

Distribution Transformer Monitoring

Appropriate Metering Solutions for1) Loss Reduction2) Asset Maintenance

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Introduction



Distribution transformers



- Converts MV to LV in a typical distribution grid
- Pole or plinth mounted or mini-substation type
- Maintenance and monitoring should be undertaken to avoid transformer damage or failure
- Operating Conditions have a large impact on the longevity and possible failure



Utility Metering System



Metering is done at Generators, Feeders and Consumers to measure losses



*The above losses are based on global averages and vary in each country / utility



Metering at Buffalo City Municipality





Buffalo City Municipality: At a Glance

- Electricity is supplied via <u>31 supply points</u> located at Buffalo/Stafford, Mdantsane, Pembroke, Port Rex, Stoneydrift and Woodbrook
- Installed base of <u>±1800 Transformers</u> covering <u>± 46 localities (load centers)</u> in the Buffalo City administered area
- Ratings of these transformers vary from <u>5kVA to 1600kVA</u>
- These transformers have been further categorized as per installation type:
 - Pole Mounted : 551
 - Floor Mounted : 412
 - o Mini Sub : 836
 - Total Consumers > 90,000

Source: Inputs from Buffalo Municipality



Source: Presentation by Buffalo @ SAPRA event Jun/Jul-2022

- Technical Loss: Constant ~ 6%
- Non Technical Losses are around 15%* over past 3-4 years (excl. 2019-20)

(NERSA standards specify this to be between 5-12%)



Why do we need to Meter Transformers





Transformer Failure Analysis



Transformer Failures: Fishbone Analysis





Transformer Metering: Energy Accounting Studies



Why do we need to Meter Transformers

- Feeders and consumers are metered
- Transformer metering is the missing piece of the puzzle in order to perform studies on losses

"Appropriate Metering" can help with:

- Energy audits (identify loss pockets)
- Network Strengthening by linking customers to respective transformers and Feeder
- Monitoring and Maintenance
- Audit compliance
- Customer Satisfaction





