

### B1. (E) Application availability reports

TIME	dac1nrl_STATUS	dac2nrl_STATUS	his1nrl_STATUS	his2nrl_STATUS	fep1nrl_STATUS	fep2nrl_STATUS	iccp1nrl_STATUS
2020-07-30 00:00:00.000	1	1	1	1	1	1	1
2020-07-30 00:01:00.000	1	1	1	1	1	1	1
2020-07-30 00:02:00.000	1	1	1	1	1	1	1
2020-07-30 00:03:00.000	1	1	1	1	1	1	1
2020-07-30 00:04:00.000	1	1	1	1	1	1	1
2020-07-30 00:05:00.000	1	1	1	1	1	1	1
2020-07-30 00:06:00.000	1	1	1	1	1	1	1
2020-07-30 00:07:00.000	1	1	1	1	1	1	1
2020-07-30 00:08:00.000	1	1	1	1	1	1	1
2020-07-30 00:09:00.000	1	1	1	1	1	1	1
2020-07-30 00:10:00.000	1	1	1	1	1	1	1
2020-07-30 00:11:00.000	1	1	1	1	1	1	1
2020-07-30 00:12:00.000	1	1	1	1	1	1	1
2020-07-30 00:13:00.000	1	1	1	1	1	1	1
2020-07-30 00:14:00.000	1	1	1	1	1	1	1
2020-07-30 00:15:00.000	1	1	1	1	1	1	1
2020-07-30 00:16:00.000	1	1	1	1	1	1	1
2020-07-30 00:17:00.000	1	1	1	1	1	1	1
2020-07-30 00:18:00.000	1	1	1	1	1	1	1
2020-07-30 00:19:00.000	1	1	1	1	1	1	1
2020-07-30 00:20:00.000	1	1	1	1	1	1	1
2020-07-30 00:21:00.000	1	1	1	1	1	1	1

### B1. (F) VDI Report

Voltage Deviation Index of Northern Region for 01 Dec 2020				
Station	VOLTAGE < V(lower) (V(lower)=380 kV)	V(lower)< VOLTAGE<V(upper)	VOLTAGE > V(upper) (V(upper)=420 kV)	Voltage Deviation Index (%age of time voltage is outside range)
400 kV Bhiwani (BBMB)	0.00%	58.33%	41.67%	41.67%
400 kV Dehar	0.00%	100.00%	0.00%	0.00%
400kV Panipat	0.00%	99.31%	0.69%	0.69%
400 kV Bamnoli	0.00%	100.00%	0.00%	0.00%
400kV Bawana	0.00%	88.19%	11.81%	11.81%
400kV CCG Bawana	0.00%	36.46%	63.54%	63.54%
400 kV Harsh Vihar	0.00%	40.63%	59.38%	59.38%
400 kV Mundka	0.00%	0.00%	100.00%	100.00%
400 kV Baspa	0.00%	100.00%	0.00%	0.00%
400 kV Dhanonda	0.00%	68.40%	31.60%	31.60%
400kV Daultabad	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
400 kV Dipalpur	0.00%	64.93%	35.07%	35.07%
400 kV Kabulpur	0.00%	93.06%	6.94%	6.94%
400 kV Kirori	0.00%	89.93%	10.07%	10.07%
400 kV MGTPS	0.00%	37.50%	62.50%	62.50%
400 kV Nawada	0.00%	72.92%	27.08%	27.08%
400 kV Nuhyawali	0.00%	0.00%	100.00%	100.00%
400 kV RGTPS	0.00%	72.92%	27.08%	27.08%
400kV Abdulapur	0.00%	66.32%	33.68%	33.68%
400kV Agra	0.00%	100.00%	0.00%	0.00%
AGRA HVDC	0.00%	82.64%	17.36%	17.36%
400kV Ajmer	0.00%	100.00%	0.00%	0.00%
400kV Allahabad	0.00%	32.64%	67.36%	67.36%
400kV Amargarh	0.00%	100.00%	0.00%	0.00%

