schedule, project design and implementation in electricity distribution network.
- I would also be acquainted with ways of team building and conflict resolution mechanisms that ensures seamless operation of work for timely resolution of electricity distribution issues.

3) Please describe what you would like to learn regarding the efforts for outage frequency and outage duration reduction in the Japanese electric power company.

- I would like to learn fastest Schedule time for proper and timely outage management in japan to be applicable in Nigeria.
- Duration of outage frequency reduction in japan and how it can be applied in Nigeria.
- Methods use in outage frequency/reduction management.
- Any other technique used in real time outage frequency management.

4) Please describe anything else you would like to learn in this program.

- I would like to learn process and procedures for transformer connection and individual/customer connection to Japanese grid supply.
- I would like to learn metering processes and installation in japan.
- Technical losses reduction.
- Transformer repairs and Maintenance.
- Procurement process in japan
- Materials standard testing prior to usage.

By Participant

Date

06/06/2023

Name

Engr. Ifeanyi Amobi Chinedu.

To be answered by the 16th of June 2023.

Thank you for your kind cooperation.

Inception Report for Training in Japan

1. Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.
- 2) Understand the human resources development system in place to accurately carry out business in the Japanese electric power company to see how skills are improved; and reflect them in Disco's human resources development program through the NAPTIN training courses in Nigeria.
- 3) By understanding the distribution training facilities and training contents in the Japanese electric power company, the installation of NAPTIN's distribution training facilities will be implemented appropriately.
- 4) By understanding the efforts of the Japanese electric power company to reduce power outages. (Reduction of power outages by section switches, mechanism and operation method of automatic operation of distribution lines, etc.) The effect of the AEDC pilot project and the effect of the Outage Management System improvement will be understood more concretely, and the AEDC pilot project and the Outage Management System improvement will be implemented appropriately.

2. Background and Challenges

What are you currently experiencing as problem(s) in your organization or your country's distribution?

- 1) **Current challenges in the organization in relation to the objectives of this program:** Describe the issues that your organization/department intends to tackle by participating in this program.

Suppressed Load: A lot of proposed customers and businesses with our franchise area are unable to use electricity due to poor power quality, unreliability and unavailability of distribution network.

Ageing and dilapidated distribution infrastructure: Most of the distribution network and equipment are aged, obsolete and dilapidated with high ATC&C losses and low operational efficiency

Lack of modern technology in the network: Modern distribution network relies on integration of communication system and relevant software to monitor, control and analyses the network.

Obsolete Meters: Presence of obsolete meters in the system also contributes negatively towards effective distribution of power as this impact negatively on revenue collection.

Vandalism/Sabotage on the networks by hoodlums and criminals: AEDC network continue to experience setback from the frequent vandalism (daily basis) across the its franchise area resulting to prolonged downtime, loss of revenue and waste of resources which could have been invested in network improvement.

- 2) **Main duties of Participant:** Describe your main duties and responsibilities in relation to this program.

1. Supervision of construction works and evaluation of distribution lines and Substation works within Abuja Electricity Distribution Plc
2. Power system analysis (Reliability analysis, Demand forecast, Load Flow Analysis and Short-circuit Analysis etc)
3. Regular studies on Embedded Generation to improve system reliability.
4. Preparation of annual Performance Improvement Plan (PIP) and budget.
5. Monitor and force HSE Safety rule and regulation.

3) Relevant Experience of Participant: Describe previous occupational experiences that is highly relevant in this program.

1. Power system analysis (Reliability analysis, Demand forecast, Load Flow Analysis and Short-circuit Analysis etc)
2. Ensure system technical loss reducing by adherence to best practices and specifications
3. Supervision of Project construction in line with safety requirements to enhance supply
4. Redesign and Remodeling of Shanty Areas (Liaise with stakeholders to construct safe network and reduce losses)
5. Establishment of feeder viability based on SRT, PIM, Commercial Viability
6. Ensure that all our distribution feeders are in circuit with quality supply distributed to our customers with minimum of hours of supply based on their tariff band

4) Your individual Goal: Elaborate on your plans to apply the lessons learned from this program to your organization.

1. Dissemination of the acquired knowledge to fellow colleagues
2. Lesson learnt will help to improve network reliability.
3. Lesson learnt will help me identified areas within our network that needs to be rehabilitated and expanded in order to reduce ATC&C losses
4. To improve frequency and duration of outage hence reduce downtime and improve customer's satisfaction
5. It will equip and guide me to ensure proper planning, coordination and application of right mentality on maintenance of distribution network

5) Area of Interest and/or your expectation: Specify your particular interest with reference to the contents of this program.

Outage management system that gives visibility of the entire network, loss reduction measures, reliability and quality improvement which will in turn increase electricity distribution to customers, increase the amount of electricity tariff collected from customers and significantly improve the financial condition of the power distribution company. This financial improvement which cuts across the transmission and generation sector translates to more investment in the power sector, then the nation's economy sector is revitalized and quality of life improved.

3. Learning through Training

What are you willing to learn in this training in Japan in order to solve the problem(s)?

1) Please describe what you would like to learn regarding the human resources development system and skill improvement in the Japanese electric power company.

1. System Operation by Distribution Automation System (DAS)
2. Use of Mobile Device for Facility Patrol and Inspection
3. Restoration of Power Outage
4. Smart Grid

2) Please describe what you would like to learn regarding the training facilities and practical training courses in the Japanese electric power company.

1. Smart Grid
2. Modern techniques/strategies on network planning, design, operation and maintenance
3. Modern techniques on power quality and protection

3) Please describe what you would like to learn regarding the efforts for outage frequency and outage duration reduction in the Japanese electric power company.

1. Mean Time to Repair (MTTR)
2. Failure Rate
3. Mean Time Between Failure (MTBF)
4. Repair Rate
5. SAIDI
6. SAIFI
7. CAIDI
8. ASAI
9. ASUI

4) Please describe anything else you would like to learn in this program.

1. Modern techniques/strategies used in Japan to reduce Aggregate Technical, Commercial and Collection Losses (ATC&C)
2. Standard Operation & Maintenance Procedure
3. Embedded Generation
4. Power system analysis

By Participant

Date **14th June 2023**

Name **Rufai Taofeeq Kola**

To be answered by the 16th of June 2023.

Thank you for your kind cooperation.

Inception Report for Training in Japan

1. Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.
- 2) Understand the human resources development system in place to accurately carry out business in the Japanese electric power company to see how skills are improved; and reflect them in Disco's human resources development program through the NAPTIN training courses in Nigeria.
- 3) By understanding the distribution training facilities and training contents in the Japanese electric power company, the installation of NAPTIN's distribution training facilities will be implemented appropriately.
- 4) By understanding the efforts of the Japanese electric power company to reduce power outages. (Reduction of power outages by section switches, mechanism and operation method of automatic operation of distribution lines, etc.) The effect of the AEDC pilot project and the effect of the Outage Management System improvement will be understood more concretely, and the AEDC pilot project and the Outage Management System improvement will be implemented appropriately.

2. Background and Challenges

What are you currently experiencing as problem(s) in your organization or your country's distribution?

- 1) **Current challenges in the organization in relation to the objectives of this program:** Describe the issues that your organization/department intends to tackle by participating in this program.

1. ATC& C loss reduction challenges
2. Power interruptions (Outages) Challenge
3. Power quality Challenges.
4. Vandalism Challenges.
5. Obsolete network equipment

- 2) **Main duties of Participant:** Describe your main duties and responsibilities in relation to this program.

1. Creation of Periodic Maintenance Strategies Annually
2. Ensure compliance to periodic maintenance strategies, plans and procedures for overhead and underground distribution network.
3. Ensure in meeting up with operational goals by contributing information and recommendations for strategic planning and review.
4. Follow up trends of recognized problems and determining appropriate system improvements and solutions.
5. Ensuring that the performance and KPIs of the maintenance team to deliver agreed targets and objectives are met.
6. Ensuring that all maintenance operations are done in accordance with company policy and regulatory guidelines.
7. Ensures timely resolutions of network defects .
8. Coordination of network maintenance activities.
9. Carry out overhead and underground network inspections of facilities to identify and resolve issues
10. Ensures stable and reliable electrical supply by maintaining overhead & underground network equipment.
11. Ensures Technical loss reduction improvement via excellent maintenance work output.

- 3) **Relevant Experience of Participant:** Describe previous occupational experiences that is highly relevant in this

program.

1. Operations and Maintenance of Network facilities
2. Protection, Control and Metering of Power Network.

4) Your individual Goal: Elaborate on your plans to apply the lessons learned from this program to your organization.

1. To ensure network operations and maintenance are second to none in AEDC
2. To ensure that AEDC ATC&C loss is reduced to minimum through improved network maintenance
3. To ensure improvement on power quality, stability and reliability.
4. To have robust network activities that is free/reduced technical complaints

5) Area of Interest and/or your expectation: Specify your particular interest with reference to the contents of this program.

1. Loss reduction, especially technical loss reduction. If there would be a model for it, I will be glad.
2. Outage reduction strategies
3. Modern strategy/ways for Network Maintenance.
4. Power quality improvement methods/strategies
5. Smart Grid

3. Learning through Training

What are you willing to learn in this training in Japan in order to solve the problem(s)?

1) Please describe what you would like to learn regarding the human resources development system and skill improvement in the Japanese electric power company.

1. Techniques used to ensure improved power stability.
2. The modern ways of network maintenance to reduce Technical loss
3. Techniques to improve power qualities.
4. Ways of ensuring ATC&C loss reduction improvement
5. Modern techniques/strategies on network planning, design, operation, and maintenance
6. Modern techniques on power quality and protection

2) Please describe what you would like to learn regarding the training facilities and practical training courses in the Japanese electric power company.

1. A detailed and good knowledge on your Distribution Automation System(DAS)
2. The use of phone, tablets, etc for record purpose at maintenance point.
3. The use of fault detecting equipment for quick fault resolution.
4. Use of automated line switch for faulty section isolation.
5. Best practices in Japan on design and construction of power network.
6. Most commonly use distribution transformer to reduce technical loss and improved power stability and quality.

3) Please describe what you would like to learn regarding the efforts for outage frequency and outage duration reduction in the Japanese electric power company.

1. What outage and maintenance management systems do you have, if any?
2. Modern software in use for outage and maintenance management.
3. The standard Routh-length of your network, based on voltage level (132kV, 33kV, 11kV and 0.415kV), needed for power stability and quality.
4. Maximum feeder load to avoid incessant outage due to load.
5. What reliability indices do you have for network studies?
6. If any, want to know overhead and underground automated network detectors you have and their mode of operations
6. Details on the conductor cover will be appreciated.
7. Standards on network design, construction and material quality for power stability, reliability and network accident reduction.

4) Please describe anything else you would like to learn in this program.

1. I would have love to know, see and learn something about your renewable energy projects. Their mode of operations, locations and how positive they contribute to the country power sector.
2. The country`s metering system as a means of AT&C loss reduction.
3. Your present challenges in power sector and plans to solve them.
4. Modern techniques/strategies used in Japan to reduce Aggregate Technical, Commercial and Collection Losses (ATC&C)
5. Embedded Generation

By Participant

Date **15th June, 2023**

Name: **Frederick
Obuye**

To be answered by the 16th of June 2023.

Thank you for your kind cooperation.

INCEPTION REPORT FOR TRAINING IN JAPAN

Written by

Engr. Olumuyiwa A. Awoniyi (AED)

CURRENT CHALLENGES IN MY ORGANIZATION AND HOW IT RELATE TO THE OBJECTIVES OF THIS PROGRAM:

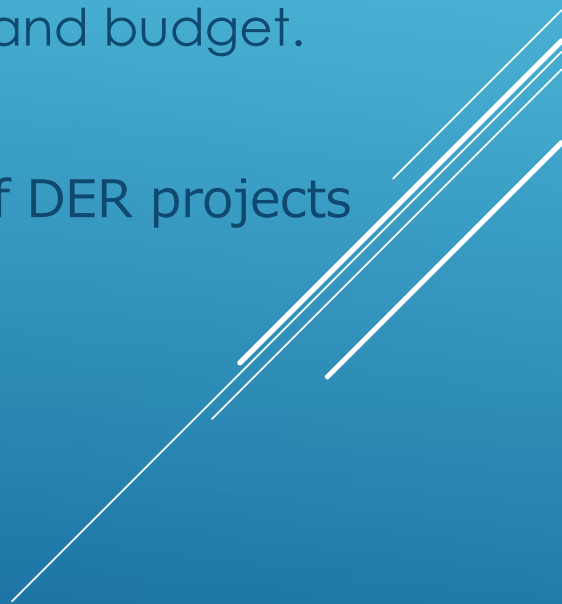
Technical ,Commercial and Collection (ATC&C)loss Challenges

Technical loss: The over loaded feeders as a result of load growth resulting to losses due to quality of materials used for the construction (i.e Sizes of cables, Overloading of equipment, poor terminations) has adverse effect, that contribute to technical loss thereby makes it impossible to meet up with clean, constant, and reliable energy demand to our customers.

Commercial and Collection loss Challenges: Inability to relating maintenance activities to collection thereby making technical operation not visible to commercial activities I.e down time not related to commercial impact.

Power quality improvement on distribution energy resource - Integration (mini grid system) into our existing distribution network for adequate load forecast and load demand for network management users, for the improvement of power quality and reliability in the network

MY DUTIES AS MY WORK PLACE

- ✓ Project coordination, Supervision of construction works, evaluation of feeder loading and Substation works within Abuja Electricity Distribution franchise area
 - ✓ Manage all studies provided on Embedded Generation to improve system reliability.
 - ✓ Preparation of annual Performance Improvement Plan (PIP) and budget.
 - ✓ Monitor and force HSE Safety rule and regulation.
 - ✓ New Product/Service Development. Manage construction of DER projects
 - ✓ Develop design for distribution substations.
 - ✓ Ensure installation and material standards
 - ✓ Manage construction of new Injection Substation
 - ✓ Optimize manpower utilization
- 

MY RELEVANT EXPERIENCE

Based on my occupational experience,

- ✓ I Supervised and co-ordinating Infrastructural setup, system optimization and new substation integration with network connections for the company
- ✓ Ensure system technical loss reducing by adherence to best practices and specifications
- ✓ Redesign and Remodeling of Shanty Areas (Liaise with stakeholders to construct safe network and reduce losses)
- ✓ Establishment of feeder viability based on SRT, PIM, Commercial Viability
- ✓ Ensure that all our distribution feeders are in circuit with quality supply distributed to our customers with minimum of hours of supply based on their tariff band

MY GOAL FOR THE TRAINING

My set out goal:

- ✓ Other technical philosophies of Electrical design of distribution system.
- ✓ To know better process of system integration of various sources of generations at distribution level
- ✓ Numerical method of calculating downtime against collection.
- ✓ Power optimization standardization and implementation procedures.
- ✓ Infrastructural setup, system configuration and optimization and new substation integration.

MY MAJOR INTEREST AND EXPECTATION

- ✓ System integration of various sources of generations at distribution level for power quality and system reliability
- ✓ Numerical method of calculating downtime against collection. This is to have value for energy accountability and implication of prolong outages to energy business performance.
- ✓ Infrastructural setup, system configuration and optimization and new substation integration
- ✓ My expectation is that knowledge acquired through this training is put into practice for energy business transformation in AEDC. Thereby making AEDC world class company.

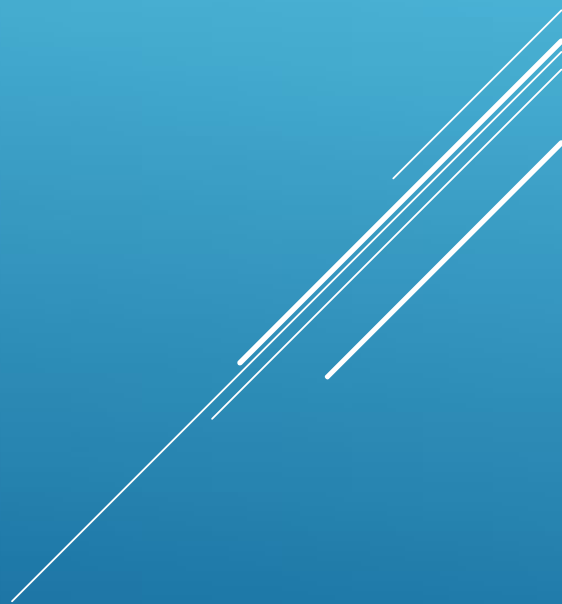
WHAT I WOULD LIKE TO LEARN REGARDING THE HUMAN RESOURCES DEVELOPMENT SYSTEM AND SKILL IMPROVEMENT IN THE JAPANESE ELECTRIC POWER COMPANY.

- ✓ Staff management and welfare
- ✓ Standard operational structure
- ✓ Process of integrating smart Grid of various sources of generations at distribution level to achieve power quality and system reliability
- ✓ Use of Mobile Device for Facility Patrol and Inspection
- ✓ Infrastructural setup, system configuration and optimization and new substation integration
- ✓ Power optimization standardization and implementation procedures.
- ✓ System Operation by Distribution Automation System (DAS)

DESCRIPTION OF WHAT I WOULD LIKE TO LEARN REGARDING THE TRAINING FACILITIES AND PRACTICAL TRAINING COURSES IN THE JAPANESE ELECTRIC POWER COMPANY.

- ✓ Modern techniques on power quality and protection
 - ✓ Smart Grid
 - ✓ Modern techniques/strategies on network planning, design, operation and maintenance
- 
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WHAT I WOULD LIKE TO LEARN REGARDING THE EFFORTS ON OUTAGE FREQUENCY AND OUTAGE DURATION REDUCTION IN THE JAPANESE ELECTRIC POWER COMPANY.

- ✓ Mean Time to Repair (MTTR)
 - ✓ Failure Rate
 - ✓ Mean Time Between Failure (MTBF)
 - ✓ Repair Rate
- 
- A series of white lines of varying lengths and angles, located in the bottom right corner of the slide, creating a modern, abstract graphic element.

SOMETHING ELSE I WOULD LIKE TO LEARN IN THIS PROGRAM.

- ✓ Other Numerical method of calculating downtime against collection
 - ✓ Modern techniques/strategies used in Japan to reduce Aggregate Technical, Commercial and Collection Losses (ATC&C)
 - ✓ Standard Operation & Maintenance Procedure
 - ✓ System integration of various sources of generations at distribution level for power quality and system reliability
- 
- A series of white diagonal lines of varying lengths and thicknesses, located in the bottom right corner of the slide, creating a modern, abstract graphic element.

THANK YOU



THE PROJECT
FOR
CAPACITY DEVELOPMENT OF POWER DISTRIBUTION

Inception Report for Training in Japan

To be answered by the 16th of June 2023

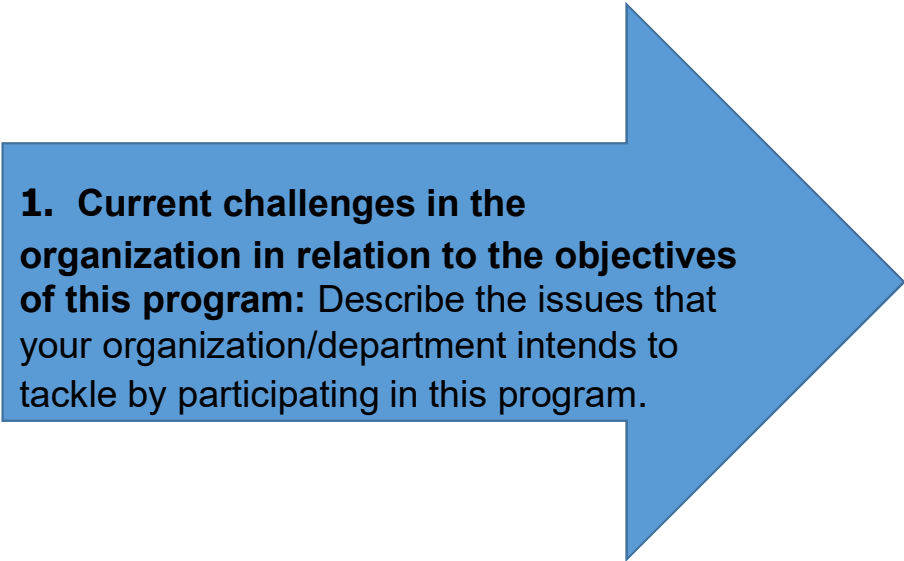
Name: Mba, Andy Chinenye

1. Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.**
- 2) Understand the human resources development system in place to accurately carry out business in the Japanese electric power company to see how skills are improved; and reflect them in Disco's human resources development program through the NAPTIN training courses in Nigeria.**
- 3) By understanding the distribution training facilities and training contents in the Japanese electric power company, the installation of NAPTIN's distribution training facilities will be implemented appropriately.**
- 4) By understanding the efforts of the Japanese electric power company to reduce power outages. (Reduction of power outages by section switches, mechanism and operation method of automatic operation of distribution lines, etc.) The effect of the AEDC pilot project and the effect of the Outage Management System improvement will be understood more concretely, and the AEDC pilot project and the Outage Management System improvement will be implemented appropriately.**

2. Background and Challenges

What are you currently experiencing as problem(s) in your organization or your country's distribution?

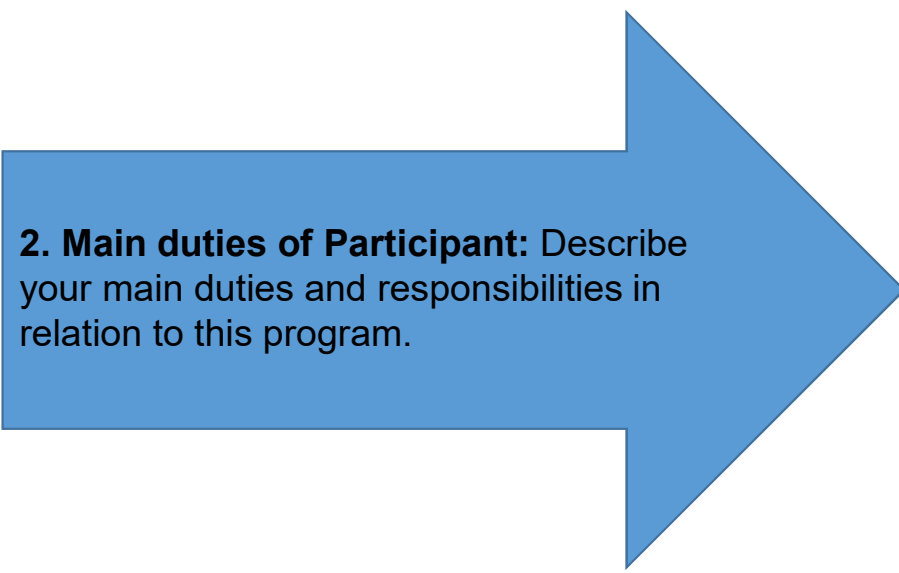


1. Current challenges in the organization in relation to the objectives of this program: Describe the issues that your organization/department intends to tackle by participating in this program.