Meter Data or Actionable Reports

Date	Int	terval St	tart Interv	al End Act	tive(I) Total	Active(E) Total	Reactive(I) R	eactive(E) Vo	oltage L1-L2 Vol	tage L2-L3 Vo	oltage L3-L1	Average Curre	nt Average Pow	er Factor Inst A	ctive Power (Total) All Ph	ases Avg-Max Reactive Powe	r All Phases Avg-Max	
26-1	Date	Int	terval Star	t Interval	End Active(I) Total Active	(E) Total Read	tive(I) React	ive(E) Voltage	1-L2 Voltage	e L2-L3 Vol	tage L3-L1 Aver	age Current Av	erage Power Fa	ctor Inst Active Power (T	otal) All Phases Avg-Max Rea	ctive Power All Phases Avg-Max	
26-1	26-1												0			, ,		
26-1	26-1	Date	Inter	al Start Ir	nterval End	Active(I) Total	Active(E) Tota	Reactive(I)	Reactive(E) V	oltage L1-L2	Voltage L2-	L3 Voltage L3-L	1 Average Curre	ent Average Po	wer Factor Inst Active Po	wer (Total) All Phases Avg-Ma	IX Reactive Power All Phases Avg-Max	
26-1	26-1	26-1	Date	Interval	Start Interv	al End Active(I	Total Active	(E) Total Rea	rtivo(I) Reartiv		11-12 Volt	ago 12-13 Volta	ge 13-11 Avera	te Current Ave	rage Dower Factor Inst	tive Power (Total) All Phases	Avg.Max Reactive Rower All Phases Avg.Max	1
26-1	26-1	20-1	26-12-1	8	15:00	16:00	81.9	-	17.7	- 11.	104.0	11.101.0	11.160.0	-	age rower ractor list A	tive rower (rotal) All rilases	200.0 50.0	
26-1	26-1	26-1	26-12-1	Data	Interval 6t	art Intonial En	d Activo(I) Tot	al Activo(E)	Total Boastivo	I) Reactive/	Voltago	1 12 Voltage I	12 Voltage 12	11 Avorage Cur	ront Average Dewer Fact	or Inst Active Dewer (Tetal)	II Phases Aug Max. Reactive Rever All Phases A	ug Max
26-1	26-1	26-1	26-12-1	26-12-1	interval st	art intervalen	a Active(I) for	ai Active(E)	Total Reactive	I) Reactive(E	e) voltage	LI-LZ VOICage L	Z-L3 VOItage L3-	LI Average Cur	rent Average Power Fact	or inst. Active Power (Total) A	Reactive Power All Phases Av	/g-iviax
26-1	20	26-1	26-12-1	26-12-1	Date	Interval Start II	nterval End Ac	tive(I) Total	Active(E) Total	Reactive(I)	Reactive(E)	Voltage L1-L2	Voltage L2-L3 V	/oltage L3-L1 Av	verage Current Average P	ower Factor Inst Active Powe	er (Total) All Phases Avg-Max Reactive Power All	Phases Avg-Max
27-1	26-1	26-1	26-12-1	26-12-1	26-12-18	15:00	16:00	81.9	-	17.7	-	11,104.0	11,101.0	11,160.0		1.0	200.0	50.0
27-1	27-1	26-1	26-12-1	26-12-1	26-12-18	16:00	17:00	139.2	-	33.1	-	11,120.0	11,120.0	11,178.0	5.5	0.9	190.0	50.0
27-1	27-:	26-1	26-12-1	26-12-1	26-12-18	17:00	18:00	107.5	-	34.9	-	11,041.0	11,037.0	11,097.0	4.9	1.0	150.0	50.0
27-1	27-:	27-1	26-12-1	26-12-3	20-12-18	18:00	19:00	100.0	-	30.7	-	11,041.0	11,030.0	11,098.0	5.5	1.0	120.0	30.0
27-1	27-1	27-1	26-12-1	26-12-1	26-12-18	20.00	20.00	79.5		30.0		11,015.0	11,011.0	11,072.0	4.3	1.0	100.0	30.0
27-1	27-1	27-1	27-12-1	26-12-1	26-12-18	20.00	22:00	76.3	-	30.0		11,041.0	11,050.0	11,050.0	4.3	0.9	80.0	30.0