**B1. (G) FDI Report**

**(A) Frequency Profile (HZ)**

Date	Max	Time	Min	Time	Average	Freq Dev Index
	Hz	Hrs	Hz	Hrs	Hz	
15-NOV-2021	50.20	06:02:10	49.77	13:40:30	50.00	0.03
16-NOV-2021	50.21	13:03:30	49.84	23:07:10	50.01	0.03
17-NOV-2021	50.16	04:03:20	49.63	10:54:30	49.96	0.10
18-NOV-2021	50.19	16:03:40	49.68	15:13:20	49.97	0.07
19-NOV-2021	50.26	13:30:20	49.77	09:15:40	50.02	0.04
20-NOV-2021	50.15	04:03:00	49.81	15:21:00	50.01	0.03
21-NOV-2021	50.17	11:03:20	49.87	05:53:20	50.02	0.03

**B1. (H) NMS Reports, LAN, CPU, RAM, Memory Utilization Report**

Rank	Node Short Name	Node Availability (avg)	CPU 1min Utilization (avg)	Memory Utilization (avg)	Disk Space Utilization (avg)
1	<a href="#">nrpoosm2</a>	100.00%	70.66%	5.06%	4.51%
2	<a href="#">nrpopdp1</a>	100.00%	35.51%	69.89%	16.79%
3	<a href="#">nrpoows3</a>	100.00%	14.30%	25.92%	65.99%
4	<a href="#">nrpoows4</a>	100.00%	14.03%	33.52%	74.41%
5	<a href="#">nrpopdc1</a>	100.00%	13.07%	3.92%	5.23%
6	<a href="#">nrpopdc2</a>	100.00%	11.56%	3.43%	3.87%
7	<a href="#">nrpoows2</a>	100.00%	11.48%	48.93%	82.29%
8	<a href="#">nrpoows1</a>	100.00%	10.57%	29.83%	57.46%
9	<a href="#">nrpoomi4</a>	100.00%	7.05%	32.47%	25.29%
10	<a href="#">nrpopds1</a>	100.00%	6.55%	28.72%	53.46%
11	<a href="#">nrpoomi3</a>	100.00%	6.18%	32.69%	28.01%
12	<a href="#">nrpodhs1</a>	100.00%	5.76%	43.64%	15.04%
13	<a href="#">nrpoosm1</a>	100.00%	4.67%	4.82%	4.47%
14	<a href="#">nrpoisw1</a>	100.00%	3.90%	5.00%	
15	<a href="#">nrpoisw2</a>	100.00%	3.90%	5.00%	
16	<a href="#">nrpoasw2</a>	100.00%	3.82%	5.00%	
17	<a href="#">nrpoasw1</a>	100.00%	3.80%	5.00%	
18	<a href="#">nrpohsw2</a>	100.00%	3.60%	5.00%	
19	<a href="#">nrpohsw1</a>	100.00%	3.59%	5.00%	
20	<a href="#">nrporw2</a>	100.00%	3.58%	2.67%	
21	<a href="#">nrporw1</a>	100.00%	3.57%	2.67%	
22	<a href="#">nrpofw3</a>	100.00%	3.05%	35.91%	52.32%
23	<a href="#">nrpopds2</a>	100.00%	2.91%	19.81%	85.37%
24	<a href="#">nrpoisp1</a>	100.00%	2.70%	45.64%	63.07%
25	<a href="#">nrpoows5</a>	100.00%	2.66%	37.40%	35.81%
26	<a href="#">nrpoomi2</a>	100.00%	2.62%	33.74%	14.78%

## B2. Daily Power Supply Position Report

Technical Specifications for Implementation of Unified Load Despatch and Communication (ULDC) Phase-III “SCADA/EMS Upgradation Project-Eastern Region SLDCs and RLDC”



Evening Peak (19:00) MW		Off-Peak (03:00) MW				Day Energy(Net MU)			
Demand Met	Shortage	Requirement	Freq (Hz)	Demand Met	Shortage	Requirement	Freq (Hz)	Demand Met	Shortage
47,222	350	47,572	50.01	30,041	50	30,091	49.98	938	4.33

**1. Regional Availability/Demand:**

2(A)State's Load Deals (At State Periphery) in MU:

State	State's Control Area Generation (Net MU)							Drawal Sch (Net MU)	Act Drawal (Net MU)	UI (Net MU)	Requirement (Net MU)	Shortage (Net MU)	Consumption (Net MU)
	Thermal	Hydro	Gas/Naptha/Diesel	Solar	Wind	Others/Biomass/Small Hyd/Co-gen etc.	Total						
PUNJAB	51.16	6.91	0	2.41	0	0.98	61.45	55.09	54.74	-0.35	116.94	0.75	116.19
HARYANA	34.83	0.76	0	0.43	0	0.56	36.57	82.72	84.41	1.69	120.98	0	120.98
RAJASTHAN	133.69	1.64	3.59	20.22	1.8	2.33	163.27	67.97	68.64	0.67	231.91	0	231.91
DELHI	0	0	11.43	0	0	0.91	12.34	50.96	49.58	-1.38	61.92	0	61.92
UTTAR PRADESH	141.3	9.9	0	9	0	12	172.2	108.39	109.4	1.01	281.73	0.13	281.6
UTTARAKHAND	0	9.28	0	0.54	0	0.88	10.69	24.21	24.63	0.42	35.32	0	35.32
HIMACHAL PRADESH	0	5.43	0	0.07	0	4.1	9.6	21.84	21.83	-0.01	31.43	0	31.43
J&K(UT) & Ladakh(UT)	0	5.86	0	0	0	0	5.86	49.56	50.05	0.49	59.36	3.45	55.91
CHANDIGARH	0	0	0	0	0	0	0	3.52	3.08	-0.44	3.08	0	3.08
Region	360.98	39.78	15.02	32.67	1.8	21.76	471.98	464.26	466.36	2.1	942.67	4.33	938.34

2(B)State Demand Met (Peak and off-peak Hrs)

State	Evening Peak (19:00) MW				Off-Peak (03:00) MW			
	Demand Met	Shortage	UI	STOA/PX/RTM Transaction	Demand Met	Shortage	UI	STOA/PX/RTM Transaction
PUNJAB	5,793	150	53	-414	3,546	0	-38	-221
HARYANA	5,845	0	1	0	3,802	0	11	309
RAJASTHAN	10,417	0	72	233	7,145	0	-44	-905
DELHI	3,205	0	-8	-625	1,531	0	12	-809
UTTAR PRADESH	15,836	0	211	194	9,762	0	442	335
UTTARAKHAND	1,706	0	21	350	1,138	0	-61	380
HIMACHAL PRADESH	1,546	0	57	-393	950	0	4	470
J&K(UT) & Ladakh(UT)	2,706	200	144	417	2,095	50	187	734
CHANDIGARH	169	0	-81	0	73	0	-24	0
Region	47,223	350	470	-238	30,042	50	489	293

2(C)State's Demand Met in MWs (Maximum Demand Met and Maximum requirement of the day details)

State	Maximum Demand, corresponding shortage and requirement details for the day				Maximum requirement, corresponding shortage and demand details for the day					
	Maximum Demand Met of the day	Time	Shortage during at maximum demand	Requirement at the max demand met of the day	Maximum Requirement of the day	Time	Shortage during at maximum Requirement	Demand Met at maximum requirement	Min Demand Met	Time
PUNJAB	6,037	8:00	0	6,037	6,037	8:00	0	6,037	3,546	3:00
HARYANA	6,226	10:00	0	6,226	6,226	10:00	0	6,226	3,802	3:00
RAJASTHAN	13,032	9:00	0	13,032	13,032	9:00	0	13,032	7,004	4:00
DELHI	3,518	11:00	0	3,518	3,518	11:00	0	3,518	1,478	5:00
UP	15,836	19:00	0	15,836	15,836	19:00	0	15,836	9,495	4:00
UTTARAKHAND	1,889	8:00	0	1,889	1,889	8:00	0	1,889	1,138	3:00
HP	1,713	8:00	0	1,713	1,713	8:00	0	1,713	941	2:00

Daily Power Position Report

SLDC									
BSPTCL									
Power supply position in BSPTCL for 03.11 2022									
Date of reporting :04.11 2022									
<b>I. State Availability/Demand</b>									
	peak (19:00 hrs)MW	Off Peak (03:00hrs) MW							