Suppressed Load: A lot of proposed customers and businesses are unable to use valuable electricity due to poor power quality, reliability and unavailability of the distribution network.

Ageing & dilapidated distribution infrastructure: A great part of the distribution network and equipment are aged, obsolete, dilapidated with high ATC&C losses, and low operational efficiency resulting to poor offtake of load allocation.

2. Background and Challenges



2. Main duties of Participant: Describe your main duties and responsibilities in relation to this program.

In my present position with Abuja Electricity Distribution Company, I manage a well energetic, focus driven and dedicated team of staff.

Through detailed data analysis, targeted strategic plans and development of challenging objectives, my team transforms imbibed cultures into well improved customer satisfaction and increased output.

I represent AEDC in the Nigerian Electricity Supply Industry (NESI) Situation Room meetings twice a day for hourly performance assessment based on load allocation versus offtake.

I must ensure 95% energy offtake every two months out of three in a quarter as stipulated by the Nigeria Electricity Regulatory Commission (NERC) ORDER and KPI, which saves the company from penalties.

I work with ICT software developers to develop an Outage Management System (OMS) for company wide use for the purpose of reporting forced, planned and emergency outages. All outage data can be assessed from a back end for analysis.

2. Background and Challenges

3. Relevant Experience of Participant:

Describe previous occupational experiences that is highly relevant in this program.

Coordinating switching operations among transmission substations and distribution interface in line with grid code conditions to ensure safety of equipment and personnel.

Implements daily load management plan in strict accordance with the Service Based Tariff bands to guarantee an efficient and effective allocation and distribution of available energy within the network coverage.

Sending daily day ahead forecast indicating the previous day load allocation, previous day load consumption and day ahead forecast, New 14days load forecast to Transactional Data Processing/National Control Centre, weekly rolling.

2. Background and Challenges



4. Your individual Goal: Elaborate on your plans to apply the lessons learned from this program to your organization.

Dissemination of the acquired knowledge to fellow colleagues.

To be able to have visibility of the network for smooth network operation.

To identify areas of network to be rehabilitated and expanded in order to reduce ATC&C losses.

To increase customer satisfaction by distributing more electricity to customers with higher reliability and quality.

Reduction in the number of power outages and outage time.

2. Background and Challenges



5. Area of Interest and/or your expectation: Specify your particular interest with reference to the contents of this program.

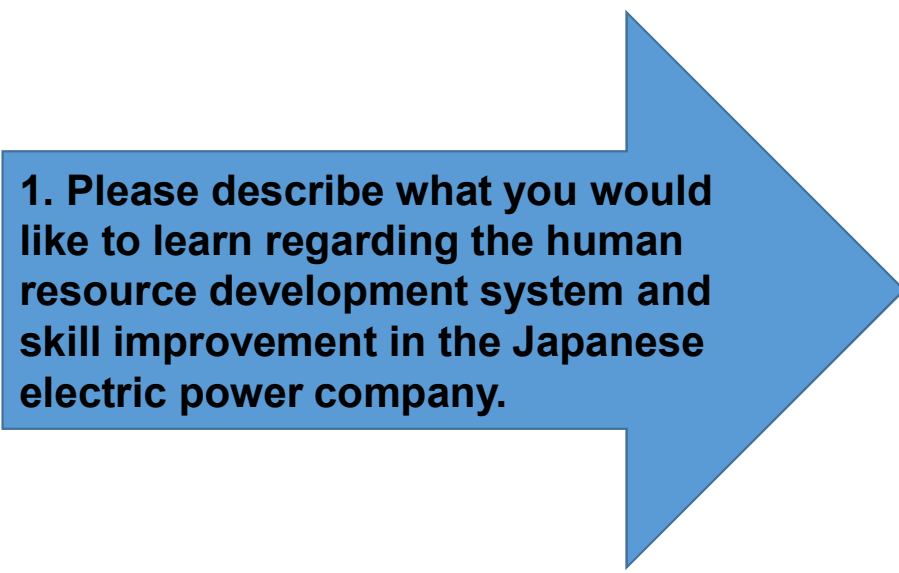
I am interested in an outage management system that gives visibility of the entire network, loss reduction measures, reliability and quality improvement which will in turn increase electricity distribution to customers, increase the amount of electricity tariff collected from customers and significantly improve the financial condition of the power distribution company.

This financial improvement which cuts across the transmission and generation sector translates to more investment in the power sector, then the nation's economy sector is revitalized and quality of life improved.

I am interested in the reduction of technical, commercial and collection losses.

3. Learning through Training

What are you willing to learn in this training in Japan in order to solve the problem(s)?

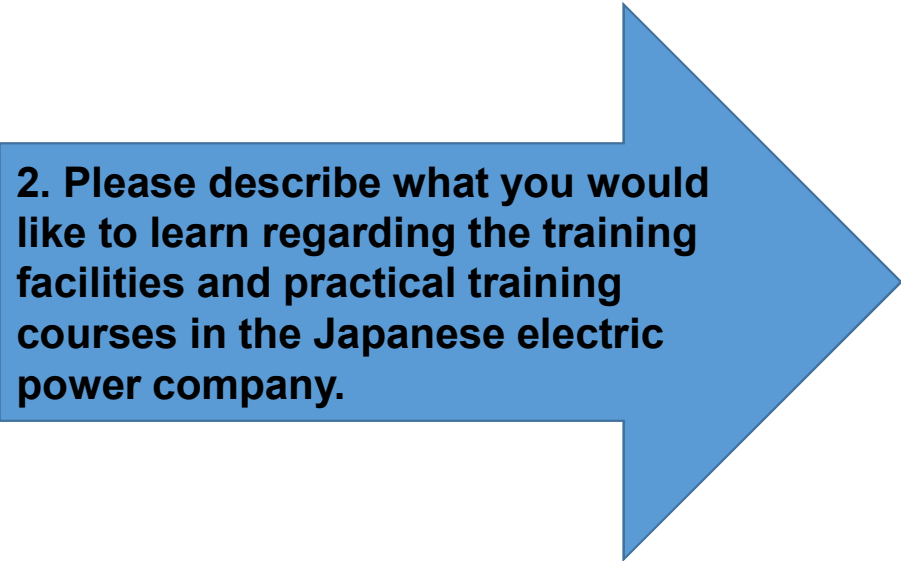


1. Please describe what you would like to learn regarding the human resource development system and skill improvement in the Japanese electric power company.

I would like to learn and adopt Japanese electric power company's in-house educational tools, skill certification system and activities at their training center to nurture staff members and add valuable skills to respond to customers needs.

I would like to learn how to use information and communication technology (ICT) to provide quality and high assistance in the area of outage management as it concerns both planned and forced outages. Also, to use same in the analysis of those outages.

3. Learning through Training



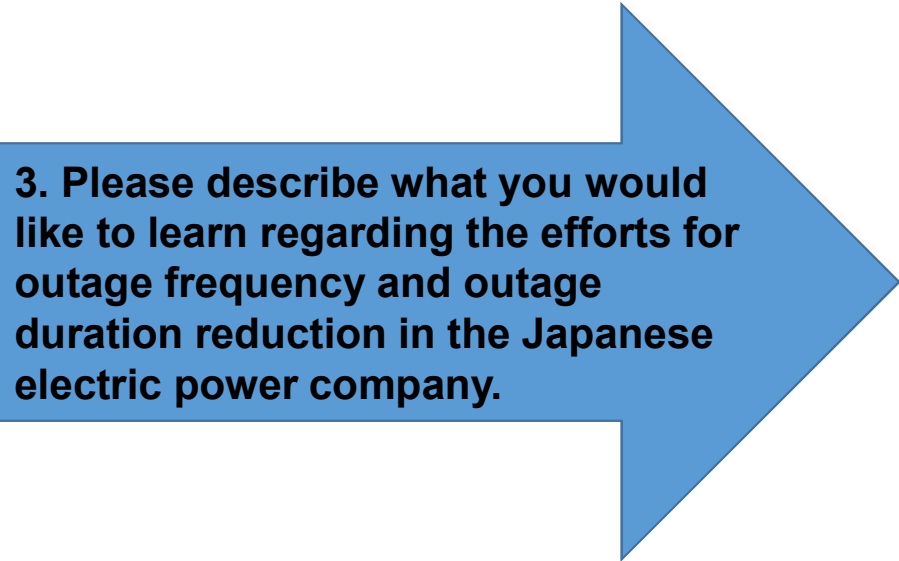
2. Please describe what you would like to learn regarding the training facilities and practical training courses in the Japanese electric power company.

I would like to acquire more knowledge about reducing technical losses, improving reliability and quality improvement.

I would like to see and experience how power outages are done by section switch mechanism, and the operation method of automatic operation of distribution lines.

To learn the fault occurrence and clearing procedures.

3. Learning through Training

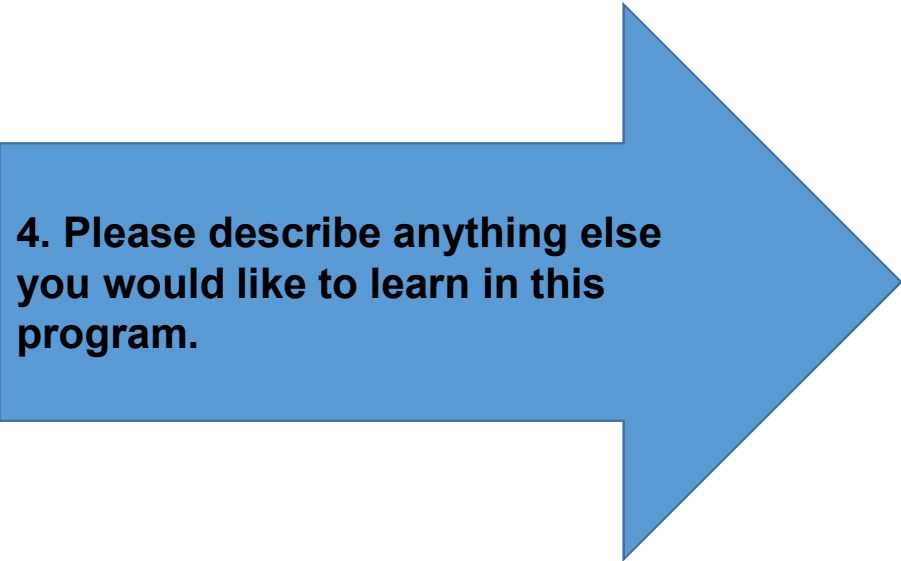


3. Please describe what you would like to learn regarding the efforts for outage frequency and outage duration reduction in the Japanese electric power company.

Japan is a well-developed and advanced country, so it will be nice to learn how they have advanced over time to achieve reduced frequency of outages.

This will be implemented in AEDC in order to reduce losses, improve reliability (SAIDI, CAIDI and SAIFI), and improve the quality of our electric power supply to customers.

3. Learning through Training



4. Please describe anything else you would like to learn in this program.

I would like to learn more on how to effectively implement and monitor a load forecast for maximum efficiency which will translate to improvement in the network availability, stability and revenue increase.

Enhanced knowledge on optimized System Operations processes.



THANK YOU

**THE PROJECT
FOR
CAPACITY DEVELOPMENT OF POWER
DISTRIBUTION**

Inception Report for Training in Japan

Name: Engr. Abu Kadiri

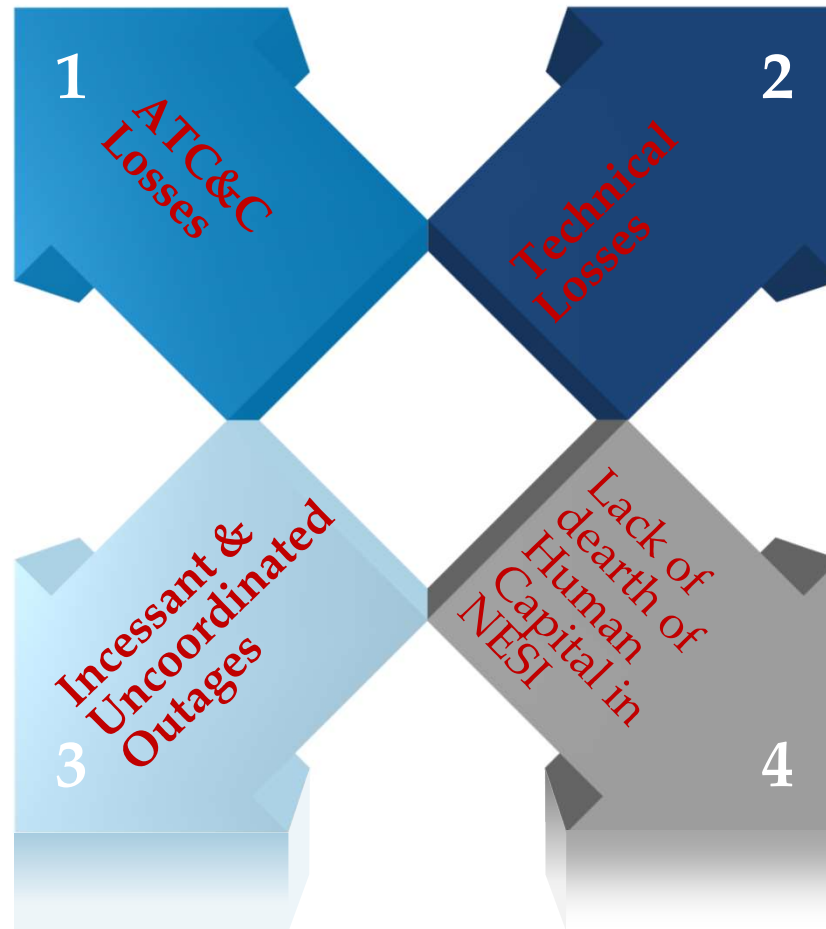
July 2023

1. Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.**
- 2) Understand the human resources development system in place to accurately carry out business in the Japanese electric power company to see how skills are improved; and reflect them in Disco's human resources development program through the NAPTIN training courses in Nigeria.**
- 3) By understanding the distribution training facilities and training contents in the Japanese electric power company, the installation of NAPTIN's distribution training facilities will be implemented appropriately.**
- 4) By understanding the efforts of the Japanese electric power company to reduce power outages. (Reduction of power outages by section switches, mechanism and operation method of automatic operation of distribution lines, etc.) The effect of the AEDC pilot project and the effect of the Outage Management System improvement will be understood more concretely, and the AEDC pilot project and the Outage Management System improvement will be implemented appropriately.**

Background and Challenges: **Current challenges in the organization in relation to the objectives of this program**

Very high Aggregate Technical, Commercial and Collection (ATC&C) Losses across the DisCos in NESI which impacts market liquidity negatively



The NESI distribution network is characterized with high technical losses due to excessive route length and substandard feeder construction, which compromise power quality at some customer ends

The NESI Distribution network is plagued with frequent and un-coordinated outages which, makes power supply unreliable and affects the implementation of the service based tariff

The train the trainer program will prepare the participants to transfer knowledge from the Japanese utilities best practice in distribution network construction and operation to the DisCos in NESI

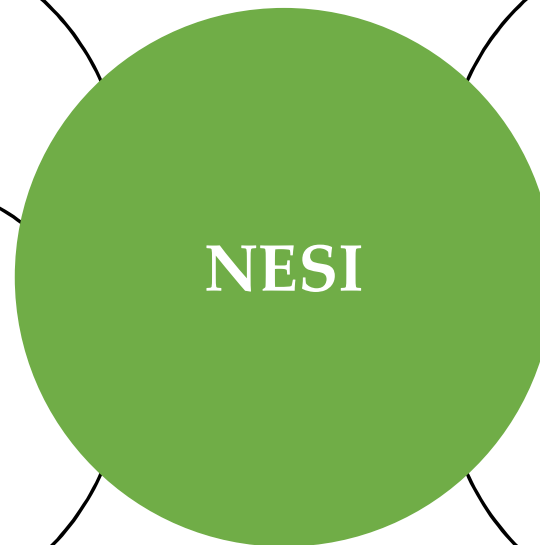
Background and Challenges: **Main Duties of Participant**

- **Head Networks, Engineering Standards & Safety**

Review & inspection of transmission and distribution performance improvement plan projects

Technical evaluation of Network related license applications

Safety monitoring & investigations



Review of generation adequacy, transmission & distribution expansion plans

Monitoring of transmission and distribution system operations

Review of technical operating codes and standards

Background and Challenges: **Relevant Experience of Participant**

- Supervised the construction of NIPP distribution projects in Kaduna & Kano States
- Coordinated the ATC&C loss studies for Abuja, Ikeja, Kano & Port Harcourt DisCos by DFID consultant
- Review, validation and monitoring of transmission and distribution interface projects
- Inspection of transmission and distribution PIP projects
- Monitoring the daily operational performance of grid power generation, transmission and distribution offtake
- Review of Grid, Metering & Distribution Codes and NESIS Regulations

Back Ground and Challenges: **Individual Goal & Area of Interest/Expectation**

Individual Goal

- To reduce technical losses in power distribution network in NESI
- To achieve reliable, stable and quality supply of electricity to consumers in NESI
- To develop capacity in power distribution planning and operations

Area of Interest/Expectation

- Understand strategies for technical loss reduction in power distribution
- Gain knowledge from the Japanese best practice in power distribution planning, construction and operations
- Understand the relevant standards that can be adopted in the technical regulatory instruments

Learning Through Training: Area of Interest in Human Resource Dev. System and Skill Improvement in the Japanese Electric Power Co.

- Basic, intermediate and advance training curriculum covering the following modules:
 - ✓ Distribution system planning
 - ✓ Overhead & underground line construction
 - ✓ Protection system for distribution lines & substations
 - ✓ Operation & maintenance
 - ✓ Cable jointing
 - ✓ Distribution substation automation system
- The frequency of the training and stages of certification

Learning Through Training: Interest in training facilities and practical training courses in the Japanese electric power company.

- Power system Simulators
- Hands on training facilities
- Training equipment and physical infrastructure at the training center

Learning Through Training: Interest in Outage Frequency and Duration Reduction in the Japanese Electric Power Co.

- Load scheduling optimization methods
- Practical strategies for reducing outage frequency and duration (Sectional switch, auto recloser etc)
- What is the regulatory requirement for maximum outage duration on distribution circuits?

Learning Through Training: Other Areas of Interest

- What is the expected impact of the AEDC pilot project in metrics:
 - ✓ What is the baseline average number of daily and monthly trippings and outage duration of feeder H31 ?
 - ✓ What is the baseline line value of technical losses on feeder H31
 - ✓ What is the technical losses & reliability metrics for feeder H31 targeted after the project
- Relay coordination at transmission/distribution interface is a key reliability issue in the NESI
- Other strategies to deal with reduction of commercial losses beyond metering
- Distribution substation automation system

Thank
You!

Inception Report for Training in Japan

1. Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.
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2. Background and Challenges

What are you currently experiencing as problem(s) in your organization or your country's distribution?

- 1) **Current challenges in the organization in relation to the objectives of this program:** Describe the issues that your organization/department intends to tackle by participating in this program.

1. High Percentage of Technical Commercial And Collection Loses Through in the Distribution Sub-Sector.
2. Poor Supply and Quality with a long downtime due to minor faults.
3. Load rejection due to the weakness of the network

- 2) **Main duties of Participant:** Describe your main duties and responsibilities in relation to this program.

1. Supervision And Monitoring Of Activities Of The Distribution Companies In The Nigerian Electricity Supply Industry (NESI)
2. Drafting, Formulating And Implementation Of Government Policies In The NESI.

- 3) **Relevant Experience of Participant:** Describe previous occupational experiences that is highly relevant in this program.

- Load Studies Of Nigerian Distribution System, Smart Distribution Design And Implementation. Ultra High Voltage Transmission System And Networks Studies and Design
-

4) Your individual Goal: Elaborate on your plans to apply the lessons learned from this program to your organization.

1. To Apply Knowledge Gained From The Training When Formulating Government Policies To Improve Power Distribution In Nigeria Electricity Distribution Sub-Sector.
2. To Improve My Technical Ability In Identifying And Tracking The Performance Of The Operators In The Nigerian Distribution Sub-Sector.

5) Area of Interest and/or your expectation: Specify your particular interest with reference to the contents of this program.

1. Experience A Better Distribution Management Technology And Its Application In Loss Reduction Measures
2. Experience reliability of electricity supply techniques etc

3. Learning through Training

What are you willing to learn in this training in Japan in order to solve the problem(s)?

1) Please describe what you would like to learn regarding the human resources development system and skill improvement in the Japanese electric power company.

- To identify the techniques of improving loss and reliability of distribution systems in Japan with respect to the human resource development

2) Please describe what you would like to learn regarding the training facilities and practical training courses in the Japanese electric power company.

- The discipline of power utility operators in Japan will definitely add value to me
- Utilization of automation systems in Japan Grid operations and use of Artificial intelligence to improve maintenance practice is also important for me to understand.
- I learn the how to monitor and supervise operators in the sector

3) Please describe what you would like to learn regarding the efforts for outage frequency and outage duration reduction in the Japanese electric power company.

- I want to understand the secret behind their success of the Japan Power Sector.
- I also want to understand the techniques of easy restoration of faulty sections of the network within short time, as it happens in Japan.

4) Please describe anything else you would like to learn in this program.

I will like to know the History of Japan and the secret of their sucessess

By Participant

Date 14/06/2023

Name David Joshua

To be answered by the 16th of June 2023.

Thank you for your kind cooperation.

Inception Report for Training in Japan

1. Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.
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- 4) By understanding the efforts of the Japanese electric power company to reduce power outages. (Reduction of power outages by section switches, mechanism and operation method of automatic operation of distribution lines, etc.) The effect of the AEDC pilot project and the effect of the Outage Management System improvement will be understood more concretely, and the AEDC pilot project and the Outage Management System improvement will be implemented appropriately.

2. Background and Challenges

What are you currently experiencing as problem(s) in your organization or your country's distribution?

- 1) **Current challenges in the organization in relation to the objectives of this program:** Describe the issues that your organization/department intends to tackle by participating in this program.

1. High Percentage/level of electricity theft by customers.
2. Poor Supply due to losses along the distribution lines.
3. Load rejection by the Electricity Distribution Companies due to the inability to recover cash from customers because majority of the customers are not metered.
4. It is difficult for the distribution companies to reduce the Aggregate Technical and commercial (AT&C) losses.
5. Reduction of frequent / duration of outages.