27-1	27-:	27-1	27-12-1	26-12-1	26-12-18	22:00	23:00	76.0	-	30.3	-	11,003.0	11,035.0	11,085.0	4.2	0.9	80.0	30.0
27-1	27-:	27-1	27-12-1	27-12-1	26-12-18	23:00	0:00	75.3	-	29.9	-	11.024.0	11.020.0	11.081.0	4.2	0.9	80.0	30.0
27-1	27-:	27-1	27-12-1	27-12-1	27-12-18	0.00	1:00	112.2	_	49.0		11,066,0	11,066,0	11 124 0	4.5	0.9	120.0	50.0
27-1	27-:	27-1	27-12-1	27-12-1	27-12-18					I	1						120.0	50.0
27-1	27-:	27-1	27-12-1	27-12	27-12-18				Eac	n n	net	er is	sac	lata	logge	r	120.0	50.0
27-1	27-1	27-1	27-12-1	27-12	27-12-18							_			55		120.0	50.0
27-1	2/-1	27-1	27-12-1	27-12	27-12-18	4:00	5:00	118.2	-	51.1	-	11,161.0	11,163.0	11,219.0	6.7	0.9	120.0	50.0
27-1	27-2	27-1	27-12-1	27-12-	27-12-18	5:00	6:00	118.9	-	51.5	-	11,130.0	11,134.0	11,189.0	6.7	0.9	130.0	50.0
27-1	27	27-1	27-12-1	27-12	27-12-18	6:00	7:00	123.7	-	49.2	-	11,105.0	11,105.0	11,161.0	6.0	0.9	190.0	60.0
27-1	27	27-1	27-12-1	27-12-1	27-12-18	7:00	8:00	172.9	-	60.8	-	11,039.0	11,043.0	11,099.0	8.5	0.9	230.0	70.0
27-1	27-	27-1	27-12-1	27-12-1	27-12-18	8:00	9:00	172.4	-	61.3	-	10,993.0	10,992.0	11,049.0	8.9	0.9	220.0	70.0
27-1	27-1	27-1	27-12-1	27-12-1	27-12-18	9:00	10:00	171.0	-	60.9	-	10,959.0	10,958.0	11,015.0	8.7	0.9	210.0	70.0
27-1	27-1	27-1	27-12-1	27-12-1	27-12-18	1				_							230.0	70.0
27-1	27-:	27-1	27-12-1	27-12-1	27-12-18	1	Acti	iona	able	Ret	or	ts cr	'eate	es in	telliaer	nce from	230.0	80.0
27-1	27-:	27-1	27-12-1	27-12-1	27-12-10	1												
27-1	27-1	27-1	27-12-1	27-12-:	27-12-10	1					the	e me	eter d	data			10011101	-
28-1	27-:	27-1	27-12-1	27-12-1	27-12-18	1											010011001110	3
28-1	27-:	27-1	27-12-1	27-12-1	27-12-18	16:00	17:00	133.0	-	53.8	-	11.062.0	11.062.0	11.119.0	6.0	0.9	001100111010100	
28-1	28-1	27-1	27-12-1	27-12-1	27-12-18	17:00	18:00	112.6	-	47.8	-	10,998.0	10,994.0	11,055.0	5.3	0.9	0111101001100101	
28-1	28-1	27-1	27-12-1	27-12-1	27-12-18	18:00	19:00	85.2	-	35.3	-	10,994.0	10,991.0	11,053.0	3.7	0.9	1010100110011110	
-	28-1	28-1	27-12-1	2/-12-1	27-12-18	19:00	20:00	67.5	-	26.9	-	10,965.0	10,959.0	11,020.0	3.6	0.9	1001100110010	Allevi
	28-1	28-1	28-12-1	27-12-	27-12-18	20:00	21:00	67.1	-	26.8	-	11,001.0	10,996.0	11,058.0	3.5	0.9	A A A A A A A A A A A A A A A A A A A	antel .
		28-1	28-12-1	27-12	27-12-18	21:00	22:00	67.9	-	26.9	-	11,030.0	11,024.0	11,088.0	3.4	0.9		
			28-12-1	28-12-1	27-12-18	22:00	23:00	68.4	-	26.8	-	11,008.0	11,003.0	11,067.0	3.6	0.9		
			28-12-1	28-12-	27-12-18	23:00	0:00	68.1	-	26.8	-	11,016.0	11,011.0	11,071.0	3.6	0.9		h
		L		28-12-1	28-12-18	0:00	1:00	68.0	-	27.0	-	11,059.0	11,057.0	11,116.0	3.8	0.9		
				28-12-1	28-12-18	1:00	2:00	68.0	-	26.7	-	11,079.0	11,081.0	11,138.0	3.8	0.9		-
					28-12-18	2:00	3:00	67.9	-	27.0	-	11,090.0	11,091.0	11,148.0	3.7	0.9		-
					28-12-18	3:00	4:00	67.8	-	27.0	-	11,113.0	11,118.0	11,1/4.0	3.8	0.9		