- 2) **Main duties of Participant:** Describe your main duties and responsibilities in relation to this program.

1. Research and development of training activities/materials.
2. Implementation of Government Policies In relation to the training program.
3. Learn how to improve and manage outages.

- 3) **Relevant Experience of Participant:** Describe previous occupational experiences that is highly relevant in this program.

1. Supervision of the Construction Of 8km 33kv Line And Upgrading Of 1x2.5mva To 1x7.5mva 33/11kv Substation Including Construction Of 5km 11kv Line And Installation Of 11no 500kva Transformers In Ile-Oluji, Mamukomo, Odigbo, Ajue And Showboy Town In Idigbo Lga Ondo State.
2. Ministry of Power's Desk officer to Benin Electricity Distribution Company.

4) Your individual Goal: Elaborate on your plans to apply the lessons learned from this program to your organization.

1. To organize a Mini Training for my colleagues in the office aimed at improving their knowledge of Power distribution and how to improve it.
2. To Improve and develop new ideas on how the Distribution Companies can improve on the quality of services rendered to customers.
3. Come up with positive ideas on how the Government can create a platform for the distribution companies in metering their customers.(Mass metering program).

5) Area of Interest and/or your expectation: Specify your particular interest with reference to the contents of this program.

1. Experience A Better Distribution Management Technology And Its Application In Loss Reduction Measures
2. Experience reliability of electricity supply techniques.
3. Improvement of outage management.
4. Design, Construction of the distribution network.

3. Learning through Training

What are you willing to learn in this training in Japan in order to solve the problem(s)?

1) Please describe what you would like to learn regarding the human resources development system and skill improvement in the Japanese electric power company.

1. I want to learn management skills in improving the distribution companies.
2. I want to learn Japan's Metering scheme and its implementation.
3. I want to learn smart grid technology and energy management.

2) Please describe what you would like to learn regarding the training facilities and practical training courses in the Japanese electric power company.

1. I will like to learn digital technology in Japan power sector.
2. Utilization of automation systems in Japan Grid operations and use of Artificial intelligence to improve and in the maintenance of the distribution network.
3. I will like to learn how to monitor and supervise operators in the Power sector

3) Please describe what you would like to learn regarding the efforts for outage frequency and outage duration reduction in the Japanese electric power company.

1. I will like to learn why outage occurs.
2. I will like to learn the techniques of easy restoration of faulty sections of the network within short time.
3. I will like to learn how to detect outage cause on time.

4) Please describe anything else you would like to learn in this program.

I will like to learn the technological advancement in Japan's power sector and the secret of their success.

By Participant

Date 30/06/2023

Name ODIDI
CHRISTOPHER

To be answered by the 16th of June 2023.

Thank you for your kind cooperation.

**THE PROJECT
FOR
CAPACITY DEVELOPMENT OF POWER DISTRIBUTION**

Action Plan after the Training in Japan

To be submitted by the 2nd of August 2023, at 6pm (JST)

Name: Chukwudum Okeke

1. Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.**
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2. Your Duties and Responsibilities: Please describe your duties and responsibilities in relation to this program.

- I study technical material for addition to NAPTIN curriculum and Training Manuals.
- Improving NAPTIN Capacity for Distribution sector related upskilling by the addition of descriptions, pictures and technical content to existing NAPTIN Power Distribution curriculum and Power Distribution Training Manuals.
- Facilitation of training courses that teach new techniques and concepts
- Developing annual Training programmes and calendars of such programmes under supervision

3. Lessons learned through the Training in Japan: What have you learned in the Training in Japan?

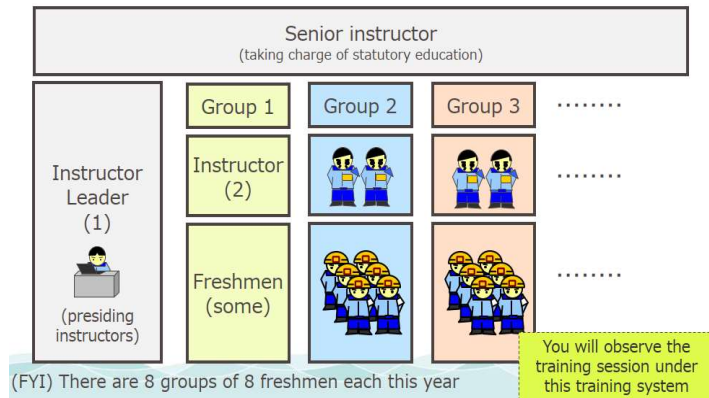
- **I am grateful for exposure to the culture and patterns of estimating the appropriate amount of time to complete tasks**
- I am grateful for the exposure to Japanese way of organizing work and organizing people
- I am grateful for exposure to Japanese methods of working safely and prioritizing the use of tools to simplify work and reduce time
- I am grateful for the opportunity to learn from all the project counterparts
- I am grateful for exposure to the scale of the facilities (both grid side and demand side) needed for instruction and simulation for power distribution training
- I am grateful for exposure to the usefulness of eLearning training for acquiring soft-skills
- I am grateful for exposure to the culture of responsively implemented countermeasures
- I am grateful for exposure to the benefits offered by Specialization of departments like DFCEG

3. Lessons learned through the Training in Japan: What have you learned in the Training in Japan?

- I am grateful for exposure to operations of Different Departments and offices and the knowledge of resources required to carry out those operations
 - I am grateful for the exposure to the DAS and the philosophy behind its monitoring and control of distribution facilities
- I am grateful for exposure to Kansai T&D simulation of Fault Detection, Isolation, and Restoration (FDIR)
- I am grateful for exposure to reliability requirements using stand-by line for elimination of power outage during maintenance work done by Kinden Corp
- I am grateful for exposure to the practice of Quality Assurance between Kansai Distribution and Kinden Corporation

3. Lessons learned through the Training in Japan: What have you learned in the Training in Japan?

I am grateful for exposure to the training system of Kansai Distribution



3. Lessons learned through the Training in Japan: What have you learned in the Training in Japan?

I am also grateful for exposure to the skill management system using Skill Record System

Systematic management of employees' skills

20

Every employee's technical skills are managed by the system called "Skill Record System (SRS)".

■ Screenshot of SRS

区分 category	代表スキル Representative skill	年度目標 Annual Target	現状レベル current level	詳細スキル Detailed skill	年度目標 Annual Target	現状レベル current level	承認年月日 Approval date	技能段階 Skill stage	指揮監督段階 Supervision stage
基本技能 Basic Skills	共通技能(基礎Ⅰ) common skills		A	作業標識の設置 Installation of Work Signs		A	2009/12/21	基礎Ⅰ ▼	基礎Ⅱ
				防工保護具の取扱い Handling of Protective gear		A	2009/12/21	基礎Ⅱ	応用Ⅰ
				昇降柱 Lifting Column		A	2009/09/18	応用Ⅰ	応用Ⅱ
				計測器の取扱い(電圧、電流、絶縁、接地、相回転計) Handling of Measuring Instruments (Voltage, current, insulation, operation)		A	2009/12/25	上級	専門
支線 Branch Line	支線の新設 Basic Skills		A	支線上部の施工 current level		A	2009/12/21	基礎Ⅰ	基礎Ⅱ
				柱間支線の取付け Installation of guy wires		A	2009/12/21	基礎Ⅱ	応用Ⅰ
開閉器 Switch	高圧手動開閉器の新設(操作含む) Installation of HV manual switch including operation		A	高圧手動開閉器の装柱 Mounting of HV manual switch		A	2010/02/24	応用Ⅰ	応用Ⅱ
				高圧手動開閉器の吊架と取付け Suspension and installation of HV manual switch		A	2010/03/18	上級	専門

Skill level	Evaluation criterion
S	Able to instruct others
A	Able to complete work on his/her own
B	Able to complete work while referring to manuals
C	Able to complete work under supervision
D	Having no experience or no capability

Required skill levels at each technical stage

3. Lessons learned through the Training in Japan: What have you learned in the Training in Japan?

I am also grateful for exposure to the skill management system using Skill Record System

Systematic management of employees' skills

21

Employee's operational skills are also managed by SRS.

■ Screenshot of SRS

区分	代表スキル <i>Representative skill</i>	年度目標	現状レベル	詳細スキル <i>Detailed skill</i>	業務段階	年度目標	現状レベル	承認年月日
保全 ▲	設備巡視		II	Knowledge of patrol points of focus 巡視着眼点の知識 定期巡視の実施 改修方法の選定 改修必要箇所の管理	初級 中級 中級 上級 中級 上級		A A B B A B	2012/05/09 2012/05/09 2012/05/09 2012/05/09 2012/05/09 2012/05/09
Category	Representative skills	Detailed skills						
Maintenance	17	61						
Grid Operation	21	88						
Construction Management	14	40						
Facility designing	26	94						
Other	1	6						
Total	79	289						

Skill level	Evaluation criterion
A	Understanding work flow and standard operations, and able to deal with work on their own
B	Have experience and knowledge of the work
C	Have no experience and no knowledge of the work

4. Issues and Challenges: Please refer to the QC methods and Examples.

Issue 1: Training Program Quality and Relevance

NAPTIN offers training programs that may not be tailored to meet specific industry demands, leading to a lack of relevance and competitiveness.

This is further compounded by younger instructors lacking opportunities to gain exposure and experience. This will hinder the development of a skilled and diverse faculty.

Additionally the lack of appropriate training facilities needed to target the skills gap and carry out research for the Distribution sector is a contributor to lack of relevance of NAPTIN training.

4. Issues and Challenges: Please refer to the QC methods and Examples.

Issue 2: Competition and Industry Recognition

NAPTIN faces strong competition from other power sector training institutions (DISCOs, Siemens Power Academy ETC), affecting its market share and industry standing.

Low Awareness in the industry: NAPTIN faces challenges in increasing its visibility and recognition among industry players, this has limited our potential collaborations with industry practitioners

Non-attachment to Power Utility: Limited engagement and partnerships with power utility companies may impact NAPTIN's recognition and support within the power sector.

Unclear Ranking System of Instructors: An unclear ranking system for instructors may lead to challenges in identifying and rewarding top-performing faculty, impacting motivation and retention.

5. Action Plan: What can you utilize in order to solve the problem(s) above or to improve your organization or the situation of your country's distribution? Please describe in detail with 5W1H (what, who, when, where, how and why).

1. Training Program Quality and Relevance:

What: Enhance training program content and delivery. Implement Continuous improvement techniques like Kaizen in a Dramatic manner. Push for the implementation of the Man Power Audit and Training Policy

Who: Training and PRM&E Department, AFDE PIU.

When: Continuous improvement throughout the year.

Where: At all NAPTIN training centers.

Why: To meet industry demands and provide relevant skills to industry practitioners.

How: Conduct regular reviews of training content and objectives, Quality Assurance checklists, explorations, involve industry experts, and incorporate eLearning modules for flexibility.

5. Action Plan: What can you utilize in order to solve the problem(s) above or to improve your organization or the situation of your country's distribution? Please describe in detail with 5W1H (what, who, when, where, how and why).

2. Competition and Industry Recognition:

What: Enhance training facilities, properly structure internal training by adapting a Skills Record System and implement instructor ranking different from Instructor grade level and position.

Who: Training center management, DG and instructors, AFD PIU.

When: Ongoing improvement efforts.

Where: At all NAPTIN training centers.

Why: To remain competitive and gain industry recognition.

How: increase the number of written advice to the DG about investing in training infrastructure upgrades and request for a project to manage monthly goals setting by NAPTIN instructors,

5. Action Plan: What can you utilize in order to solve the problem(s) above or to improve your organization or the situation of your country's distribution? Please describe in detail with 5W1H (what, who, when, where, how and why).

Monitoring and Evaluation:

What: Regularly review progress and results.

Who: Management colleagues at the JICA Training.

When: Scheduled quarterly reviews and ongoing assessments of internal training and progress of acquired training equipment.

Where: Throughout NAPTIN's regional training centers.

Why: To measure the effectiveness of implemented actions and identify areas for improvement, to know concretely the number of capable instructors and the categorization of the skills at NAPTIN, To set monthly and annual targets for instructors.

How: Collect and analyze reports of internal training to understand the skills gap and the efforts needed to close it, Collect and analyze training program evaluations, and feedback from industry stakeholders. Use the data to make informed decisions and adjust existing strategies for improving the standing of NAPTIN instructors.

6. Recommendation: Any comments or suggestions for this program. If you have any expectation for JICA, please describe it.

Thank you for your kind cooperation.

**THE PROJECT
FOR
CAPACITY DEVELOPMENT OF POWER DISTRIBUTION**

Action Plan after the Training in Japan

To be submitted by the 2nd of August 2023, at 6pm (JST)

Name: BAWA GARSHIMA GAMIYA

1. Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.**
- 2) Understand the human resources development system in place to accurately carry out business in the Japanese electric power company to see how skills are improved; and reflect them in Disco's human resources development program through the NAPTIN training courses in Nigeria.**
- 3) By understanding the distribution training facilities and training contents in the Japanese electric power company, the installation of NAPTIN's distribution training facilities will be implemented appropriately.**
- 4) By understanding the efforts of the Japanese electric power company to reduce power outages. (Reduction of power outages by section switches, mechanism and operation method of automatic operation of distribution lines, etc.) The effect of the AEDC pilot project and the effect of the Outage Management System improvement will be understood more concretely, and the AEDC pilot project and the Outage Management System improvement will be implemented appropriately.**

2. Your Duties and Responsibilities: Please describe your duties and responsibilities in relation to this program.

Training programme Facilitation/instruction in power transmission and distribution related courses

Training Programme reports; status, evaluation and completion reports on the areas stated above

Developing course materials for facilitation of training programmes in power transmission and distribution.

Design course materials for training programme in power distribution loss reduction.

Researching on conventional and renewable energy systems

3. Lessons learned through the Training in Japan: What have you learned in the Training in Japan?

Advanced Power Distribution Technologies: Japan is renowned for its superior power distribution techniques and technologies. I gained knowledge of cutting-edge methods for effective electricity transmission and distribution, including the Distribution Automation System, smart meters, demand-side management, and renewable energy integration.

Reliability and Resilience: As a result of frequent natural disasters like earthquakes, typhoons, and tsunamis, Japan has had a difficult time keeping its electricity distribution networks resilient. I recognize the significance of creating and running resilient power systems that can swiftly resume operations after disruptions in the course of this training.

Customer-Centric Approach: Japanese electricity utilities frequently put the needs of their customers first. I gained knowledge of techniques for addressing complaints, enhancing customer service, and interacting with customers to fulfill their changing demands.

Safety Protocols: Safety is a critical aspect of power distribution. Distribution of power must take safety seriously. To protect the health and safety of both employees and the general public, I acquired knowledge of Kansai T&D safety procedures, risk assessment, and emergency management.

Maintenance and Asset Management: Proper maintenance of power distribution infrastructure is essential for longevity and efficiency. I learned about best practices for asset management, predictive maintenance, and adopting new technologies for asset monitoring.

Training: The training emphasizes practical experience, advanced technologies, and safety procedures for maintaining, repairing, and upgrading electrical distribution systems through rigorous apprenticeships and specialized programs and skills divided into five stages.

4. Issues and Challenges: Please refer to the QC methods and Examples.

Training and Safety Protocols:

Issue: Evolving electricity sector demands skilled workforce, proper training, safety protocols for accident prevention.

Challenges: *The* needs to enhance training programs for electric utility personnel and workers to handle new technologies.

Quality Control Methods (QC) and Examples:

Issue: Effective quality control is crucial for reliable and safe electricity systems.

Challenges: Expanding or scaling up QC methods for power distribution requires ongoing investment and stakeholder collaboration.

Reliability and Resilience:

Issue: Japan faces challenges in maintaining reliable electricity supply due to natural disasters, affecting essential services and modern economies.

Challenges: Japan needs robust infrastructure, redundancy, and disaster response plans.

Advanced Power Distribution Technologies:

Issue: Japan integrates advanced technologies for sustainable, efficient grid.

Challenges: Challenges in integrating diverse technologies and addressing cybersecurity risks increase grid security measures.

5. Action Plan: What can you utilize in order to solve the problem(s) above or to improve your organization or the situation of your country's distribution? Please describe in detail with 5W1H (what, who, when, where, how and why).

What: Implement comprehensive training programs and safety protocols with JICA and other Provided facilities.

Who: NAPTIN staff, utility companies, and relevant stakeholders.

When: Immediately, as an ongoing process.

Where: Nationwide across Nigeria's power infrastructure and beyond.

How: Develop additional tailored courses, conduct regular drills, and foster a culture of safety.

Why: To enhance workforce competence, power loss and accidents reduction, and optimize power distribution efficiency.

6. Recommendation: Any comments or suggestions for this program. If you have any expectation for JICA, please describe it.

1. Future programs should be practical-based by engaging the participants of the program instead of a study tour.
2. Integrate modern technologies used in power distribution, such as smart grids, renewable energy integration, and energy storage systems, into the training curriculum.
3. Expand training beyond institutional capacity building; Collaborate with partner organizations to implement the knowledge and skills acquired during the training effectively.

Thank you for your kind cooperation.

THE PROJECT FOR CAPACITY DEVELOPMENT OF POWER DISTRIBUTION

Presented by:

ILEADRE LYNDA OIFO

03RD AUGUST, 2023



Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.
- 2) Understand the human resources development system in place to accurately carry out business in the Japanese electric power company to see how skills are improved; and reflect them in Disco's human resources development program through the NAPTIN training courses in Nigeria.
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2. Your Duties and Responsibilities: Please describe your duties and responsibilities in relation to this program.

- ❖ ☐ I Facilitate technical training in area of expertise which includes, Distribution substation operation & maintenance ,Transformer & switchgear, Utility metering and safety operations)
- ❖ ☐ Develop training materials.
- ❖ ☐ Research on topic of expertise and update on new technology
- ❖ ☐ Assess and evaluate trainees
- ❖ ☐ Coordinating trainings and report writing on trainings conducted.

3. Lessons learned through the Training in Japan: What have you learned in the Training in Japan?



My Journey



JOURNEY THROUGH
JAPAN

25th July, 2023

- ❖ Good programme Planning and coordination
- ❖ Punctuality
- ❖ Readiness to improvement.
- ❖ History of Kansai Electric Power Group.
- ❖ Respect for time / time management.



26th July, 2023

- ❖ Training of new employees is very key to the Japan power sector
- ❖ Priority to skills Transfer/ knowledge transfer (**succession plan**)
- ❖ High level of initiative to improve technology and skill within the sector.
- ❖ Good skill management plan (technical skill and operational skill)
- ❖ Good training facility, environment and supervision.
- ❖ Good quality control culture.(test certification)

27th July, 2023

- ❖ Good Automation concept
- ❖ Clear Specific Job role
- ❖ Proper maintenance concept/ planning
- ❖ Disaster management plan
- ❖ priority to inspection and patrol process
- ❖ Quick outage restoration plan/ backup plan
- ❖ Good citizen culture leading to to zero energy theft/low non-technical losses

28th July, 2023

- ❖ Love/respect for culture
- ❖ Detail quality control check
- ❖ Hospital among Japan Citizen
- ❖ Good Procedure culture

31st july, 2023

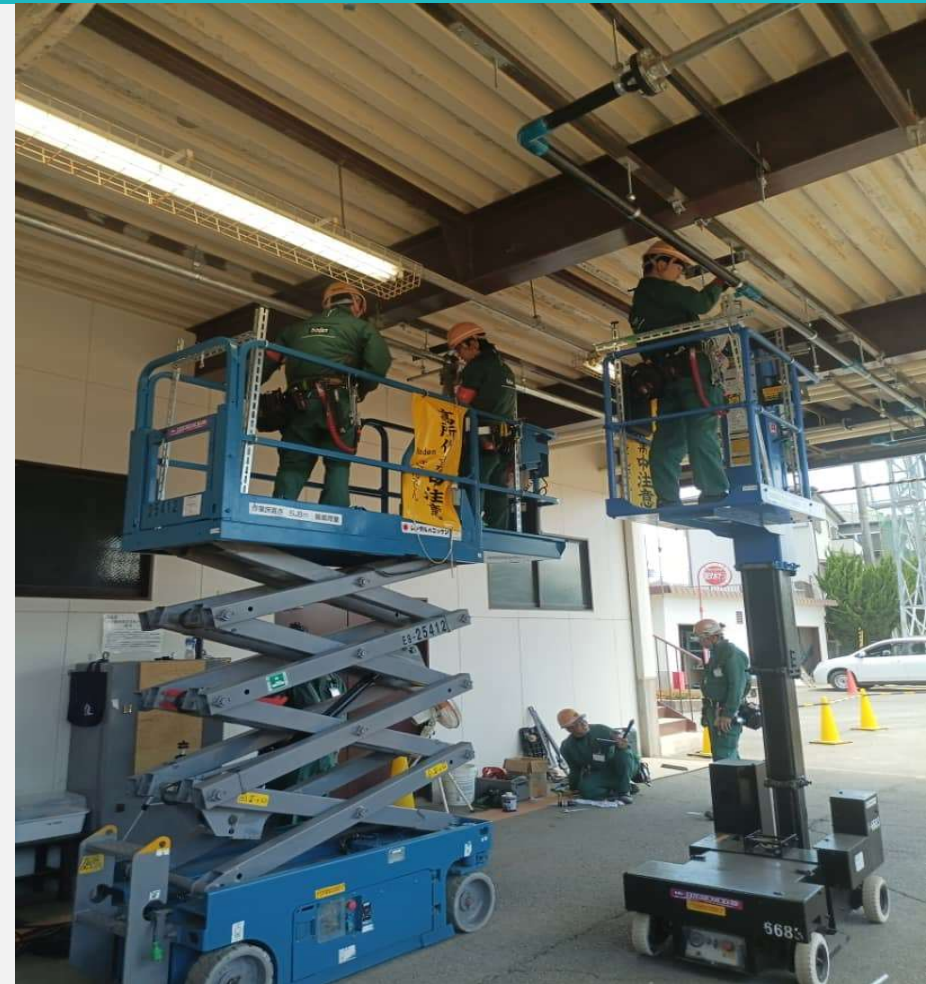
- ❖ Priority to safety procedures
- ❖ Speed and accuracy among staffs (quick response time)
- ❖ Team work/ proper coordination during work.
- ❖ High skills and knowlede on the Job
- ❖ Proper briefing from Supervisor
- ❖ Good communication skill
- ❖ Strong Will', 'Sense of Mission' and 'Safety Consciousness' as distribution expert.

1st August, 2023

- ❖ Good future plan Underground cables)
- ❖ Good prevention plan

2nd August, 2023

- ❖ Quality skill training for the Utility workforce
- ❖ Good curriculum for training of the Utility work force.
- ❖ accessibiltiy to quality training tools/kits
- ❖ Proper supervision of Trainees
- ❖ Constant Communication to ensure all trainees are active.



4. Issues and Challenges: Please refer to the QC methods and Examples.

- ❖ □ Retention and turnover: Power distribution organizations/Utility companies may struggle with retaining skilled employees, leading to turnover and loss of knowledge and expertise. This can make it challenging to maintain a consistent level of training across the organization.
- ❖ □ Inability to Reduce Aggregate Technical, Commercial and Collection.
- ❖ □ Utility companies are unable to recover cash as a result of a large amount of customers who are not metered.
- ❖ High level of Electricity theft by the Metered and Un-Metered customers.

S:

- ❖ Good number of employee
- ❖ Good working environment
- ❖ Good Training facilities

W:

- ❖ Poor work CULTURE
- ❖ Lack of priority to employee training
- ❖ No clear Job discription and No clear Goals
- ❖ Zero culture to health and safety procedures

O:

- ❖ Public-Private Partnerships
- ❖ Energy Efficiency
- ❖ Problem solving for the utilities via research
- ❖ International collaborations.

T:

- ❖ Lack of funding/ Investment
- ❖ Processes and procedure to good work culture
- ❖ Succession Plan for skilled employees

5. Action Plan: What can you utilize in order to solve the problem(s) above or to improve your organization or the situation of your country's distribution? Please describe in detail with 5W1H (what, who, when, where, how and why).

- ❖ Needs Assessment
- ❖ Set Clear Objectives
- ❖ Good safety Procedures
- ❖ Continuous Improvement
- ❖ Good work culture
- ❖ Speed and accuracy
- ❖ Set Goal/ team work
- ❖ Pass on knowledge gain.
- ❖ 5 Years succession planing.

6. Recommendation: Any comments or suggestions for this program. If you have any expectation for JICA, please describe it.

- I am delighted to offer my sincere appreciate to JICA, YACHIYO, KINDEN, KANSAI D&T for the outstanding training program conducted, support, hospitality and sponsorship.
- I will suggestion the all the JICA, YACHIYO and all company concerns to create more avenue for us to be trainned more and guide us till will get to the desired goal in Nigeria power sector.

*Thank
you*





THE PROJECT FOR CAPACITY DEVELOPMENT OF POWER DISTRIBUTION

Action Plan Report

August 02, 2023

Participant: KHALIL Yusuf Adamu

Organization: National Power Training Institute of Nigeria (NAPTIN)

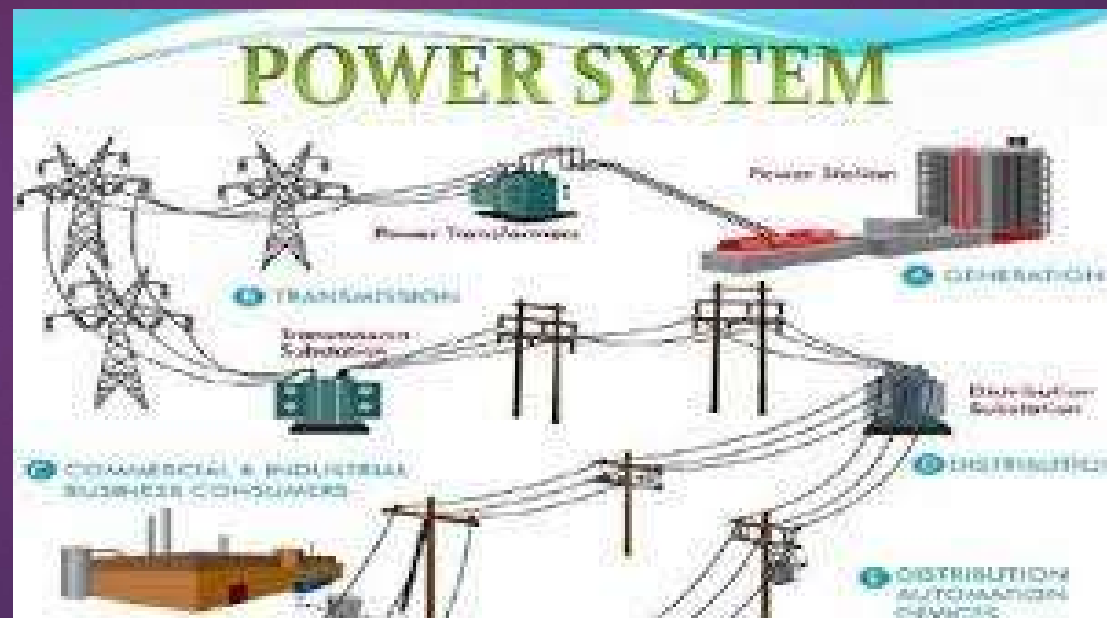
Country: Nigeria

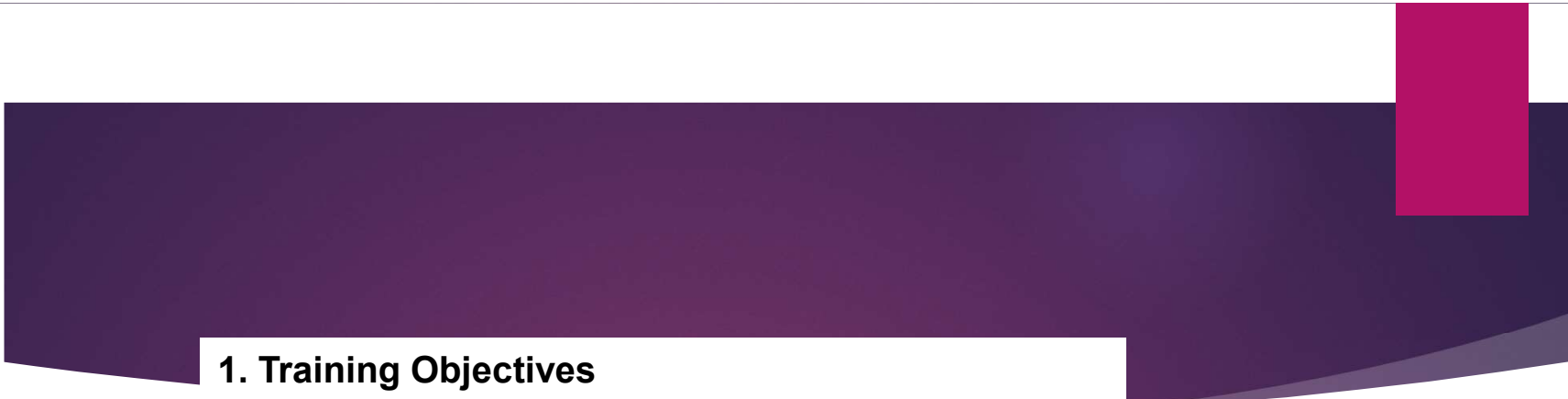




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Training Objectives





1. Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.**
- 2) Understand the human resources development system in place to accurately carry out business in the Japanese electric power company to see how skills are improved; and reflect them in Disco's human resources development program through the NAPTIN training courses in Nigeria.**
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Lessons Learnt through the Training in Japan



ORIENTATION

The first day was for orientation which centred on;

- Overview of the training
- Guidelines required
- Rules - Dos and Dents

Orientation and induction in training is critical in every training programme

Participants expectation via inception report presentation



OPERATIONS TO REDUCE LOSSES, IMPROVE RELIABILITY AND POWER QUALITY

HR Development of Kansai T&D

- Training is necessary for new intakes
- Technical and Non-Technical professional courses

Defect detection and test of facilities

- Testing and Certification group (like NEMSA)
- Distribution Automation System (DAS)

Field work

- Maintenance activities
- Vegetation management
- Use of conductor cover



HUMAN RESOURCES DEVELOPMENT

Training for
Transmission
and
Distribution
companies

- 3 Years training for new employees
- 3 levels of training - Basic, Advance (I and II) and Higher, then becomes Master
- Professional training courses
- Instructors identified from masters then trained for 2 months on pedagogy



DISTRIBUTION TRAINING FACILITIES AND TRAINING CONTENTS

Supply side training facilities

- Overhead training facilities
- Underground training facilities
- Transformer training facilities
- Switchgear training facilities

Demand side training facilities

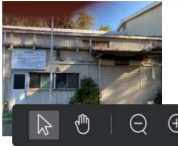
- Service drops
- Meter installation



DISTRIBUTION TRAINING FACILITIES AND TRAINING CONTENTS

Facilities in Distribution Training Center

25

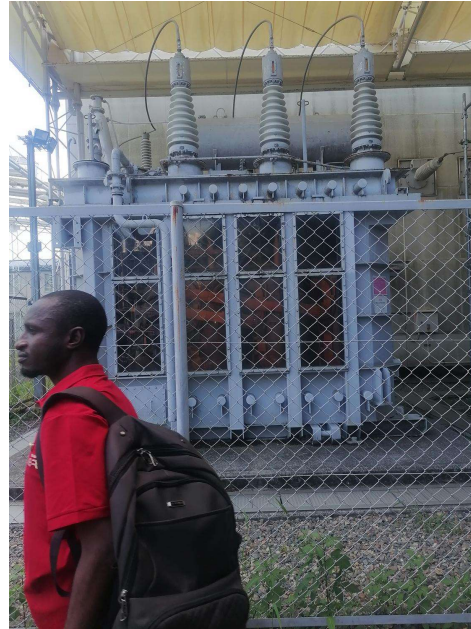
No.	Facility	Appearance		
(1)	Training yard for grid side #1			
(2)	Training yard for grid side #2			
(3)	Training yard for demand side			

Facilities in Distribution Training Center

26

No.	Facility	Appearance		
(4)	Training ground			
(5)	Training yard for underground network			

Kansai Transmission and Distribution, Human Resources Development in Distribution Department, Distribution Training Centre (DTC), July 2023



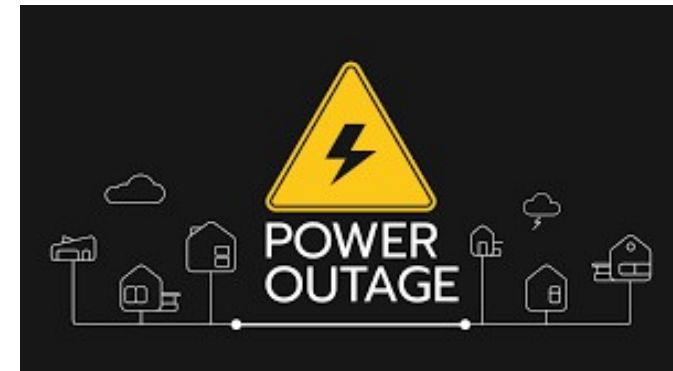
REDUCE POWER OUTAGES

Reduction of power outages by;

- section switches,
- mechanism and operation method of automatic operation of distribution lines,
- Uninterruptive method (Live line).

Distribution Automation System (DAS)

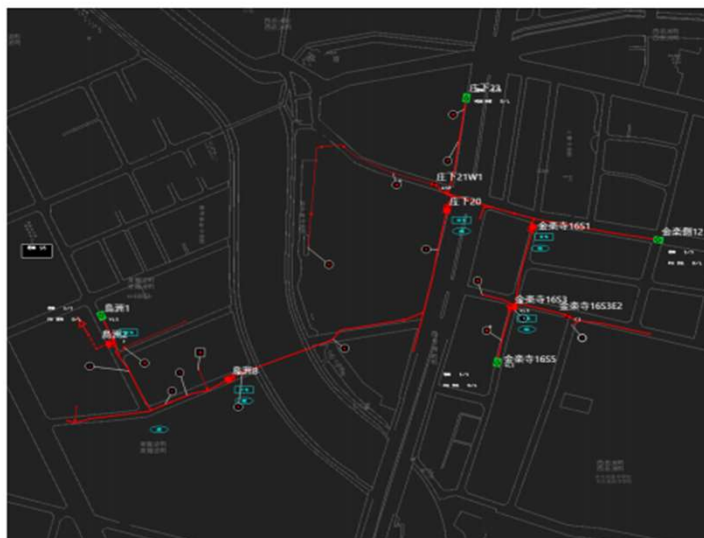
- Fault detection
- Isolation
- Restoration



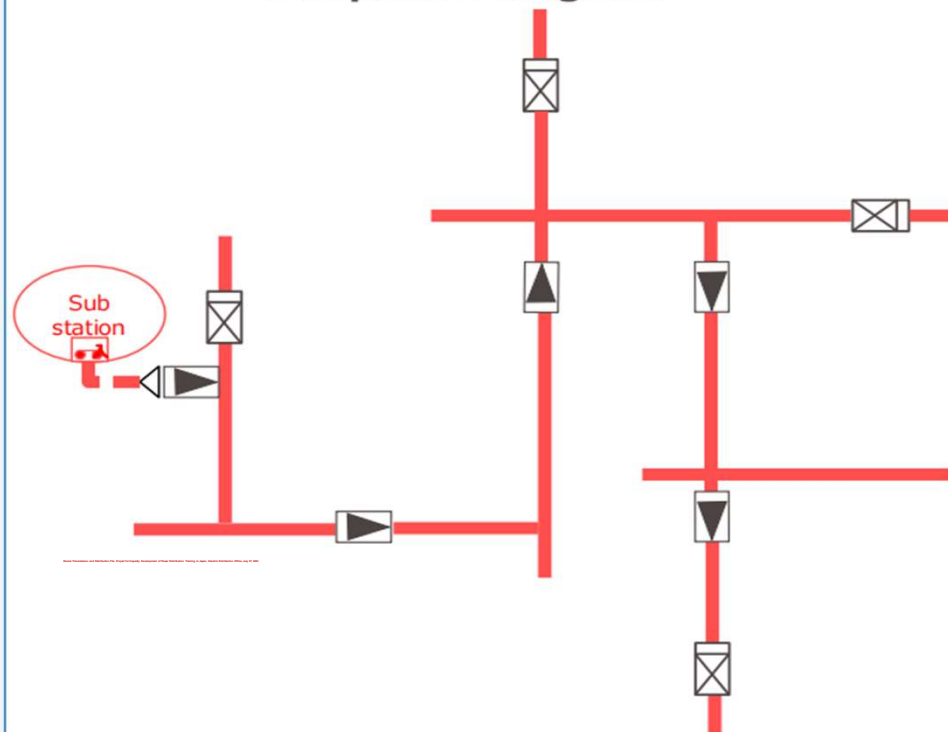
Restoration process in the event of an outage incident

19

Screenshot of DAS



Simplified diagram



Kansai Transmission and Distribution, The Project for Capacity Development of Power Distribution Training in Japan, Hanshin Distribution Office, July 27, 2023

BEHAVIOUR and ATTITUDE

Time Management

- Punctuality
- Organization

House Keeping

- Different trash containers
- Everywhere clean

Respect for each other

- Elders respect
- The young

Professionalism

- Happy what you do
- Maintain your area of practice

Attitude and Behaviour Cycle





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Duties and Responsibilities

Indeed

Must haves to define roles
and responsibilities



Job title &
description



Job qualifications
& requirements



List of
responsibilities



Who the position
reports to



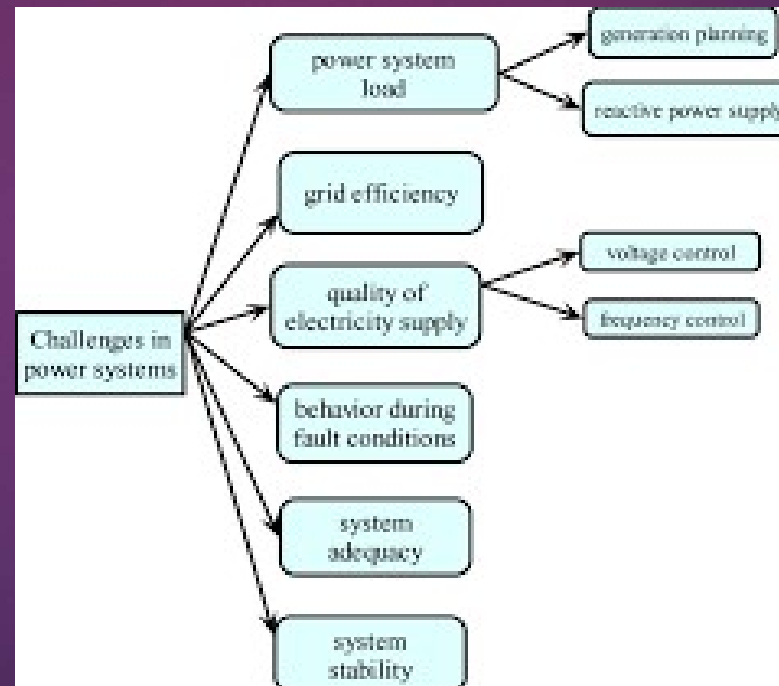
MAIN DUTIES AND RESPONSIBILITIES

As an Instructor, I train the utilities on courses relating to Transmission and Distribution Network operations and maintenance to improve their performance

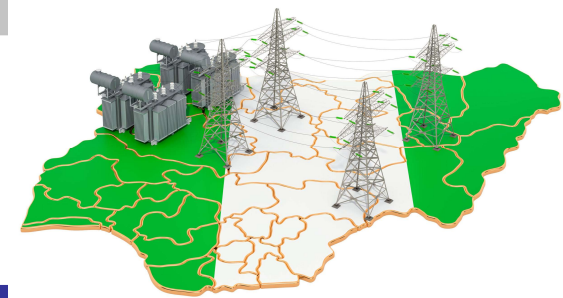
- Conduct Training Needs Analysis
- Design Training Courses
- Develop the Training Materials
- Evaluate the Trainees and the programme
- Conduct Research and provide consultancy



Issues and Challenges



ISSUES AND CHALLENGES IN THE POWER SECTOR



In my country, Nigeria:

- High power losses of about 40% total (ATC & C)
- System instability, low reliability and poor quality
- Distribution System not automated, Manually operated
- Inadequate qualified and competent workforce



FINDINGS (from Distribution Capacity Development)

In my country, Nigeria:

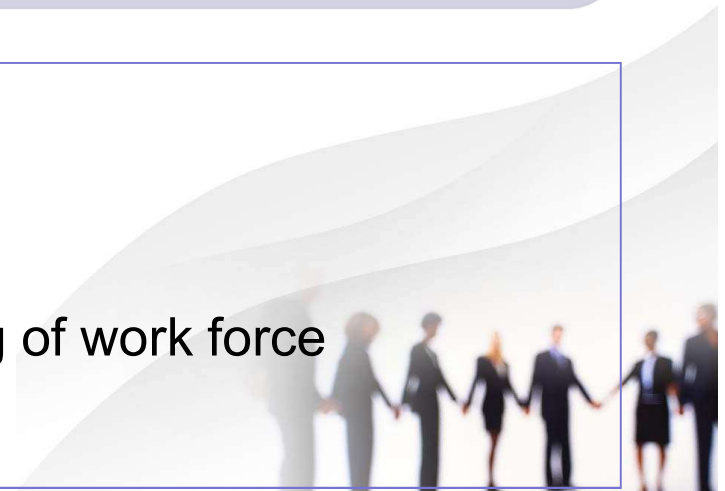
- Power losses very high, about 40%
- Timely infrastructural expansion and maintenance usually neglected resulting to very low reliability indices
- Distribution network operated manually

In Japan:

- Power losses very low, about 5.2%
- Timely infrastructural expansion and maintenance
- Distribution network automated via Distribution Automation System (DAS)
- Well trained workforce

Effects of the above difference:

- High power losses
- Low reliability and stability
- Poor quality of supply and low training of work force





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Action Plan



ACTION PLAN-1

Challenges	Causes	Remedies	Implementer	Timeline
High Losses	-Lack of expansion -Poor maintenance -Low competence	-Identify loss level -Develop action plan -Implement the plan	Distribution Companies	1-3 years
Low Reliability	-Manual operation -Frequent Forced outages -Delapidated Network	-Automation System -Maintenance Schedule -Infrastructural Expansion	Distribution Companies	1-3 years
Poor Quality	-Generation issues -Transmission issues -Distribution issues	-Governor Control system -Load Frequency Control -Economic Dispatch Control	GenCos, TCN and DisCos.	1-3 years

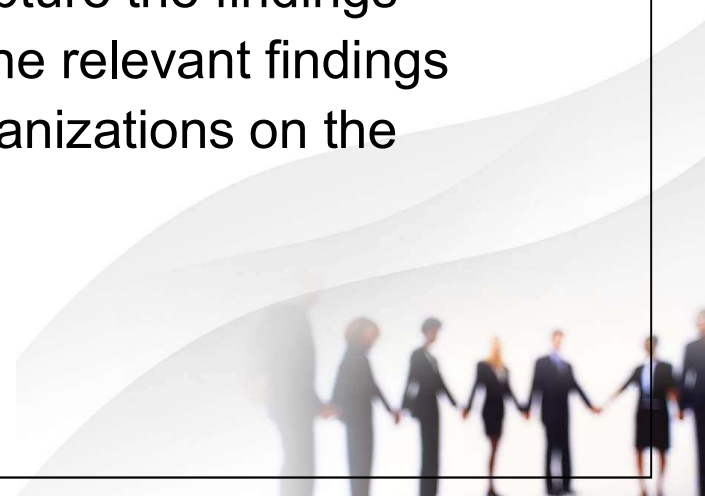
ACTION PLAN-2

Within 6 months

- Report my findings to my organization
- Share my findings with colleagues, Instructors through internal training
- Brainstorm with my colleagues, Instructors on better ways to recommend the changes to the organizations

Within 3 Years

- Update NAPTIN's training curriculum to capture the findings
- Propose trainings to the organizations on the relevant findings
- Write recommendations to the relevant organizations on the improvement plan through the findings



MY ACTION PLAN & DUTY-3

My Actions	1 st Year				2 nd Year				3 rd Year			
	1st QTR	2nd QTR	3rd QTR	4th QTR	1st QTR	2nd QTR	3rd QTR	4th QTR	1st QTR	2nd QTR	3rd QTR	4th QTR
Activity 1 (Training and Reporting)	JICA Project On-going	JICA Training Preparation	Attend Training and Submit report to my organization	Prepare and conduct in-house training								
Activity 2 (Training Courses Review)					Review curriculums	Review Training manuals	Validate Training Manual	Conduct ToT on the developed training manuals				
Activity 3 (Recommendations to Utilities)									Recommend Courses to utilities	Submit to the utilities	Expected preparation on recommendations by utilities	Recommendations implementation



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Recommendations



RECOMMENDATIONS

Participants from different countries at the same time will give better opportunity in identifying issues and solutions

NERC needs to use the training in identifying regulatory and legal issues to solve Discos problems

FMoP identifies opportunities in aligning policies of the government in the power sector

NAPTIN uses the opportunity to enhance training delivery





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Japan International
Cooperation Agency

KHALIL, Y. A. - JICA Trainee on Distribution Capacity Development

Action Plan after the Training in Japan

1. Training Objectives and Activities

The JICA training program in Japan had four main objectives:

- To understand the specific operations and methods that the Japanese electric power companies use to reduce losses, improve reliability, and improve the quality of electric power.
- To understand the human resources development system and skill improvement strategies that the Japanese electric power companies employ to ensure accurate and efficient business performance.
- To understand the training facilities and training contents that the Japanese electric power companies offer to enhance the practical skills and knowledge of the trainees in the distribution sector.
- To understand the efforts and innovations that the Japanese electric power company implements to reduce power outages and ensure a continuous and stable power supply.