Service: Energy Accounting, Identify Loss

- T&D loss and commercial loss
- Network segment wise losses
- Substation losses
- Feeder to DT
- DT to consumer
- Area wise losses
- Web portal to access reports

- Identify high loss area/network
- Suggest corrective actions to be taken by utility
- Closely work with utility to improve Feeder/DT to consumer tagging



Transformer – Consumer Loss Report





Management Information System (MIS) Reporting for Maintenance and Monitoring



Kenya: Transformer Failure & Concerns



Health Reports from Transformer Meters

The following reports are produced to address the requirements

- Unbalance Reports (Voltage and Current)
- Operation & Reliability Report

Let us review these reports



Voltage Unbalance



Voltage Unbalance Report

Unbalancing report of distribution transformers

Period: 01-Mar-2020 to 01-Apr-2020

Sr.		Meter	Rated	Maxim	num volt	age (V)	Minim	um volt	age (V)	Maxin	num curr	ent (A)	Minim	ium curr	ent (A)	Neutral current	Maximu	m neutra	I current condition	Relativ unb	ve phas alance	e wise (%)	% Voltage	% Max
no.	DT location details	serial number	(kVA)	R	Y	в	R	Y	в	R	Y	в	R	Y	в	at max demand (A)	Current (A)	Load (kVA)	Date & time (dd/mm/yy hh:mm)	R	Y	в	at peak kVA	gradient
Feed	er: Naya Bazar		Se	ection:	Chakul	ia 1																		
1	A.R. Chemicals	X0346687	200	257	250	254	218	218	216	28	28	26	0	1	0	4	13	6	07-03-20 11:30	81	175	44	2.18	9.27
2	Amlagora Gousala	X0344059	100	280	256	258	240	223	220	21	19	18	0	0	0	3	8	1	13-03-20 12:30	53	46	201	-5.64	-10.45
3	Amlagora Near D.P. Rice Mill	X0344516	100	298	289	298	252	251	250	54	54	60	0	0	0	6	17	15	09-03-20 10:30	96	95	109	-13.18	-22.91
4	Amlagora D.P. Rice Mill	X0344188	100	255	255	249	245	186	82	110	116	108	0	0	0	6	16	2	12-03-20 14:30	105	97	99	5.36	28.64
5	Amlagora Near Middil School	X0344486	100	249	268	252	231	2	234	32	86	1	6	0	0	74	99	28	27-03-20 09:30	79	181	40	-0.55	35.09
6	Bajpayee Nagar 1	X0346698	200	244	260	249	209	225	219	82	105	40	31	31	12	61	66	38	14-03-20 06:30	110	143	47	1.64	9.18
7	Bajpayee Nagar 2	X0344267	25	250	256	252	221	219	214	11	31	51	3	6	15	32	52	18	01-03-20 12:00	46	70	184	0.55	9.09
8	Bajrang Udyog Naya Bazar	X0344376	63	283	278	285	236	237	237	105	108	113	0	0	0	7	13	80	27-03-20 01:30	95	100	104	-7.82	-17.73
9	Bsnl Tower Naya Bazar	X0344461	25	258	252	256	220	221	218	10	8	10	0	0	1	1	7	5	15-03-20 14:00	102	86	113	1.64	8.36
10	Chouthia 1	X0344215	25	254	257	258	118	144	243	30	34	34	0	0	0	3	10	22	14-03-20 14:00	118	91	90	4.18	29.73

Zoom in



Voltage Unbalance Report

Unbalancing report of distribution transformers

Period: 01-Mar-2020 to 01-Apr-2020

Sr.		Meter	Rated	Maxin	num vol	tage (V)	Minim	ium vol	age (V)
no.	DT location details	number	(kVA)	R	Y	в	R	Y	в
Feed	ler: Naya Bazar		Se	ction:	Chaku	lia 1			
1	A.R. Chemicals	X0346687	200	257	250	254	218	218	216
2	Amlagora Gousala	X0344059	100	280	256	258	240	223	220
3	Amlagora Near D.P. Rice Mill	X0344516	100	298	289	298	252	251	250
4	Amlagora: D.P. Rice Mill	X0344188	100	255	255	249	245	186	82
5	Amlagora Near Middil School	X0344486	100	249	268	252	231	2	234
6	Bajpayee Nagar 1	X0346698	200	244	260	249	209	225	219
7	Bajpayee Nagar 2	X0344267	25	250	256	252	221	219	214
8	Bajrang Udyog Naya Bazar	X0344376	63	283	278	285	236	237	237
9	Bsni Tower Naya Bazar	X0344461	25	258	252	256	220	221	218
10	Chouthia 1	X0344215	25	254	257	258	118	144	243

Let's investigate this scenario

This is the area of attention for the operations team



Unbalance Report: Voltage Analysis...





Unbalance Report: Voltage Analysis...



Current Unbalance



Unbalance Report: Current(A) Analysis

Unbalancing report of distribution transformers

Period: 01-Mar-2020 to 01-Apr-2020

Sr.		Meter	Rated	Maxin	num voli	tage (V)	Minim	um vol	tage (V)	Maxim	num cur	rent (A)	Minin	num curr	ent (A)	Neutral current	Maximu	ım neutra	I current condition	Relati un	ve phas balance	e wise (%)	% oltage	% Max
no.	DT location details	number	capacity (kVA)	R	Y	в	R	Y	в	R	Y	В	R	Y	в	at max demand (A)	Current (A)	Load (kVA)	Date & time (dd/mm/yy hh:mm)	R	Y	в	g adlent at peak kVA	voltage gradient
Feed	ler: Naya Bazar		Se	ection:	Chaku	lia 1																		
1	A.R. Chemicals	X0346687	200	257	250	254	218	218	216	28	28	26	0	1	0	4	13	6	07-03-20 11:30	81	175	44	2.18	9.27
2	Amlagora Gousala	X0344059	100	280	256	258	240	223	220	21	19	18	0	0	0	3	8	1	13-03-20 12:30	53	46	201	-5.64	-10.45
3	Amlagora Near D.P. Rice Mill	X0344516	100	298	289	298	252	251	250	54	54	60	0	0	0	6	17	15	09-03-20 10:30	96	95	109	-13.18	-22.91
4	Amlagora D.P. Rice Mill	X0344188	100	255	255	249	245	186	82	110	116	108	0	0	0	6	16	2	12-03-20 14:30	105	97	99	5.36	28.64
5	Amlagora Near Middil School	X0344486	100	249	268	252	231	2	234	32	86	1	6	0	0	74	99	28	27-03-20 09:30	79	181	40	-0.55	35.09
6	Bajpayee Nagar 1	X0346698	200	244	260	249	209	225	219	82	105	40	31	31	12	61	66	38	14-03-20 06:30	110	143	47	1.64	9.18
7	Bajpayee Nagar 2	X0344267	25	250	256	252	221	219	214	11	31	51	3	6	15	32	52	18	01-03-20 12:00	46	70	184	0.55	9.09
8	Bajrang Udyog Naya Bazar	X0344376	63	283	278	285	236	237	237	105	108	113	0	0	0	7	13	80	27-03-20 01:30	95	100	104	-7.82	-17.73
9	Bsnl Tower Naya Bazar	X0344461	25	258	252	256	220	221	218	10	8	10	0	0	1	1	7	5	15-03-20 14:00	102	86	113	1.64	8.36
10	Chouthia 1	X0344215	25	254	257	258	118	144	243	30	34	34	0	0	0	3	10	22	14-03-20 14:00	118	91	90	4.18	29.73