2. Duties and Responsibilities (My duties and responsibilities in relation to this program.)

My duties and responsibilities for this program are:

- ✓ Facilitating the project execution from NAPTIN's perspective as a NAPTIN trainer and a working group member. This involves attending meetings and monitoring the project's progress, especially the

distribution training facility.

- ✓ Participating in the design, development, and update of the reference manual for distribution technical loss reduction with Kashiwagi-san from the JICA Expert Team as a Train-The-Trainer (TOT) member.
- ✓ Coordinating and evaluating courses on power loss reduction techniques, power reliability, and power quality.

3. Lessons learned through the Training in Japan (What I learned in the Training in Japan)

Through this training program, I learned a lot of valuable lessons that will help me improve my performance as a training instructor in NAPTIN and contribute to solving the challenges that we face in our country's distribution sector, especially in the aspect of human resource capacity development. These learning outcomes have significant implications for my organization and country. So as a result of this training program:

- I learned about the comprehensive human resources development system that the Japanese electric companies (Kansai T&D and Kinden Corporations) adopt to cultivate a skilled and motivated workforce. For example, I learned about their structured training methodology that covers both theoretical knowledge and practical skills for different levels of employees from freshmen to Masters. I also learned about their continuous learning culture that encourages employees to update their knowledge and skills regularly through both On-The-Job (OJT) and Off-The-Job (Off-JT) trainings.

- I learned about the advanced technologies and equipment which Japanese electric power companies use to monitor, control, protect, and optimize their distribution network. For example, I learned about the section switches that can isolate faults automatically, the Distribution Automation System (DAS) that can remotely operate and supervise the network, Smart Metering System, and the various tools and equipment that make work easier, more efficient, and less time-consuming.
- I learned about the effective management and operation systems that Japanese electric power companies follow to ensure high-quality service delivery. For example, I learned about their rigorous planning, design, construction, maintenance, inspection, testing, and evaluation processes that cover every aspect of their business. I also learned about their customer-oriented approach that focuses on meeting customer needs and expectations.
- I have gained new insights and ideas on how to design, facilitate, coordinate, and evaluate electrical power system trainings in NAPTIN. I have also acquired new knowledge and skills on power loss reduction techniques, power reliability improvement methods, and power quality enhancement measures that I can share with my colleagues and trainees back home.
- I have developed a better understanding of the current situation and challenges of our distribution sector in Nigeria. I have also identified some

gaps and areas for improvement in our management, operation, technical, and human resources development systems.

- I have established a network of contacts with the JICA experts, trainers, engineers, and managers from Yachiyo Engineering, Kansai T&D, Kinden Corporation, Daito Corporation, and other participants from Nigeria. I have also exchanged experiences and best practices with them that can help us learn from each other and collaborate in the future.
- I am deeply impressed by the Japanese approach to work. Their culture, mindset, and philosophy regarding hard work, punctuality, politeness, and cleanliness are admirable. Their meticulous attention to detail, unwavering commitment, and respect for others are truly remarkable. If JICA's goal is to inspire people to adopt these values and ways of thinking, then they have certainly succeeded with me.”

4. Issues and Challenges

Using the MECE (Mutually Exclusive, Collectively Exhaustive) QC method, here are the issues and challenges bedeviling the distribution sector of the Nigerian Electricity Supply Industry, with a focus on power losses, power reliability, and power quality in the context of human capacity development:

1. Power Losses:

a. Inadequate Training: Lack of comprehensive training programs for distribution personnel on identifying and addressing technical and commercial losses.

b. Outdated Techniques: Reliance on outdated power loss reduction techniques if any and failure to adopt advanced methodologies.

c. Limited Skill Development: Insufficient focus on enhancing technical skills related to power loss management among Distribution Companies.

d. Ineffective Monitoring: Lack of efficient monitoring systems to track and manage power losses throughout the distribution network.

2. Power Reliability:

a. Inadequate Fault Restoration: Delayed response and restoration during faults, leading to prolonged power outages and customer dissatisfaction.

b. Limited Reliability Training: Insufficient emphasis on training distribution personnel in effective fault identification and quick restoration techniques.

c. Aging Infrastructure: The presence of aged and poorly maintained distribution infrastructure contributes to frequent breakdowns and reduced reliability.

d. Inadequate Contingency Planning: Lack of robust contingency plans to handle unexpected events, such as natural disasters or equipment failures, affecting power reliability.

3. Power Quality:

a. Insufficient Quality Training: Limited training programs for distribution personnel on power quality monitoring, analysis, and mitigation techniques.

b. Voltage Fluctuations: Inconsistent voltage levels resulting in unstable power supply and potential damage to electrical appliances and equipment.

c. Harmonic Distortions: The presence of harmonics in the distribution network, affects the quality of power supplied to consumers.

d. Reactive Power Management: Poor management of reactive power leading to power factor issues and reduced overall power quality.

- **Issue: Language barrier between the participants and the trainers**

- **Challenge:** Difficulty in understanding the lectures and instructions, communication gaps, misunderstandings

- **Issue: Cultural differences between the participants and the organizers**

- **Challenge:** Different expectations, values, norms, behaviors, etiquette, customs, beliefs, attitudes, preferences

- **Issue: Weather conditions**

- **Challenge:** Heat and humidity that affect the training activities, health, comfort, or safety of the participants and trainers

- **Issue: Different time zones**

- **Challenge:** Jet lag, fatigue, sleep disturbance, difficulty in adjusting to the local time, disruption of the daily routine or schedule

- **Issue: Different technology or infrastructure**

- o **Challenge:** Incompatibility or unfamiliarity with the local technology or infrastructure, difficulty in using or accessing the equipment or facilities, communication or connectivity issues

5. Action Plan

Based on the challenges and issues raised above, the action Plan to Address Challenges in the Nigerian Electricity Distribution Sector may include;

1. Power Losses:

What: Implement a Comprehensive Power Loss Reduction Training Program

Who: NAPTIN

When: Include in the Training calendars every year

Where: NAPTIN training centers across Nigeria

How: Develop a specialized training curriculum on power loss identification, analysis, and reduction techniques. Train distribution personnel, engineers, and technicians on modern methodologies.

Why: Enhancing the skills of the workforce will lead to better power loss management and a reduction in technical and commercial losses.

2. Power Reliability:

What: Establish Rapid Response and Fault Restoration Training

Who: NAPTIN, DisCos

When: As scheduled

Where: NAPTIN training centers and DisCo

How: Develop training modules focused on quick fault identification, isolation, and restoration. Conduct drills and simulations for distribution personnel to practice response in real-time scenarios.

Why: Enhanced fault restoration capabilities will reduce downtime and improve power reliability for consumers.

3. Power Quality:

What: Introduce Power Quality Monitoring and Analysis Training

Who: NAPTIN, Power Quality Experts

When: Schedule

Where: NAPTIN training centers

How: Develop training modules on power quality monitoring, analysis, and mitigation techniques. Collaborate with power quality experts to provide hands-on training and demonstrations.

Why: Equipping distribution personnel with power quality knowledge will help identify and address issues affecting power supply quality.

Based on the lessons learned from the training program, I will take the following actions to apply the knowledge and skills gained to my organization and country:

- Complete the upgrade of the NAPTIN manual on distribution technical loss reduction with the help of Kashiwagi san, the JICA expert team lead. The manual will include the best practices and techniques that I learned from the Japanese electric power company. The manual will also be aligned with Nigerian electricity supply industry standards and regulations. The manual will be completed by December 2023.
- Organize a training course on distribution technical loss reduction for distribution engineers and technicians in Nigeria using the upgraded NAPTIN manual. The course will be included in the 2024 calendar.
- Share my experiences from the training program with my colleagues at NAPTIN through presentations and discussions. This will help spread the knowledge gained from the training program to other members of my organization.
- Maintain communication and cooperation with the JICA experts, trainers, engineers, and managers from Yachiyo Engineering, Kansai T&D, Kinden Corporation, Daito Corporation, and other participants from Nigeria through emails, phone calls,

6. Recommendation

Any comments or suggestions for this program. If you have any expectations for JICA, please describe it.

Based on the report, I would suggest the following recommendations for JICA and other stakeholders:

- For JICA: Continue to support and monitor the implementation of the action plan by the participants, provide feedback and guidance, facilitate the exchange of knowledge and experience among the participants and trainers, evaluate the impact and outcomes of the training program, identify areas for improvement or further collaboration
- For Yachiyo Engineering, Kansai T&D, and Kinden Corporation: Share their expertise and best practices with the participants, provide technical assistance or consultation if needed, maintain communication and relationship with the participants, explore opportunities for joint projects or partnerships
- For NAPTIN: Encourage and support the participants to apply the knowledge and skills gained from the training program to their organization and country, disseminate the lessons learned and best practices to other members of the organization, provide resources and incentives for the participants to achieve their goals, collaborate with JICA and other stakeholders to improve electric power distribution systems in Nigeria

Conclusion

In conclusion, the training program in Japan was a very rewarding and enriching experience for me. I have learned a lot from the Japanese electric power company's achievements and challenges in reducing losses, improving reliability, and improving the quality of the electric power business. I have also gained new perspectives and skills that will help me perform better as a training instructor in NAPTIN and contribute to solving the problems that we face in our country's distribution sector.

I would like to express my sincere gratitude to JICA, Yachiyo Engineering, Kansai T&D, Kinden Corporation, Daito Corporation, and all the trainers, engineers, managers, and staff who made this training program possible and successful. I would also like to thank my fellow participants from Nigeria for their friendship and support. I hope that we can continue to work together to achieve our common goals of improving our distribution sector and providing better service to our customers."

By Participant

Date	2 nd August, 2023
Name	Murtala Yabo Lawa

**ACTION PLAN FOR TRAINING
ON
CAPACITY DEVELOPMENT OF POWER DISTRIBUTION
JICA KANSAI INTERNATIONAL CENTER, JAPAN.**

**Prepared By:
Engr. Amobi Ifeanyi Chinedu.**

Action Plan after the Training in Japan



1. Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.
- 2) Understand the human resources development system in place to accurately carry out business in the Japanese electric power company to see how skills are improved; and reflect them in Disco's human resources development program through the NAPTIN training courses in Nigeria.
- 3) By understanding the distribution training facilities and training contents in the Japanese electric power company, the installation of NAPTIN's distribution training facilities will be implemented appropriately.
- 4) By understanding the efforts of the Japanese electric power company to reduce power outages. (Reduction of power outages by section switches, mechanism and operation method of automatic operation of distribution lines, etc.) The effect of the AEDC pilot project and the effect of the Outage Management System improvement will be understood more concretely, and the AEDC pilot project and the Outage Management System improvement will be implemented appropriately.

2. Your Duties and Responsibilities

Please describe your duties and responsibilities in relation to this program.



- ✓ Coordinate and liaise with all technical and commercial teams on all technical /commercial issues, ensure quick resolution of all and update MD/CEO AEDC ASAP.
- ✓ Interface between customers and our technical teams to ensure timely resolution of complaints.
- ✓ Ensure that all our distribution feeders are circuit with quality supply distributed to our customer with minimum of hours of supply based on their tariff bands.
- ✓ Ensure that all AEDC high profile customers with huge commercial value have improved quality power supply with minimal tripping and outages.
- ✓ Ensure that technical team have the right knowledge on maintenance and resolution of faults within the shortest possible time to resolve customer complaints and dissatisfaction.
- ✓ Advise MD/CEO on all technical issues, recommend solutions for quick resolution, in order to improve quality of the grid supply.
- ✓ Liaise and work with Chief technical Officer (CTO) for timely resolution of all technical related issues that affects quality, improve supply to our customers.

3. Lessons learned through the Training in Japan

What have you learned in the Training in Japan?



- ✓ **Japanese heritage, culture and way of life:** Japanese take pride in their culture and have a rich heritage spanning hundreds of years. This helped inculcate the right discipline mentality which are exemplified in greetings, time management, orderliness, quality of work, hard work, honesty etc.
- ✓ **There is robust pupillage training program for freshmen/technical staff:** The over one-year freshmen training program in class room and on-the-job practical training provides a solid foundational grounding for front line personnel to be well acquainted with necessary knowledge and skills to undertake tasks across the distribution network value chain.
- ✓ **Leadership Selection/Staff Promotion:** As freshmen bond and work together in teams during the pupillage program, selecting team leads and supervisors are done meritoriously by identifying personnel with leadership skills and assigning responsibilities as against the normal of handpicking leaders at the recruitment process like it is done in Nigeria. Also promotion are done on merit and job competence.
- ✓ **Equipment and Material Standardization:** All material used in the distribution network must undergo quality checks and test scrutiny and certify by Distribution Facility Certification Group. This ensures all materials and equipment deployed to the field are of high-quality standard as stated in the nameplate and will-stand the test of time – Presently not applicable in Nigeria.

3. Lessons learned through the Training in Japan

What have you learned in the Training in Japan? (Cont'd)

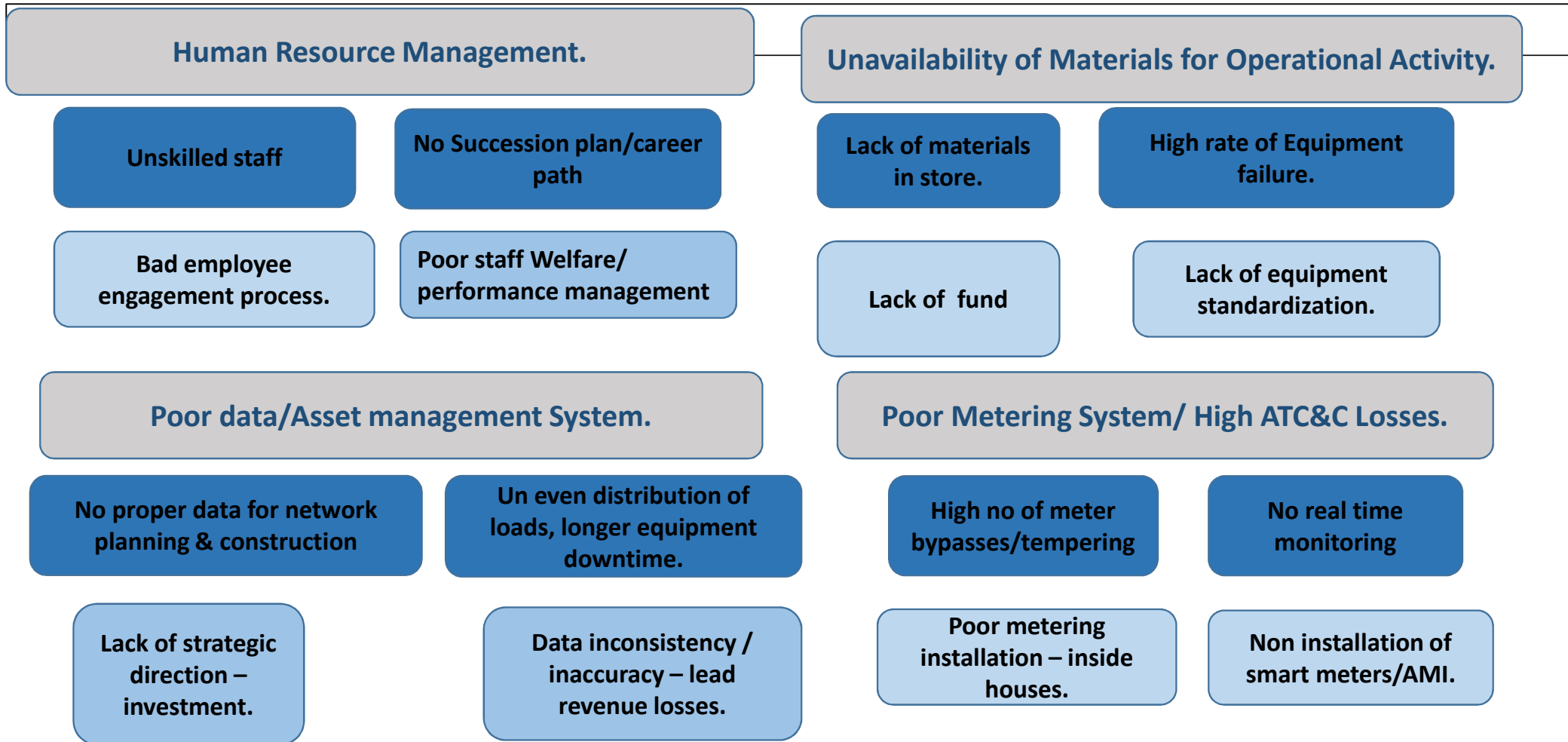
- ✓ **Strong regulation and policy framework:** The electricity sector in Japan has strong government regulations and policies that creates enabling an environment for growth of the sector. Several reforms opened up the sector to be competitive across the value chain from generation to transmission to distribution. The grid operates at two frequencies (50 and 60Hz), the West is 60Hz while the East is 50Hz, generation capacity as at 2012 is 287GW which is more than 50 times the generation capacity in Nigeria considering generation capacity hovers 3.8GW to 5GW.
- ✓ **Robust Data Asset Management:** The distribution network has a robust data asset warehouse that contains information on all essential features that make up the network architecture. This is done to aid efficiency in network monitoring, line expansion and proactive maintenance management which ultimately leads to less outage, equipment downtime and less maintenance cost. E.g. No of poles, transformers, meters within each distribution coverage.
- ✓ **The use of smart meters:** All meters in the network are installed outdoors with supply cable entering the meters while the load cable goes to the customer apartment. No regular interference with meter as they are post-paid and are remotely monitored and read by train personnel every 30 minutes not only for producing bills but also for consumption data analysis as well as checks on essential parameters responsible for meter accurate functionality and integrity – This eliminates any possibility of energy theft.

3. Lessons learned through the Training in Japan

What have you learned in the Training in Japan? (Cont'd)

- ✓ **Customers not allowed to purchase equipment:** Distribution network operators have total control of the network, no one is allowed to procure materials or equipment for installation as this may lead to system instability and unreliability because of use of non-certified substandard materials in the network.
- ✓ **Understanding power system planning, operation and maintenance practices:** Understood functions of the technical department and division of roles within the value chain that ensures system reliability (e.g., supply-demand control, voltage control, fault clearing and mitigation of outage).
- ✓ **Safety Management:** Technical Operational activities are carried out with high level of safety awareness to avoid any incidence that could lead to accident. Also inspection of all equipment's prior to use, JHA. All technical activities are carried out with high level of safety consciousness to avoid accident while delivering stable power to customers.

4. Issues and Challenges: Please refer to the QC methods and Examples.



What can you utilize in order to solve the problem(s) above or to improve your organization or the situation of your country's distribution? Please describe in detail with 5W1H (what, who, when, where, how and why).

For What?

The essence is to use knowledge gained in Japan to address quality in the power distribution system, especially in my parent company **AEDC** so as to improve network reliability and stability and improvement in revenue generation. Also, the use of renewable energy in the distribution energy mix so as to increase access to energy and reduce carbon emission footprints in the energy sector leading to climate change mitigation. Adoption and adaptation of Japanese technology and processes that have been tried and tested will help strengthen all faucets of the Nigerian electricity value chain.

For Who?

Those I will be sharing my idea will be those that will drive change all across the various departments and units in the company (**AEDC**);

1. **Human Resources:** On staff recruitment using the freshmen training model as well as Japanese work life and culture; Time management, quality of work, integrity and strict compliance to set guidelines and standards.
2. **Technical (Network Planning and Construction):** Development of Data Asset Management System containing all **AEDC**

5. Action Plan (Cont'd)

network infrastructures – CTO/GIS/ICT.

3. Metering: Development of a Japanese model smart metering system to the AEDC network – Installation at source (Outside) – Head Metering/CBO.

4. Operation and Maintenance: Fault Clearing, Time management, Voltage Control, Outage management, preventative and corrective maintenance - Head O&M/CTO.

5. Quality Control of Equipment: Establishment of equipment quality control unit to certify all materials used in the network – CTO.

6. Safety: Adherence to safety standards and protocols including the wearing of PPEs by all staff in the front-line from Manager down to the least fault man in the work hierarchy (cultivate the habit of safety consciousness)– **Safety Unit/Technical.**

7. Training: Establishment of an internal training units across all AEDC franchise areas for staff - Compulsory fresh men training, on the job training and on-site training with practical examples as seen in Japan. Engagement/collaboration with NAPTIN team on training of all technical staff every quarter of the year – **AEDC Training Team/Naptin.**

8. MD/CEO: Liaise and Discuss with MD on approval/procurement of materials in AEDC Store for operational activities – maintenance, repairs, faulty clearing etc. and restoration of supply to our customers. (**Head Procurement/CFO/CIA**).

5. Action Plan (Cont'd)

When?

These activities will be carried out in phases with the first three to six months of my return to Nigeria with evaluation done to measure impact of work improvement of business key performance indicators (KPI) i.e., ATC &C losses; billing and collection efficiencies; fault response and resolution time; staff competency on the job after training and retraining; quality control and assurance of metering installations; number of asset/infrastructures in AEDC database e.g., no of poles, no of transformers etc.

Where?

This program will be done at the company Head Quarter, respective Business Districts Offices and Regions in respective departments and units.

How?

In order to implement the outcomes of this training as outlined above in AEDC and get result as expected a SMART (Specific, Measurable, Achievable, Relevant and Time-based) Goals that are in line with the overall corporate goal of the company will be set.

This will be cascaded to Change Champions (actions owners) in respective units and departments with Change Management and Human Resources providing direction and support and leadership where necessary.

5. Action Plan (Cont'd)

Timelines will be provided for each Change Champions for completion of tasks with regular monitoring and evaluation to see that desired milestone is achieved.

Why?

As electricity distribution companies continue to seek for innovative ways to bring down ATC&C losses to single digit number, enhance network reliability, improve energy access and grow revenue base as well as shore up climate change resilience through de-carbonization of the grid, the introduction of training outcomes in AEDC business operations from top to bottom of value chain will cause a dynamic shift that will lead to greater customer satisfaction, reliable power supply, improve revenue collection and investor profitability.

As a leading developed country, Japanese innovations sit at the top of the technology pyramid as such utilization of lessons learnt while in Japan in our network to improve power reliability, reduce technical losses, quality of work, safety and manpower recruitment and training will be key in changing our narrative.

6. Recommendation



Any comments or suggestions for this program. If you have any expectation for JICA, please describe it.

- 1. I will like JICA as part of the program curriculum to implement the **Japan-Nigeria** distribution companies staff exchange program to help further entrench Japanese technology within the Nigerian power sector.
- 2. Provide materials and hand-outs to participants of the program to help them implement an action plan at home of their country within a given timeline especially as it relates to transfer of knowledge.
- 3. Support distribution companies in Nigeria especially AEDC with all special technical operational equipment's/tool for easy maintenance and repairs as we experienced in this trip. e.g. Isolating Stick.
- 4. I will strongly recommend that JICA team extends this training program to commercial, this will greatly add value to our commercial business activities aimed at reducing our ATC&C Losses and achieving a single digit % loss as requested by NERC and seen achieved in Japan **5.3%**

By Participant

<i>Date</i>	01/08/2023
<i>Name</i>	Engr. Amobi Ifeanyi Chinedu.

To be submitted by the 2nd of August 2023, at 6pm (JST).



*Thank
you*

**THE PROJECT
FOR
CAPACITY DEVELOPMENT OF POWER DISTRIBUTION**

Action Plan after the Training in Japan

To be submitted by the 2nd of August 2023, at 6pm (JST)

Name: RUFAI Taofeeq Kola

1. Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.**
- 2) Understand the human resources development system in place to accurately carry out business in the Japanese electric power company to see how skills are improved; and reflect them in Disco's human resources development program through the NAPTIN training courses in Nigeria.**
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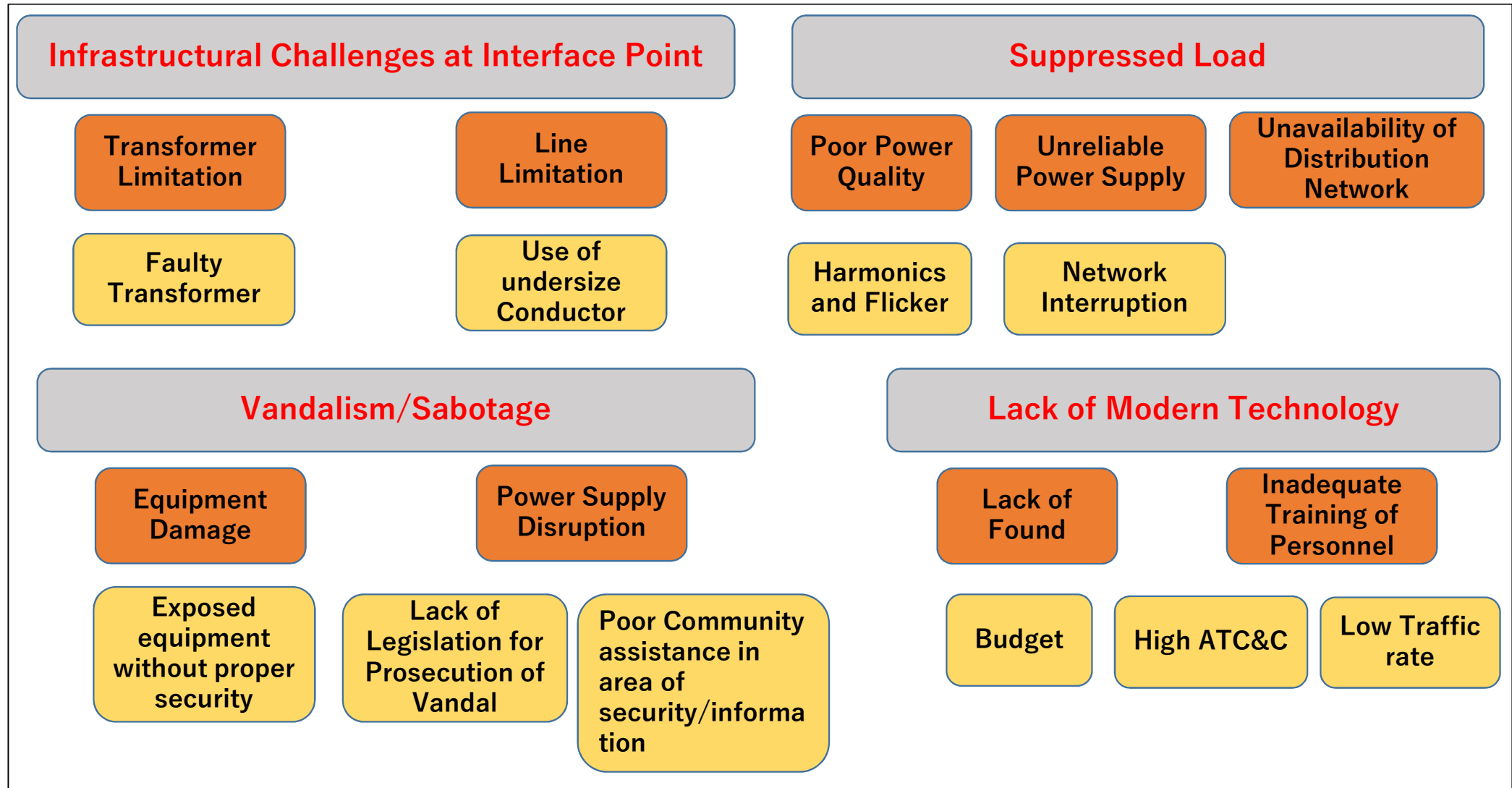
2. Your Duties and Responsibilities: Please describe your duties and responsibilities in relation to this program.

- ❖ System Planning, Design and Construction
- ❖ Supervision of construction works and evaluation of distribution lines and Substation works within Abuja Electricity Distribution Plc
- ❖ Power system analysis
 - ✓ Reliability analysis
 - ✓ Demand forecast
 - ✓ Load Flow Analysis
 - ✓ Short-circuit Analysis etc)
- ❖ Regular studies on Embedded Generation to improve system reliability.
- ❖ Preparation of annual Performance Improvement Plan (PIP) and budget.
- ❖ Monitor and enforce HSE Safety rule and regulation.

3. Lessons learned through the Training in Japan: What have you learned in the Training in Japan?

- ❖ Fault identification and resolution using DAS
- ❖ High Safety standard
- ❖ Comprehensive Distribution Research Work
- ❖ Preventive maintenance work on Live line using Grounding and Hot Pullers
- ❖ High quality of material used for distribution works
- ❖ Use of Section Switch to sectionalize the line
- ❖ Use of Spare feeder and Generator to backfield customer
- ❖ Material management
- ❖ Good staff welfare
- ❖ High trained skill Personnel
- ❖ Mitigation against bird
- ❖ Use of Conductor and insulator cover,
- ❖ Manner and Time management

4. Issues and Challenges: Please refer to the QC methods and Examples.



4. Issues and Challenges: Please refer to the QC methods and Examples.

Obsolete Equipment

Equipment
Aging

Unavailability
of parts

Abnormal
Operation of
equipment

Wears and
Tears

New set of
equipment/d
evice in the
market

Lack of
Maintenance

Right of Ways/Provision of Corridors to Evacuate Power

Illegal Structures
on RoW

Lack of

5. Action Plan: What can you utilize in order to solve the problem(s) above or to improve your organization or the situation of your country's distribution? Please describe in detail with 5W1H (what, who, when, where, how and why).

What: Infrastructural Challenges at Interface Point

Who: AEDC-TCN

When: 3years

Where: TCN-AEDC Interface Point

How:

- Collect and Analyze the data at all interface point
- Clarify and Prioritize the problem(s) at all interface point
- A goal statement for each solution of the problem
- Project Implementation and Evaluation

Why:

To expand network by providing additional transmission stations, lines, and distribution network at strategic load centers to bridge the highlighted gaps

What: Suppressed Load

Who: AEDC

When: 2years

Where: AEDC Franchise area

How:

- Collect and Analyze the data (Customer Load Profile)
- Clarify and Prioritize the problem(s)

5. Action Plan: What can you utilize in order to solve the problem(s) above or to improve your organization or the situation of your country's distribution? Please describe in detail with 5W1H (what, who, when, where, how and why).

- A goal statement for each solution of the problem
- Network Expansion Project Implementation and Evaluation

Why:

To expand network by constructing and rehabilitation of distribution network to bridge the highlighted gaps

What: Vandalism/Sabotage

Who: AEDC

When: 2years

Where: AEDC Franchise area

How:

- Collect and Analyze the data of network asset
- Clarify and Prioritize the problem(s)
- A goal statement for each solution of the problem
- Implementation and Evaluation

Why:

To enhance network availability, maintain steady power supply and generate more revenue

5. Action Plan: What can you utilize in order to solve the problem(s) above or to improve your organization or the situation of your country's distribution? Please describe in detail with 5W1H (what, who, when, where, how and why).

What: Lack of Modern Technology

Who: AEDC

When: 2years

Where: AEDC Franchise area

How:

- Collect and Analyze the data
- Clarify and Prioritize the problem(s)
- A goal statement for each solution of the problem
- Implementation and Evaluation

Why: To enhance operational efficiency

What: Obsolete Equipment

Who: AEDC

When: 5years

Where: AEDC Franchise area

How:

- Collect and Analyze the data of Network Equipment
- Clarify and Prioritize the problem(s)
- A goal statement for each solution of the problem
- Implementation and Evaluation

Why:

To reduce loss, downtime, enhance operational efficiency

5. Action Plan: What can you utilize in order to solve the problem(s) above or to improve your organization or the situation of your country's distribution? Please describe in detail with 5W1H (what, who, when, where, how and why).

What: Right of Ways/Provision of Corridors to Evacuate Power

Who: AEDC

When: 1years

Where: AEDC Franchise area

How:

- Collect and Analyze the data
- Clarify and Prioritize the problem(s)
- A goal statement for each solution of the problem
- Implementation and Evaluation

Why: To enhance network expansion

6. Recommendation: Any comments or suggestions for this program. If you have any expectation for JICA, please describe it.

The training and lesson learned from JICA Expect team (Kansai Transmission and Distribution, Kinden Corporation, YACHIYO Engineering) was awesome! I could wish his session didn't end. It was overall an enlightening experience, valuable and insightful training. I hope to apply everything I have gained from it in my career.

Thank you for your kind cooperation.

**THE PROJECT
FOR
CAPACITY DEVELOPMENT OF POWER DISTRIBUTION**

Action Plan after the Training in Japan

To be submitted by the 2nd of August 2023, at 6pm (JST)

Name: **Obuye Frederick**

1. Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.**
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2. Your Duties and Responsibilities: Please describe your duties and responsibilities in relation to this program.

- **Creation of Periodic Maintenance Strategies Annually**
- **Ensure compliance to periodic maintenance strategies, plans and procedures for overhead and underground distribution network.**
- **Ensure in meeting up with operational goals by contributing information and recommendations for strategic planning and review.**
- **Follow up trends of recognized problems and determining appropriate system improvements and solutions.**
- **Ensuring that the performance and KPIs of the maintenance team to deliver agreed targets and objectives are met.**
- **Ensuring that all maintenance operations are done in accordance with company policy and regulatory guidelines.**
- **Ensures timely resolutions of network defects.**
- **Coordination of network maintenance activities.**
- **Carry out overhead and underground network inspections of facilities to identify and resolve issues**
- **Ensures stable and reliable electrical supply by maintaining overhead & underground network equipment.**
- **Ensures Technical loss reduction improvement via excellent maintenance work output**

3. Lessons learned through the Training in Japan:

- **Excellent training facilities and staff training.**
- **Excellent Staff welfare and safety**
- **All technical materials are produced and tested locally**
- **Fault identification and resolution are carried out swiftly with the aid of the DAS**
- **The metering system is second to none as the commercial and collection losses is minimal (below 1%)**
- **Focus on job delivery was noticed.**
- **Zero record of equipment vandalism even at the rural areas.**
- **Material availability for maintenance and network expansion/improvement**
- **Finally, work is carried out with ease and everyone is cultured.**

4. Issues and Challenges:

ATC&C Loss Challenges

Technical loss

Lengthen
Network

Poor
Maintenance
work
output

Sub-
standard
and
Materials

Non
Location of
Transformers
at Load
centers

Commercial loss

Unread or
improperly read
meters and/or
wrong entries of
readings

Lack of
adequate
meters.

Meter bypass/
Energy Theft

Collection loss

Non payment of
energy billed by
some customers
like MDAs,
Military, police,
etc

4. Issues and Challenges:

Power interruptions (Outages) Challenge

Forced Outage

Network
Fault

Transformer
Limitation

Poor
Generation

System
Collapse/Partial
collapse

Planned Outage

Network
Maintenance
without
flexibility/backup

Conductor
snap,
vegetation,
reptiles,
etc

Improper
load
forecast
analysis

Contd.....

Power quality Challenges.

Lengthen /Shabby
Network

Harmonics, flickers, etc
in the distribution
System

End user
equipment/devices

4. Issues and Challenges:

Vandalism Challenges.

Power Supply disruption by Vandals

Equipment Damage

Poor community assistance in area of security/information

Lack of legislation for prosecution of vandals

Exposed equipment without proper security

Contd.....

Obsolete network equipment

Equipment Aging

Unavailability of spare parts for replacement

Abnormal operation of equipment

Wearing and Tearing

Poor Maintenance

Paucity of Funds

Lack of Equipment Manual

Lack of continuous Training of staff

5. Action Plan:

What: ATC&C loss reduction

Who: AEDC

When: 5 years

Where: AEDC Franchise Area

How:

- Ensure proper maintenance strategy, planning and work output.
- Proper Energy Management and metering system
- Training and re-training of staff on the need of reducing the ATC&C loss.
- Customer sensitization on importance of paying their bills, avoid energy theft, etc for sustainable/continuous supply of power.

Why:

To ensure that everyone is on the same page in fighting losses in the power sector.

5. Action Plan:

Contd.....

What: Power Interruption(Outage) Challenge.

Who: AEDC

When: 5 years

Where: AEDC Franchise Area

How:

- Collection of data
- Clarify and prioritize the problem(s).
- Ensure proper preventive maintenance, network flexibility
- Use of modern technology like DAS, overhead network detector, SCADA.

Why: To ensure reliable and stable power supply in AEDC franchise area, customer satisfaction, etc

5. Action Plan:

Contd.....

What: Power Quality Challenges

Who: AEDC

When: Continuous

Where: AEDC Franchise Area

How:

- Collection of data
- Clarify and prioritize the problem(s).
- Location of substations at load centers
- Use of quality and standard network materials
- Procurement of network device(s) to monitor and correct power quality
- Sensitizing the public on the use of right equipment/devices to improve power quality especially power factor improvement equipment.

Why: To ensure customers satisfaction and reliable power supply.

5. Action Plan:

Contd.....

What: Vandalism Challenge

Who: AEDC

When: Continuous one

Where: AEDC Franchise Area

How:

- Collection and analysis of data to management on ways to reduce the issue
- Ensure proper sensitization of the public on the demerits of vandalization.
- Involvement of security agencies in area of securing network equipment.

Why: To ensure reliable and stable power supply in AEDC franchise area, customer satisfaction, reduction on power outage, etc

5. Action Plan:

Contd.....

What: Obsolete Network Equipment

Who: AEDC

When: 4 years

Where: AEDC Franchise Area

How:

- Data collection
- Preparation, analysis and submission of reports to Management
- Replacement of equipment to new ones
- Effective Maintenance

Why: To ensure reliable and stable power supply in AEDC franchise area, customer satisfaction, etc

6. Recommendation:

- **Partnering with interested countries to build the kind of training centers/facilities experienced during this program will be a good one.**
- **The period for training should be extended, if possible.**
- **Global market for the sophisticated equipment/device could be a welcome idea.**
- **Bilateral relationship between countries like Nigeria on training should be a continuous, cordial and beneficial one.**
- **Management training is recommended.**



**Thank you for your
kind cooperation**

**THE PROJECT
FOR
CAPACITY DEVELOPMENT OF POWER DISTRIBUTION**

Action Plan after the Training in Japan

To be submitted by the 2nd of August 2023, at 6pm (JST)

Engr. AWONIYI, Olumuyiwa Ajibola

1. Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.**
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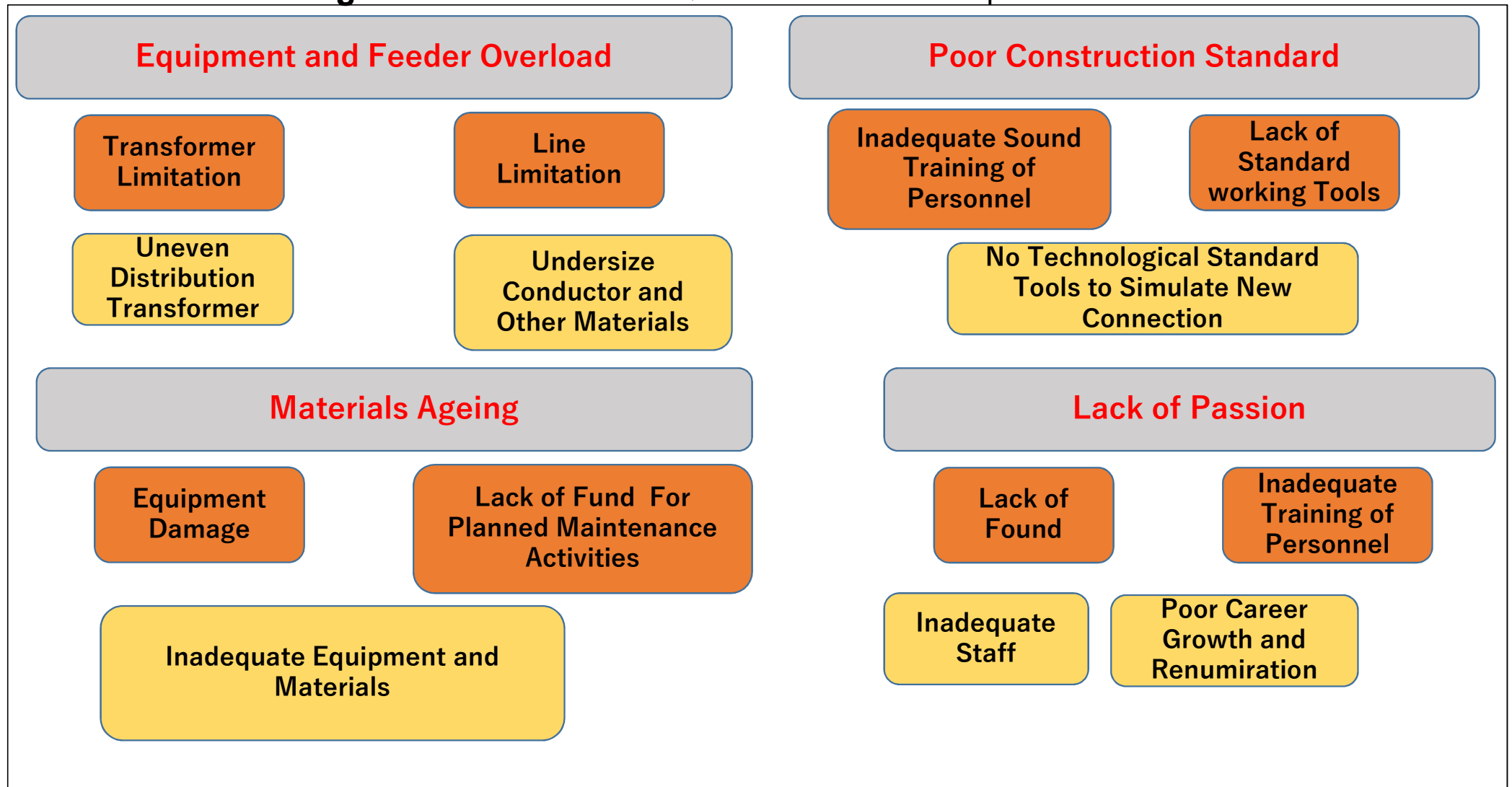
2. Your Duties and Responsibilities: Please describe your duties and responsibilities in relation to this program.

- ✓ Project nomination, co-ordination, Supervision of construction works, evaluation of feeder loading and Substation works for Abuja Electricity Distribution franchise area
- ✓ Manage all studies provided on Embedded Generation to improve system reliability.
- ✓ Preparation of annual Performance Improvement Plan (PIP) and budget.
- ✓ Monitor and force HSE Safety rule and regulation.
- ✓ New Product/Service Development. Manage construction of DER projects
- ✓ Develop design for distribution substations.
- ✓ Ensure installation and material standards
- ✓ Manage construction of new Injection Substation
- ✓ Optimize manpower utilization

3. Lessons learned through the Training in Japan: What have you learned in the Training in Japan?

- ✓ Localization of solution, taking bold decision that could stand test of time
- ✓ Replication of best idea fitted for the system
- ✓ Identify and localising solution to network challenges, encourage research centre for utility company
- ✓ Adequate planning and timing of operation to reduce down time
- ✓ Having right equipment to work and machinery
- ✓ Usage of conductor cover to reduce technical loss
- ✓ Conducive environment for staff and adequate incentives
- ✓ Benefit of outsourcing of operation for adequate coordination so as to improve efficiency
- ✓ Alternative power source for system reliability

4. Issues and Challenges: Please refer to the QC methods and Examples.



5. Action Plan: What can you utilize in order to solve the problem(s) above or to improve your organization or the situation of your country's distribution? Please describe in detail with 5W1H (what, who, when, where, how and why).

WHAT: Poor Standard, Equipment Ageing, Poor Construction Standard and Lack of Passion

WHO: Across AEDC Franchise

WHEN : 5Yrs

WHERE: Company Wide

HOW :

- ✓ Localizing solution, taking bold decision that could stand test of time
- ✓ Modern techniques/strategies used in Japan to reduce Aggregate Technical loss using DAS (distribution Automation System) with help of switch gear at appropriate location through simulation
- ✓ Strong maintenance culture for the replacement of over aged defective and obsolete equipment in the network
- ✓ Regular staff training to prepare them for unforeseen that may result to breakdown
- ✓ Rejuvenating passion for the work through staff motivation and merit assessment

WHY: To Improve network stability and reliability

6. Recommendation: Any comments or suggestions for this program. If you have any expectation for JICA, please describe it.