Zoom in



Unbalance Report: Current(A) Analysis

The maximum and minimum current just	*	ase v ce (%	elative pl unbalar	I current condition	m neutra	Maximu	Neutral	ent (A)	num curre	Minin	rent (A)	num curr	Maxin
load variation in each	3		R Y	Date & time (dd/mm/yy hh:mn)	Load (kVA)	Current (A)	demand (A)	В	Y	R	В	Y	R
Transformer.	44	75	81 1	07-03-20 11 30	6	13	4	0	1	0	26	28	28
This is not an indicator	201	46	53	13-03-20 12.50	1	8	3	0	0	0	18	19	21
of unbalance !!	09	95	96	09-03-20 10:30	15	17	6	0	0	0	60	54	54
	99	97	105	12-03-20 14 <mark>:30</mark>	2	10	6	0	0	0	108	116	110
	40	31	79 1	27-03-20 09 <mark>:30</mark>	28	99	74	0	0	6	1	86	32
	47	43	110 1	14-03-20 06 <mark>30</mark>	38	66	61	12	31	31	40	105	82
	84	70	46	01-03-20 12:0	18	52	32	15	6	3	51	31	11
This is the area of	104	00	95 1	27-03-20 01:30	80	13	7	0	0	0	113	108	105
interest/attention for the operations team	113	36	102	15-03-20 14:00	5	7	1	1	0	0	10	8	10
the operations team	90	91	118	14-03-20 14:00	22	10	3	0	0	0	34	34	30



Unbalance Report: Current(A) Analysis



The unbalance has to be measured over a period of time in order to undertake maintenance activity



Unbalance Report: Neutral Current(A) Analysis

Maxim	num curre	ent (A)	Minim	um curre	nt (A)	Neutral	Maximu	m neutra	l current condition	Relativ	e phase alance (wise %)
R	Y	В	R	Y	В	demand (A)	Current (A)	Load (kVA)	Date & time (dd/n m/yy hh:mm)	R	Y	В
28	28	26	0	1	0		13	6	<mark>07-</mark> 03-20 11:30	81	175	44
21	19	18	0	0	0	3	8	1	13-13-20 12:30	53	46	201
54	54	60	0	0	0	6	17	15	<mark>09-0</mark> 3-20 10:30	96	95	109
110	116	108	0	0	0	6	16	2	<mark>12-0</mark> 3-20 14:30	105	97	99
32	86	1	6	0	0	4	99	28	<mark>27-0</mark> 3-20 09:30	79	181	40
82	105	40	31	31	12	61	66	38	14-13-20 06:30	110	143	47
11	31	51	3	6	15	32	52	18	01 03-20 12:00	46	70	184
105	108	113	0	0	0	7	13	80	2 -03-20 01:30	95	100	104
10	8	10	0	0	1	1	7	5	15-03-20 14:00	102	86	113
30	34	34	0	0	0	3	10	22	14-03-20 14:00	118	91	90

High neutral current indicates danger of floating Voltages for consumers unless there is:

- A full rated
 neutral conductor
- Proper earthing

This requires month on month analysis



Operation and Reliability Report



Operation & Reliability Report...