I want thank JICA team for the training, exposure and good heart of reaching out to Africa, most especially our country Nigeria in particular Abuja electricity Distribution. My expectation through this training is that we will ensure and make impactful contribution to electricity industry in Nigeria at this critical time

Thank you for your kind cooperation.

**THE PROJECT
FOR
CAPACITY DEVELOPMENT OF POWER DISTRIBUTION**

Action Plan after the Training in Japan

To be submitted by the 2nd of August 2023, at 6pm (JST)

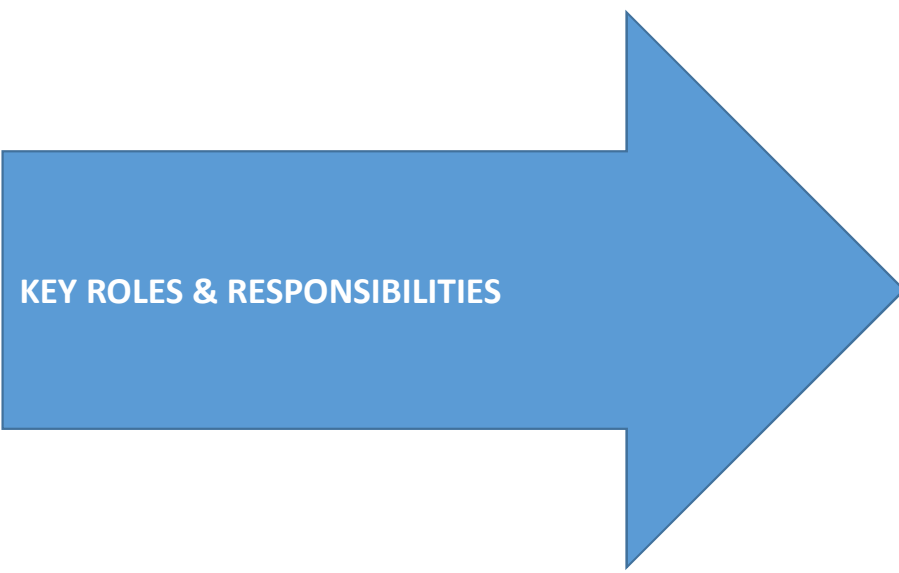
Name: Mba, Andy Chinenye

1. Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.**
- 2) Understand the human resources development system in place to accurately carry out business in the Japanese electric power company to see how skills are improved; and reflect them in Disco's human resources development program through the NAPTIN training courses in Nigeria.**
- 3) By understanding the distribution training facilities and training contents in the Japanese electric power company, the installation of NAPTIN's distribution training facilities will be implemented appropriately.**
- 4) By understanding the efforts of the Japanese electric power company to reduce power outages. (Reduction of power outages by section switches, mechanism and operation method of automatic operation of distribution lines, etc.) The effect of the AEDC pilot project and the effect of the Outage Management System improvement will be understood more concretely, and the AEDC pilot project and the Outage Management System improvement will be implemented appropriately.**

2. Your Duties and Responsibilities: Please describe your duties and responsibilities in relation to this program.

KEY ROLES & RESPONSIBILITIES



In my present position with Abuja Electricity Distribution Company, I manage a well energetic, focus driven and dedicated team of staff.

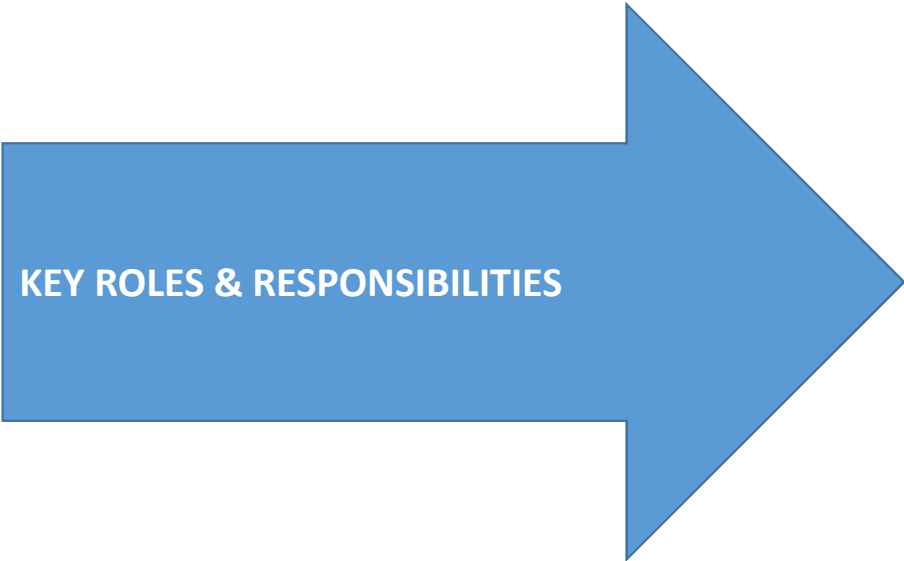
Through detailed data analysis, targeted strategic plans and development of challenging objectives, my team transforms imbibed cultures into well improved customer satisfaction and increased output.

I represent AEDC in the Nigerian Electricity Supply Industry (NESI) Situation Room meetings twice a day for hourly performance assessment based on load allocation versus offtake.

I must ensure 95% energy offtake every two months out of three in a quarter as stipulated by the Nigeria Electricity Regulatory Commission (NERC) ORDER and KPI, which saves the company from penalties.

I work with ICT software developers to develop an Outage Management System (OMS) for company wide use for the purpose of reporting forced, planned and emergency outages. All outage data can be assessed from a back end for analysis.

2. Your Duties and Responsibilities: Please describe your duties and responsibilities in relation to this program.



KEY ROLES & RESPONSIBILITIES

Coordinating switching operations among transmission substations and distribution interface in line with grid code conditions to ensure safety of equipment and personnel.

Implements daily load management plan in strict accordance with the Service Based Tariff bands to guarantee an efficient and effective allocation and distribution of available energy within the network coverage.

Sending daily day ahead forecast indicating the previous day load allocation, previous day load consumption and day ahead forecast, New 14days load forecast to Transactional Data Processing/National Control Centre, weekly rolling.

3. Lessons learned through the Training in Japan: What have you learned in the Training in Japan?

- ✓ I learned how specific operations are performed in order to reduce losses, improve reliability, and improve quality.
- ✓ I learnt about the protection instruments and also inspected protection materials
- ✓ I learned about the human resources development in place to improve the skills of the workers to accurately carry out business in the Japanese Electric Power Company.
- ✓ I learned about the Distribution Training Facilities and training contents in the Japanese Electric Power Company.
 - * Duties of Distribution Department and Area Offices.
 - * Facilities and configuration of Distribution Departments (Poles, conductors, transformers, switchgears, and smart meters).
- ✓ I learned the efforts of the Japanese Electric Power Company to reduce power outages by using section switches mechanism and operation method of automatic operation of distribution lines.
- ✓ I learned the need for special vehicles like the generator vehicle, digging and erecting vehicle, support vehicle, and the high elevation work vehicle.
- ✓ I learned and saw the simulation of the Distribution Automatic System (DAS) in fault identification and resolution

4. Issues and Challenges: Please refer to the QC methods and Examples.

Reduction of Losses

Technical loss

Lengthy
Network

Poor
Maintena
nce
Output

Sub-
substandard
materials

Non Location of
Transformers at
Load centers

Undersiz
ed
cables/
Aluminu
m
conducto
rs

Frequent
switching
operation
s

Overload
ed feeder
pillar unit

Under
voltage

Suppressed load

Poor power quality

Unavailability of
distribution
network

Unreliability of the
available power

Improper network
design

4. Issues and Challenges: Contd.....

Dilapidated Distribution Infrastructure

Aging/ obsolete
equipment

Unavailability of
spare parts or
replacement

Abnormal
operation of
equipment

Wears and
Tears

Improper
network design

Poor maintenance
culture

5. Action Plan: What can you utilize in order to solve the problem(s) above or to improve your organization or the situation of your country's distribution? Please describe in detail with 5W1H (what, who, when, where, how and why).

What: Dilapidated distribution infrastructure

Who: AEDC

When: 6 years

Where: AEDC Franchise Area

How:

- Collection of data through physical inspection
- Purchase and replacement of defective parts of the network
- Ensure proper preventive and predictive maintenance

Why: To ensure quality, reliable and stable power supply in AEDC franchise area and ensure customer satisfaction.

What: Suppressed load

Who: AEDC

When: Continuous

Where: AEDC Franchise Area

How:

- Network redesign and expansion
- Use of quality materials to expand the network

Why: To ensure reliable and stable power supply in AEDC franchise area, customer are satisfied at all time etc.

5. Action Plan: What can you utilize in order to solve the problem(s) above or to improve your organization or the situation of your country's distribution? Please describe in detail with 5W1H (what, who, when, where, how and why).

What: Reduction of Technical loss

Who: AEDC

When: 5years

Where: AEDC Franchise area

How:

- Ensure proper and standard materials are used in the network.
- Replacing weak and obsolete part of the network.
- Training of staff to identify and correct conditions that may result to losses

Why:

When the losses are reduced, the company is better financially and can embark on other forms of development

6. Recommendation: Any comments or suggestions for this program. If you have any expectation for JICA, please describe it.

Appreciations to JICA for such a rich program.

The experience is very rewarding and enlightening.

I will suggest that the program be organized periodically or the time frame increased as there is so much to be learnt in such a short time.

Also implore that JICA see to it that these important lessons be implemented in our home country for the benefit of all.

Thanks.

Thank you for your kind cooperation.

**THE PROJECT
FOR
CAPACITY DEVELOPMENT OF POWER
DISTRIBUTION**

Action Plan after the Training in Japan

Name: Engr. Abu Kadiri

03 August 2023

Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.**
- 2) Understand the human resources development system in place to accurately carry out business in the Japanese electric power company to see how skills are improved; and reflect them in Disco's human resources development program through the NAPTIN training courses in Nigeria.**
- 3) By understanding the distribution training facilities and training contents in the Japanese electric power company, the installation of NAPTIN's distribution training facilities will be implemented appropriately.**
- 4) By understanding the efforts of the Japanese electric power company to reduce power outages. (Reduction of power outages by section switches, mechanism and operation method of automatic operation of distribution lines, etc.) The effect of the AEDC pilot project and the effect of the Outage Management System improvement will be understood more concretely, and the AEDC pilot project and the Outage Management System improvement will be implemented appropriately.**

Duties & Responsibilities of the Participant in Relation to the Program

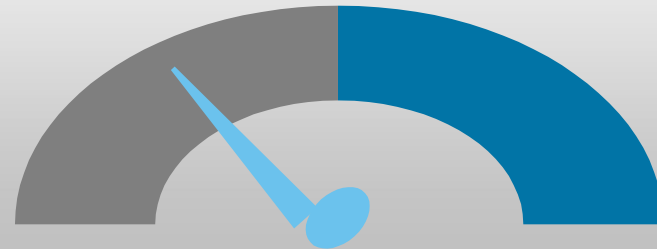
1

Ensure the safety, security, reliability and quality of power delivered to the consumers



2

Evaluate the operational performance of the DisCos, which include ability to reduce ATC&C losses



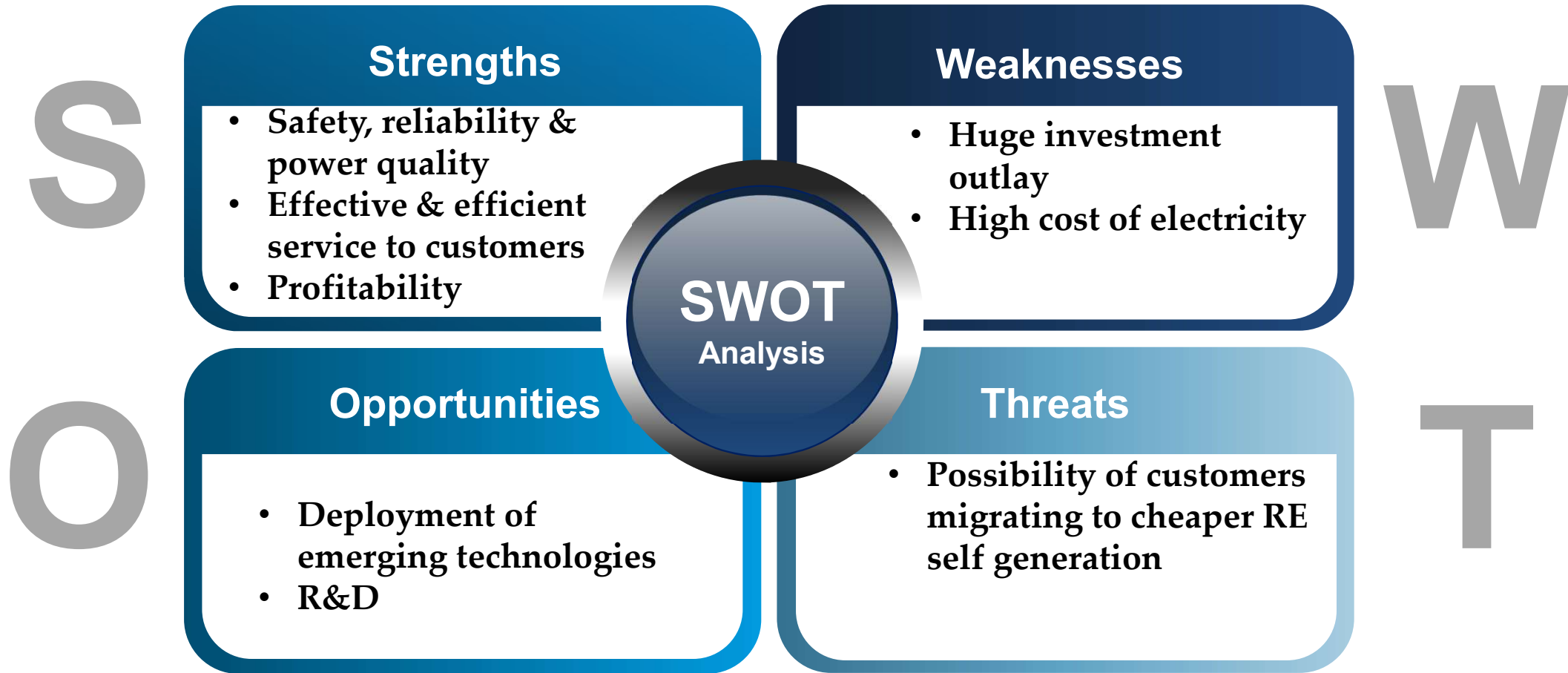
Lessons Learned through the Training in Japan

- Mechanized distribution network maintenance, including the Kaizen method for improved efficiency
- Distribution automation system (DAS) that facilitate ease of identification of fault & minimum down time (computer simulation and field demonstration)
- Effective line trace maintenance and vegetation control through a hybrid of mechanized equipment and physical trimming by maintenance crew
- Methods of isolating faulty section, when carrying out maintenance on a live distribution line, which include: grounding and use of hot pullers
- Effective utilization of pole mounted distribution transformer and switchgears for optimal service delivery to the customers

Lessons Learned through the Training in Japan Cont'd

- Adequate provision of overhead & underground materials for regular preventive maintenance and emergency situation.
- Use of high capacity mobile generator (1000KVA, 6.6kV) for emergency restoration while the carrying out rectification of fault
- The use of conductor and insulator cover, as well as proper jointing and tapping of joints for technical loss reduction and reliability.
- The use of PVC insulated conductor in a combined MV (6.6kV) and LV(200/100V) overhead network construction for safety & reliability.
- Outsourcing of distribution network maintenance to an external party on retainership basis, as an effective way of managing distribution business
- Inspection of training facilities, observation of practical training methods and certification required by utility operational staff (basic, intermediate, advance & masters)

Issues & Challenges: SWOT Analysis



Action Plan1

Activity (What):

Review of the Nigerian Electricity Supply and Installation Standards (NESIS) Regulations



Agencies (Who):

Nigerian Electricity Regulatory Commission & Other NESI Stakeholders.



Timeline (When):

September 2023 – June 2024



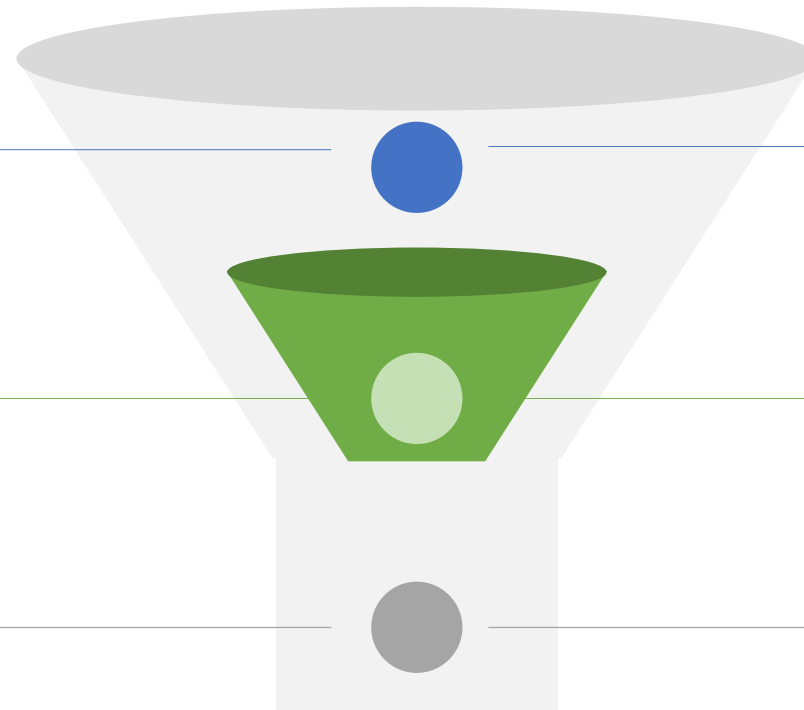
Location of activities (Where):
Nigeria.



Method (How): Integrate international standards used in Japan to achieve reliable and stable power supply (e.g. conductor covers, DAS etc)



Objective (Why): To reduce distribution network losses, and improve reliability & power quality



Action Plan2

Activity (What):

Regulatory Order on minimum qualification, training and certification for utility operations' staff 

Agencies (Who):

Nigerian Electricity Regulatory Commission & Other NESI Stakeholders 

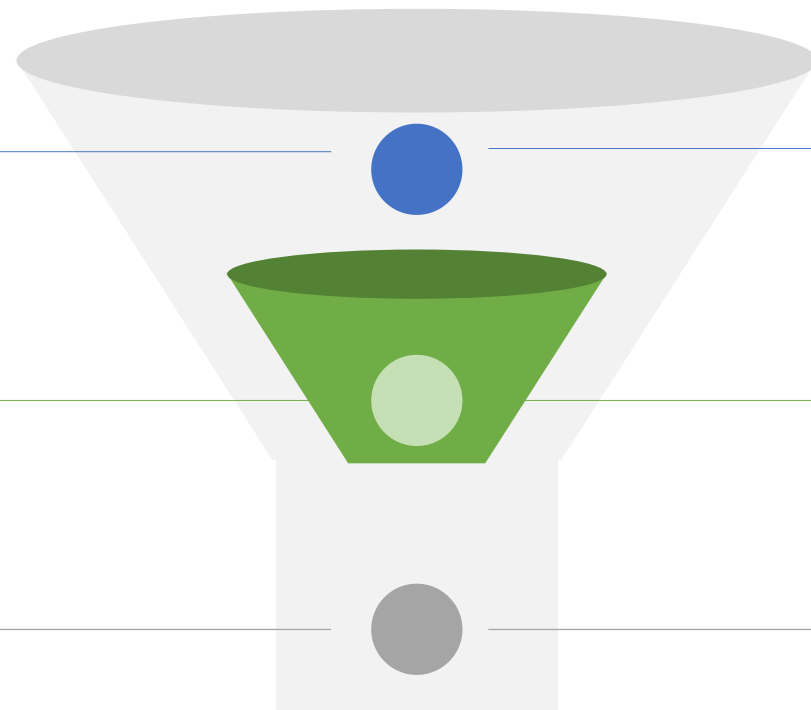
Timeline (When):

October 2023 – June 2024 

Location of activities (Where): Nigeria. 

Method (How): Utilize the Japanese and other international best practice to develop the Order of the Commission 

Objective (Why): To ensure competent work forcé & ergonomics in NESI 



Recommendation

A 2nd phase of feeder H-31 pilot project to evaluate the commercial losses by installing Smart meters may be imperative for completeness of the loss studies



1

2



Evaluation of protection equipment in Nigeria electricity distribution system: A case study of three (3) DisCos Will improve safety and reliability of power supply in NESI

Thank
You!



**FEDERAL MINISTRY
OF POWER**

ACTION PLAN PRESENTATION

AUGUST 2023 JICA TRAINING IN JAPAN

By Engr. David Joshua



**FEDERAL MINISTRY
OF POWER**

TRAINING OBJECTIVES

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.**
- 2) Understand the human resources development system in place to accurately carry out business in the Japanese electric power company to see how skills are improved; and reflect them in Disco's human resources development program through the NAPTIN training courses in Nigeria.**



**FEDERAL MINISTRY
OF POWER**

TRAINING OBJECTIVES CONTINUATION

- 3) By understanding the distribution training facilities and training contents in the Japanese electric power company, the installation of NAPTIN's distribution training facilities will be implemented appropriately.**

- 4) By understanding the efforts of the Japanese electric power company to reduce power outages. (Reduction of power outages by section switches, mechanism and operation method of automatic operation of distribution lines, etc.) The effect of the AEDC pilot project and the effect of the Outage Management System improvement will be understood more concretely, and the AEDC pilot project and the Outage Management System improvement will be implemented appropriately.**

DUTIES AND RESPONSIBILITIES:

Response

- 1. Monitoring and Supervision Of Activities Of The Distribution Companies In The Nigerian Electricity Supply Industry (NESI).**
- 2. Drafting, Formulation And Implementation Of Government Policies/Program In the NESI.**
- 3. Design and Supervision of distribution intervention projects/pilot projects nationwide.**



**FEDERAL MINISTRY
OF POWER**

LESSON LEARN FROM THE TRAINING:

Response

- 1. I Have saw and learnt about impact of training and re-training of personnel in the Distribution Sub-sector for a productivity and efficient service delivery.**
- 2. I have also learnt about the Principle of operation of the Distribution Automation System in optimizing Service Delivery.**
- 3. Fault Dictation and Correction Principles using mechanized system for customers satisfaction.**

ISSUES AND CHALLENGES:

Response

1. Rapid Response to Faults:

Working Tools and Equipment to carry out effective maintenance services.

2. Training and Safety:

Need to Develop or Enhance a highly skill acquisition facilities for the development of the skills of the Utility Workforce in Handling Challenges

ACTION PLAN:



Response

Clear Policy direction on quality control and Standard

- 1. WHY: To Ensure standardization of product/services.**
- 2. WHO: The Government of Nigeria.**
- 3. WHEN: 0-4 Years**
- 4. WHERE: Nationwide**
- 5. HOW: Through Relevant Enforcement Agencies**

RECOMMENDATIONS.



Response

- 1. The discipline of Distribution utility Workers in Japan is worth emulating.**
- 2. Extending the**



**FEDERAL MINISTRY
OF POWER**

THANK YOU

3RD AUG, 2023

Action Plan after the Training in Japan

1. Training Objectives

- 1) Understand what specific operations are being performed and how they are carried out in order to reduce losses, improve reliability, improve quality; and reflect them in the future improvement of the electric power business in Nigeria.
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2. Your Duties and Responsibilities

Please describe your duties and responsibilities in relation to this program.

1. Drafting and formulation of Government Policies.
2. The Ministry of Power Liaison officer to Benin Disco.
3. Supervision of Federal Government Intervention projects under Benin Disco.
4. Attend to complaints within the franchise area of BEDC.

3. Lessons learned through the Training in Japan

What have you learned in the Training in Japan?

1. I have learnt that Japan uses Mechanized maintenance system.
2. I have learnt about the most common causes of fault in Japan's Distribution network.
3. I have also learnt that investing in the capacity building of staffs is a way to boost their performance.
4. I have learnt the need to always develop safety consciousness.
5. I learnt about the principle of operation of a Distribution Automated system in optimizing service delivery in Japan Distribution System. .
6. I learnt about the comprehensive data management in the Distribution Network. .

4. Issues and Challenges

Please refer to the QC methods and Examples.

1. Administrative Bureaucracy - Complicated Administrative procedures in which most of the important decisions are taken by the Head.
2. Reactiveness to complaints of the customers.
3. Effective quality control policy and procedures.

5. Action Plan

What can you utilize in order to solve the problem(s) above or to improve your organization or the situation of your country's distribution? Please describe in detail with 5W1H (what, who, when, where, how and why).

A clear policy direction and quality control.

1. WHY – To ensure that product/services adheres to a defined set of quality criteria/standard
2. Who – The Government
3. When – At the beginning of every policy announcement.
4. Where – In Nigeria
5. How – Through the National Standard Agencies.

6. Recommendation

Any comments or suggestions for this program. If you have any expectation for JICA, please describe it.

I want to thank JICA for such a great privilege to be part of this program.
I wish to recommend a longer stay in Japan to acquire more knowledge.

By Participant

Date: 02 – 08 – 2023

Name: ODIDI
CHRISTOPHER

To be submitted by the 2nd of August 2023, at 6pm (JST).

Thank you for your kind cooperation.

Questionnaire for JICA KCCP Capacity Development of Power Distribution

9

応答

179:07

完了するのにかった平均時間

アクティブ

状態

1. Please give your name.

9

応答

最新の回答

*"Chukwudum Okeke "**"KHALIL Yusuf Adamu "**"RUFAl TAOFEEQ KOLA"*

2. Please fill in your ID number (D number) for this course. *e.g.) D2101234

9

応答

最新の回答

*"D2302911"**"D101234"**"D2302926"*

3. Please fill in the name of your country.

9

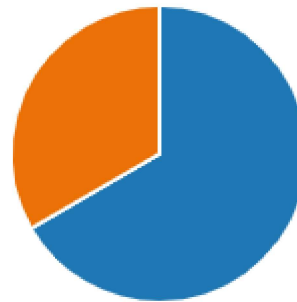
応答

最新の回答

*"Nigeria"**"Nigeria"**"NIGERIA"*

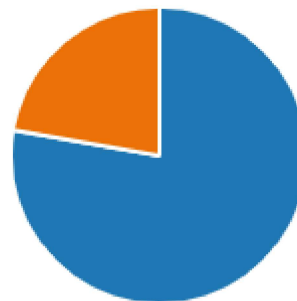
4. I had a clear understanding of the purpose and contents of this program as described in the General Information before the participation.

Strongly Agree	6
Agree	3
Neither	0
Disagree	0
Strongly Disagree	0



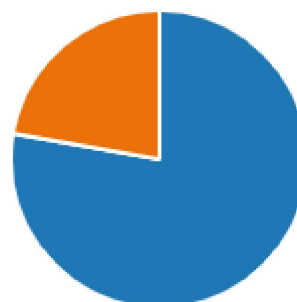
5. I have achieved the course objective.

Fully Achieved	7
Almost Achieved	2
Neither	0
Partially Achieved	0
Not Achieved	0



6. The knowledge and experience gained from this program can be fully utilized in my work.

Strongly Agree	7
Agree	2
Neither	0
Disagree	0
Strongly Disagree	0



7. Reason and comments or suggestions, especially if your rating is 1 or 2 in the above No.4-No.6.

8
応答

最新の回答

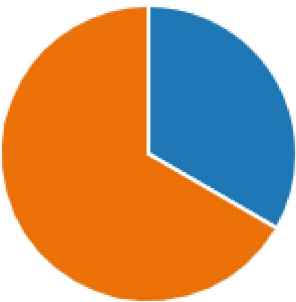
"I have been exposed to a lot as concerns reliability and its i...

"N/A"

"My suggestion is that the time is short/limited. JICA should...

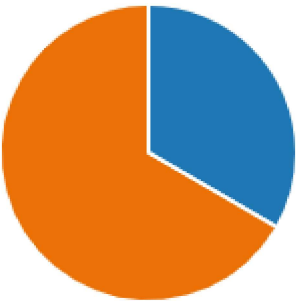
8. The structure of the curriculum was appropriate.

Strongly Agree	3
Agree	6
Neither	0
Disagree	0
Strongly Disagree	0



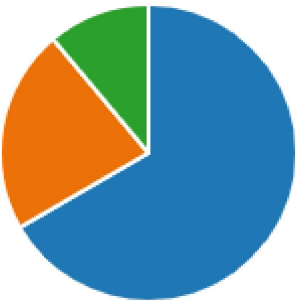
9. The duration of this course was appropriate.

Yes, Appropriate	3
No, Too short	6
No, Too long	0



10. The number of participants in the course was appropriate.

Yes, Appropriate	6
No, Too little	2
No, Too many	1



11. Any comments or suggestions, especially if you did not rate the above 3 statements as appropriate.

9
応答

最新の回答

"I think a workbook to make record of daily activities aimed...

"N/A"

"Increase the duration of the training and add more countri...

12. Subjects and contents (lectures, workshop, learning materials etc.) that were especially useful;

8
応答

最新の回答

"All the contents are very useful "

"Class and Field "

13. Subjects and contents that were not necessary;

7
応答

最新の回答

"All are very important "

14. Subjects and contents that were not covered, but should have been included;

8
応答

最新の回答

"Detection of Open conductor faults and its detection by rel...

"Renewable energy integration and distributed generation "

15. Reason and comments for the above No.12 - No.14.

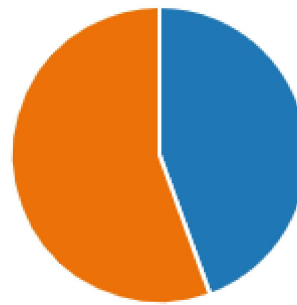
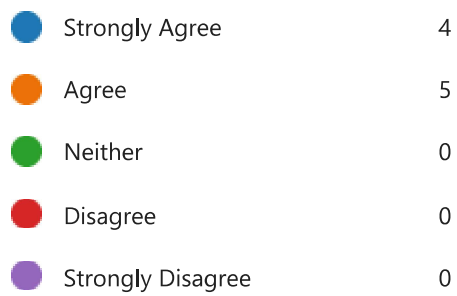
7
応答

最新の回答

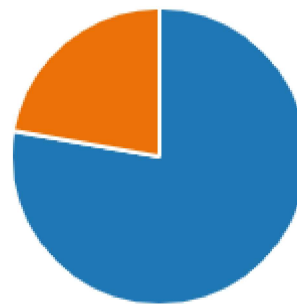
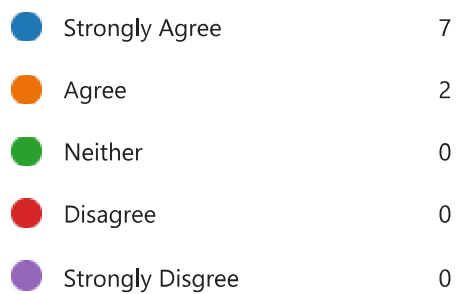
"Detection of Open conductor faults and its detection by rel...

"Very useful information in the course "

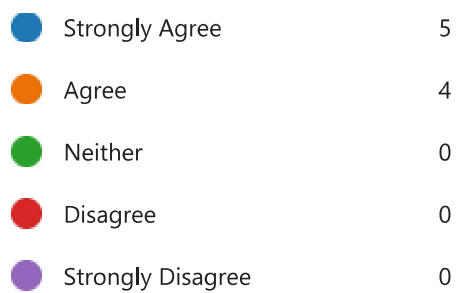
16. The presentations and explanations by the lecturers were easy to understand.



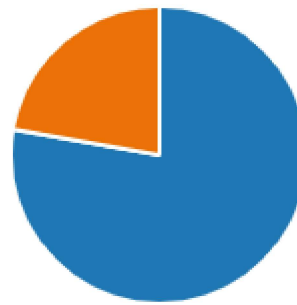
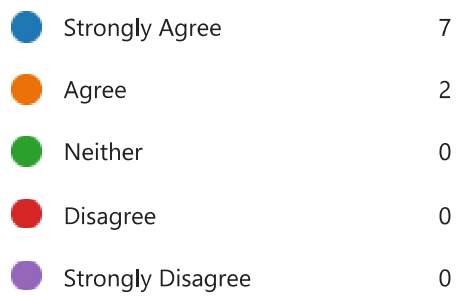
17. The lecturers were highly knowledgeable about the topics.



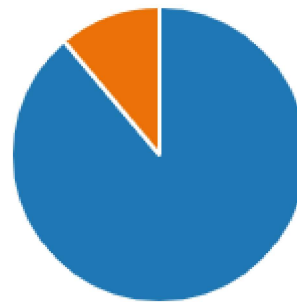
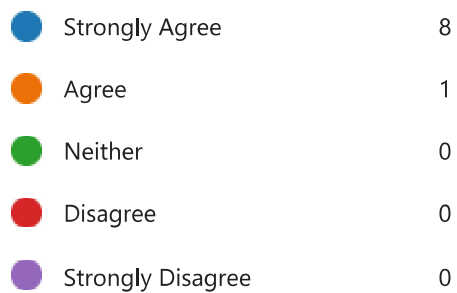
18. The learning materials are high quality and useful.



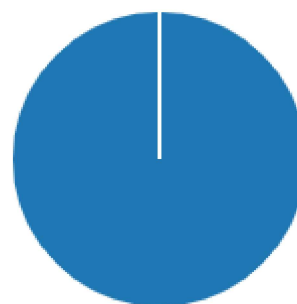
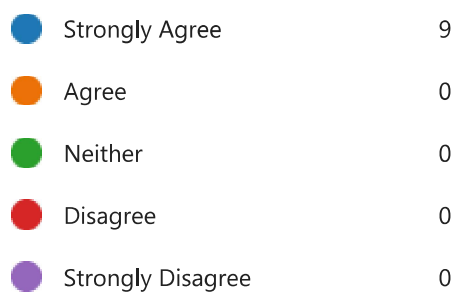
19. Sharing of knowledge among participants was effective.



20. The Japanese course leader/facilitator provided effective supports and guidance to participants. (e.g. promoting participants' proactive discussions, giving appropriate feedback)

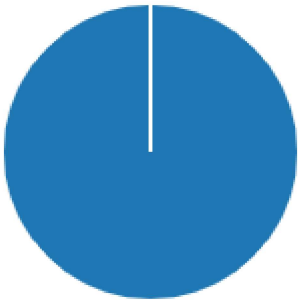


21. Interpretation was easy to understand.



22. I am satisfied with the support and coordination done by JICA training coordinator(s).

Strongly Agree	9
Agree	0
Neither	0
Disagree	0
Strongly Disagree	0



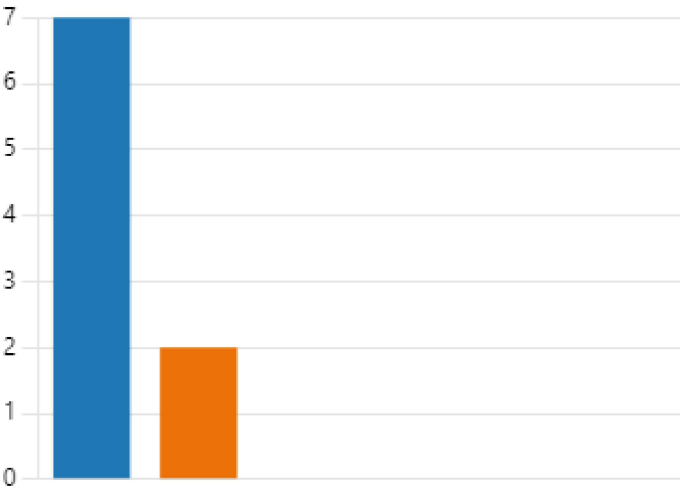
23. Any comments or suggestions, especially if your rating is 1 or 2 in the above No.16-No.22.

6
応答

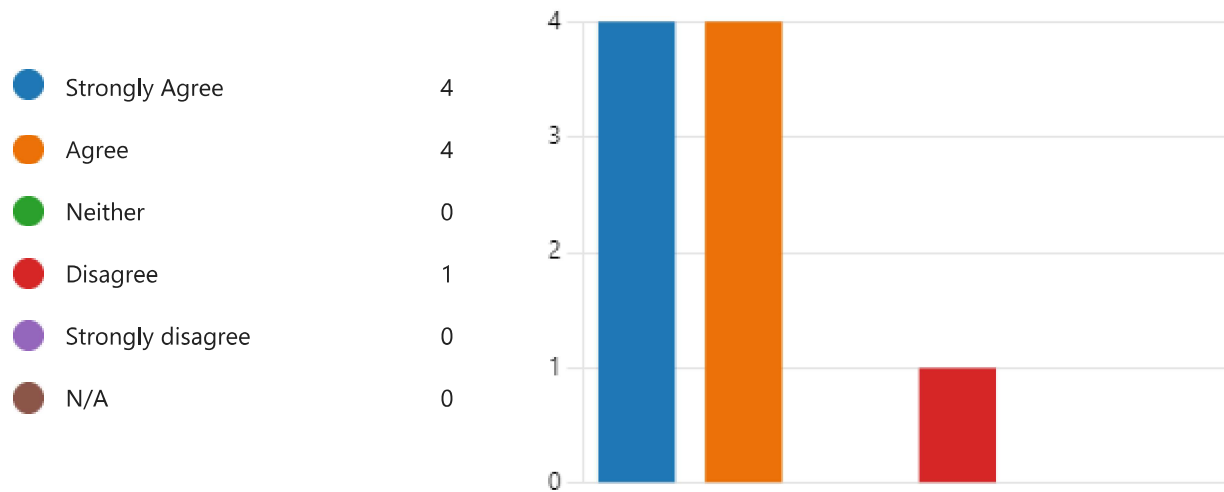
最新の回答
"N/A"
"Trainee need more training time"

24. I am satisfied with the facilities and services of JICA Center.

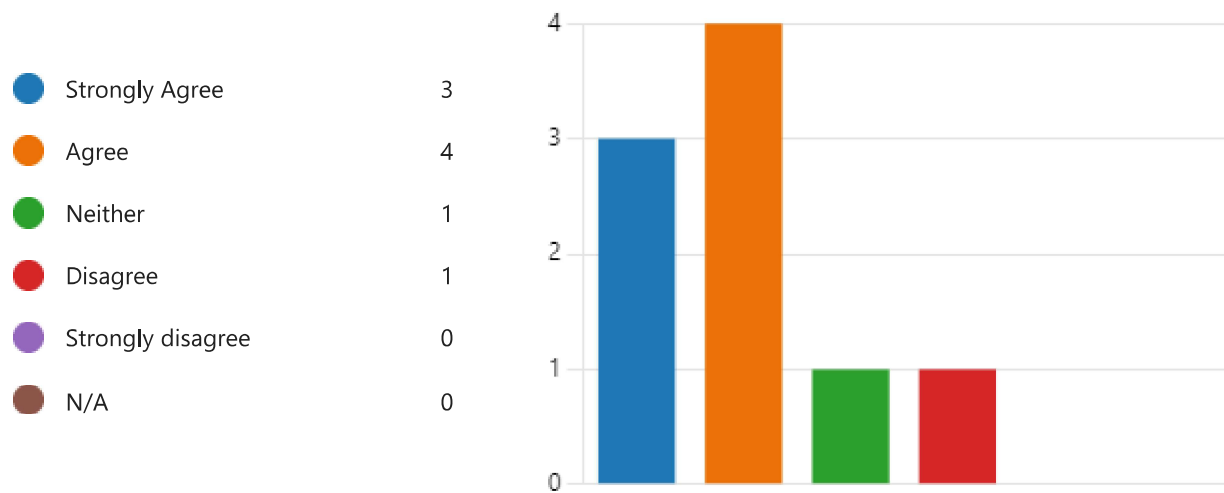
Strongly Agree	7
Agree	2
Neither	0
Disagree	0
Strongly Disagree	0
N/A	0



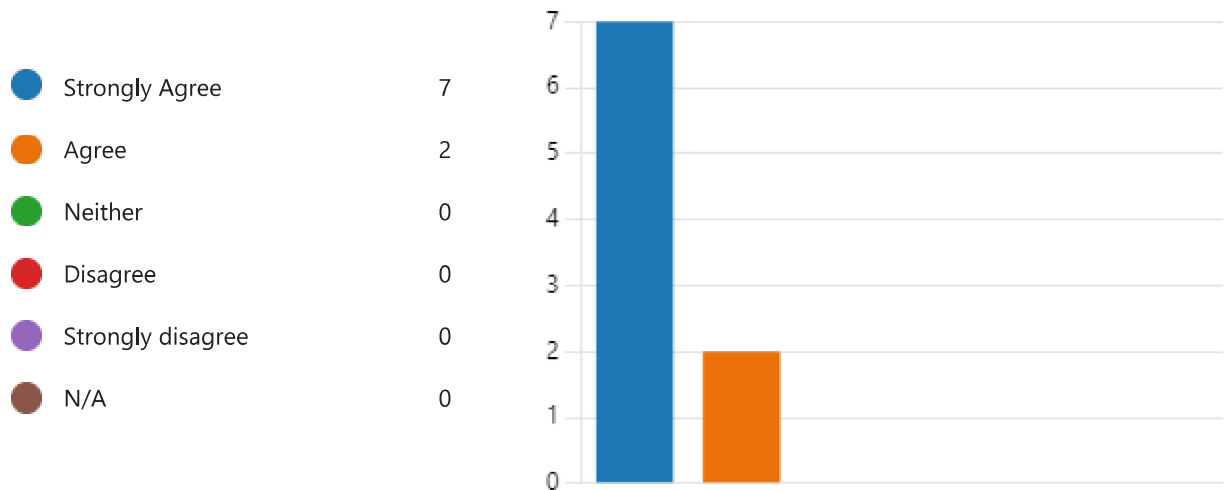
25. I am satisfied with the meals at JICA Center.



26. I am satisfied with the optional programs provided by JICA Center. (e.g. lectures and activities for understanding Japan, Japanese language course.)



27. I am satisfied with the facilities and services of hotels.



28. Any comments or suggestions on Environment for the program in Japan.

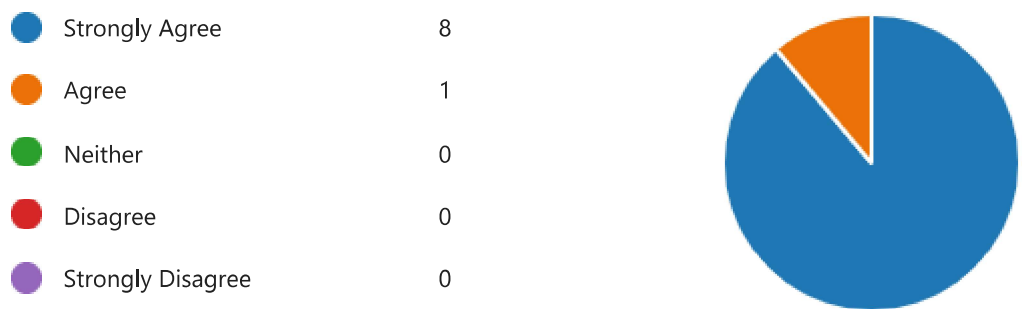
8
応答

最新の回答

"Need more time maybe even weekends to participate in o..."

"Environment always clean "

29. Through this Program, I was able to deepen my understanding and interest in Japan.



30. If you have any expectation for future collaboration with JICA, please describe it.

8
応答

最新の回答

"For Capacity Development, I hope JICA can help my organi..."

"Power System Automation, Protection Relay Coordination, ..."

31. Any other comments in regard to the program.

最新の回答

8

応答

"Thank you so much. Japan is more beautiful than I imagine..."

"Very good program. Keep it up! "

"The training period is too short"

	
7/26AM 研修設備の視察 (1)	7/26AM 研修設備の視察 (2)
	
7/26PM 特高用防護管の商用周波耐電圧試験の実演	7/26PM 高周波発生装置による碍子の不具合判別の実演
	
7/26PM 衝撃電圧によるアークホーン動作の実演	7/27 配電自動化システムの実機の見学



7/27 高所作業車(実機)の見学とデモ操作



7/27 高圧発電機車(実機)の見学



7/27 樹木伐採作業現場の見学



7/27 モバイル端末を使用した配電設備の
巡視模擬



7/28 大東電材 (防護管の説明)



7/28 大東電材 (集合写真)



7/31AM 電線張替訓練視察



7/31AM 穴掘建柱車の実演



7/31PM 架空配電線研修設備の視察



7/31PM 配電線事故課電探査装置の使用方
法講義



8/1AM 地中線工事現場の視察



8/1PM 外線工事現場の視察



8/2AM きんでん学園（工事資材の説明）



8/2AM きんでん学園（訓練内容の説明）



8/3 アクションプラン発表会



8/3 閉講式後の集合写真