Ор	eration and reliability report	t: distribution	transfo	orme	rs]				
Pen	50: 01-Mai-2020 to 01-Api-2020 (11	Meter	Rated		Max	imum p	ower demand		Minin	num po	wer demand	Loa	iding cond	dition (% ti	ime)	Davua	Land	Inte	rruptions	Data
or. no.	DT location details	serial number	capacity (kVA)	kVA	kW	kVAr	Date & time (dd-mm-yy hh:mm)	kVA	kW	kVAr	Date & time (dd-mm-yy hh:mm)	<20 %	20-80 %	80-95 %	>95 %	factor	factor	Nos.	Duration	duration (hh:mm)
3	Amlagora Near D.P. Rice Mill	X0344516	100	46	35	29	09-03-20 16:00	0.00	0.02	0.02	29-03-20 19:30	88.0	12.0	0.0	0.0	0.69	0.13	19	17:30	744:00
4	Amlagora D.P. Rice Mill	X0344188	100	75	64	39	15-03-20 09:30	0.00	0.02	0.02	31-03-20 23:30	83.1	16.9	0.0	0.0	0.76	0.11	19	18:30	744:00
5	Amlagora Near Middil School	X0344486	100	29	29	1	31-03-20 21:00	0.04	0.00	0.00	03-03-20 23:30	62.9	37.1	0.0	0.0	1.00	0.55	18	17:00	744:00
6	Bajpayee Nagar 1	X0346698	200	49	48	10	29-03-20 20:00	0.20	0.00	0.00	05-03-20 00:00	94.0	6.0	0.0	0.0	0.98	0.62	22	21:00	744:00
7	Bajpayee Nagar 2	X0344267	25	21	20	6	29-03-20 15:00	0.00	0.02	0.02	18-03-20 19:30	1.8	97.9	0.3	0.0	0.97	<mark>0.5</mark> 3	19	19:30	744:00
8	Bajrang Udyog Naya Bazar	X0344376	63	84	63	56	03-03-20 00:00	0.00	0.02	0.02	31-03-20 23:30	66.8	8.8	2.8	21.6	0.67	0.22	19	19:30	744:00
9	Bsnl Tower Naya Bazar	X0344461	25	7	7	1	01-03-20 16:30	0.00	0.00	0.00	05-03-20 06:30	97.8	2.2	0.0	0.0	1.00	0.51	19	19:00	744:00

Zoom in



SFIIDF

Operation & Reliability Report...

ł	Rated		Max	imum p	ower demand		Minim	um po	wer demand	Loa	ding cond	lition (% t	me)
Ca	apacity (kVA)	kVA	kW	kVAr	Date & time (dd-mm-yy hh:mm)	kVA	kW	kVAr	Date & time (dd-mm-yy hh:mm)	<20 %	20-80 %	80-95 %	>95 %
	100	46	35	29	09-03-20 16:00	0.00	0.02	0.02	29-03-20 19:30	88.0	12.0	0.0	0.0
	100	75	64	39	15-03-20 09:30	0.00	0.02	0.02	31-03-20 23:30	83.1	16.9	0.0	0.0
	100	29	29	1	31-03-20 21:00	0.04	0.00	0.00	03-03-20 23:30	62.9	37.1	0.0	0.0
	200	49	48	10	29-03-20 20:00	0.20	0.00	0.00	05-03-20 00:00	94.0	6.0	0.0	0.0
	25	21	20	6	29-03-20 15:00	0.00	0.02	0.02	18-03-20 19:30	1.8	97.9	0.3	0.0
ſ	63	84	63	56	03-03-20 00:00	0.00	0.02	0.02	31-03-20 23:30	66.8	8.8	2.8	21.6
	25	7	7	1	01-03-20 16:30	0.00	0.00	0.00	05-03-20 06:30	97.8	2.2	0.0	0.0
	Т	rans	forn	ner i	s overloaded					An im	media ormer	te action has to	on on be in

The pattern is consistent over the month

ed (Upgrade / Replacement)



Operation & Reliability Report...

Operation and reliability report: distribution transformers

Period: 01-Mar-2020 to 01-Apr-2020 (Total hours: 744)

Sr		Meter	Rated		Max	imum p	ower demand		Minim	um pov	wer demand	Loa	ding cond	l <mark>ition (</mark> % ti	ime)	Power	100	Inter	ruptions	Data
no.	DT location details	serial number	capacity (kVA)	kVA	kW	kVAr	Date & time (dd-mm-yy hh:mm)	kVA	kW	kVAr	Date & time (dd-mm-yy hh:mm)	<20 %	20-80 %	80-95 %	>95 %	factor	factor	Nos.	Duration	(uration (uh:mm)
3	Amlagora Near D.P. Rice Mill	X0344516	100	46	35	29	09-03-20 16:00	0.00	0.02	0.02	29-03-20 19:30	88.0	12.0	0.0	0.0	0.75	0.13	19	17:30	744:00
4	Amlagora D.P. Rice Mill	X0344188	100	75	64	39	15-03-20 09:30	0.00	0.02	0.02	31-03-20 23:30	83.1	16.9	0.0	0.0	0.76	0.11	19	18:30	744:00
5	Amlagora Near Middil School	X0344486	100	29	29	1	31-03-20 21:00	0.04	0.00	0.00	03-03-20 23:30	62.9	37.1	0.0	90	1.00	0.55	18	17:00	744:00
6	Bajpayee Nagar 1	X0346698	200	49	48	10	29-03-20 20:00	0.20	0.00	0.00	05-03-20 00:00	94.0	6.0	0.0	0.0	0.98	U.62	22	21:00	744:00
7	Bajpayee Nagar 2	X0344267	- 25	21	20	0	20 00 20 15:00	0.00	0.02	0.02	10 00 20 10:00	1.0	07.0			0.07	0.53	19	19:30	744:00
8	Bajrang Udyog Naya Bazar	X0344376	63	84	63	56	03-03-20 00:00	0.00	0.02	0.02	31-03-20 23:30	66.8	8.8	2.8	21.6	0.67	0.22	19	19:30	744:00
9	Bsnl Tower Naya Bazar	X0344461	20	7	7	1	01-03-20 16.30	0.00	0.00	0.00	00-03-20 06:30	91.0	2.2	0.0	0.0	P 10	0.51	19	19:00	744:00

Count and Duration of Power Failure: Used for SAIFI / SAIDI / CAIDI Grid code mandates reporting on these parameters

All transformers recorded > 18 interruptions

- 18 interruptions for 17:00 hrs can be associated with upstream failure
- Transformers >18 interruptions can be associated with additional downstream failure

ormer is constantly low. the nature of load in the recommended.

SFC

Benefits of Metering Transformers

- Distribution Transformer Metering is not just kWh metering
- A meter at a transformer backed with suitable application can help with:
 - Monitoring
 - Maintenance
 - Audit compliance
 - Feeder DT- Customer linkage
 - Energy audits
 - Customer satisfaction



"Appropriate Metering" backed by "MIS reporting" services is the key



Solution



Appropriate metering (DT Meter feature)

Objectives of DT meter

- Transformer loading trend
- Phase unbalancing
- Supply quality & reliability
 - Segregation of upstream & downstream reliability
- Fault identifications
- Load flow studies
- Monitor Reactive energy

Meters are designed considering these requirements / application.



Services offered for more than 300,000 Distribution Transformers



System Architecture





Software as a Service

Feeder/Distribution Transformer health monitoring Web Portal for monitoring



Conclusion



Case studies : Northern India Utility

Scope of work

- Feeder & DT metering supply & installation
- AMR and data analysis
- Feeder wise loss assessment
- Feeder/DT health analysis
- Field & data centre services

Area of Supply

- Distribution Transformer : ~5,000
- Feeders : 560
- Substations : 90
- Consumers : ~500,000



Case Study: Eastern Indian Utility

Scope of work

- Feeder & DT metering supply & installation
- Monthly reading and data analysis
- Total and commercial loss
- Feeder/DT health analysis

Area Covered

- Distribution Transformer : 28,000
- Feeders : 3500
- Admin areas : 5 zones/65 divisions
- Consumers : 2.2 million

Source: Press Information Bureau, Government of India, Ministry of Power in 2013.

Benefits

- Reduces technical & commercial losses from 43.4% to 27.2% in 4yrs.
- Maintain losses in the range of 28%-32% between FY12-FY2015.
- DT health monitoring in terms of DT phase unbalancing and over/under loading.



Continuous monitoring is the key!!



Conclusion





Transformers are Eyes and Ears of any Municipality

"Appropriate Metering" backed by "Actionable Service Reports" can help municipalities in improving overall system efficiency





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