Area/ state Availability (Gross)								
Area/ state Requirement								
Area/ state Shortage/ Restriction								
<b>II. Load Energy Details( At State periphery)</b>								
State/utility	Off Peak Hour Load MW	Peak Hour		CGS Schedule Net MU	CGS Drawal Net MU	Own Generation Net MU	Consumtion Net MU	
		Load MW	Restrictions MW					
Bihar								
DVC								
Jharkhand								
Sikkim								
.....								
Total								
<b>III Generation Details:</b>								
Station/Constituent	Installed Capacity	Peak MW	Off Peak MW	Energy	Average			
	MW	Gross	Gross	Net MU	Sentout MW			
<b>A. CS(NTPC, NHPC etc.</b>								
Dadri								
.....								
.....								
Sub Total A								
<b>B. IPP</b>								
.....								
Sub Total B								
C. State Gen Units (Pragati etc.)								
Sub Total C								
<b>D. Inter-Regional Exchange [Export(-ve)/Import(+ve)]</b>								

Sub Total D											
<b>Grand Total</b>	10568										
<b>IV. Inter State Exchange [Export(-ve)/Import(+ve)]</b>											
Element	Peak (19:00 hrs) MW	Off Peak (03:00hrs) MW	Maximum Interchange		Energy (MU)		Net Energy MU				
			Import	Export	Import	Export					
BSPTCL											
<b>Sub Total Jharkhand- BSPTCL</b>											
<b>Sub Total Bihar- Jharkhand</b>											
<b>Total IS Exch. (with DVC, JUSNL, Odisha etc.)</b>											
<b>V. Frequency Profile</b>											
-----% of Time Frequency-----											
< 48.00	< 48.5	< 49.00	< 49.50	49.0 - 50.5	> 50.00	> 50.50	> 51.00	> 51.50			
0	0	3.58	31.67	96.42	27.64	0	0	0			
-----Frequency (Hz)-----											
Maximum				Minimum		Average Frequency (Hz)	Frequency Variation Index				
Freq		Time		Freq				Time			
50.28		9.38		48.56		18.25		49.7		2.21	
<b>VI. Voltage Profile At Some Critical Stations:</b>											
-----400 KV Voltage (KV)-----					-----400 KV Voltage (KV)-----						
Maximum			Minimum		Maximum		Minimum				
Voltage	Time		Voltage	Time	Voltage	Time	Voltage	Time			
415	2.26		391	10.44	402	1.05	390	6.47			

-----220 KV Voltage (KV)-----				-----400 KV Voltage (KV)-----			
Maximum		Minimum		Maximum		Minimum	
Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
210	1.27	195	18.22	412	1.14	389	17.26
<b>VII. Hourly Average Frequency (HZ):</b>							
Time	Frequency	Time	Frequency	Time	Frequency	Time	Frequency
100	49.89	700	49.66	1300	49.29	1900	49.39
200	50.13	800	49.74	1400	49.36	2000	49.7
300	50.12	900	49.89	1500	49.39	2100	49.88
400	50.06	1000	50.14	1600	49.3	2200	49.66
500	50	1100	49.36	1700	49.62	2300	49.84
600	49.6	1200	49.54	1800	49.36	2400	50

## Daily Operational Data of Thermal Power Stations and Nuclear Stations

**Daily Operational Data of Thermal Power Stations and Nuclear Power Stations  
( Generation and Outage data)**

Generation data for the date: \_\_\_\_\_

Name of the organisation: \_\_\_\_\_

**(A) UNIT WISE GENERATION**

Name Of Station	Unit No.	Unit Capacity in MW	Gross Energy Generated during the day in MkWh	Peak load during the day (MW)	Remarks, if any
Station 1					
Station 2					
<u>Data for newly commissioned units ( if any) *</u>					

**(B) UNIT WISE OUTAGES ( Planned/Forced)**

(i) Details of Units remained out of bars & Units tripped/ taken out of the bar during the day

Name Of Station	Unit No.	Outage Date & Time	Expected date of return	Outage Reason(s)	Reason(s) of extended outage, if any	Remarks
<u>Planned outage</u>						
<u>Forced outage</u>						

(ii) Details of Units revived during the day

Name Of Station	Unit No.	Outage Date & Time	Synchronization Date & Time	Outage Duration in Hours	Outage Reason(s)	Generation Loss MkWh
<u>Planned outage</u>						
<u>Forced outage</u>						

Technical Specifications for Implementation of Unified Load Despatch and Communication (ULDC) Phase-III “SCADA/EMS Upgradation Project-Eastern Region SLDCs and RLDC”



(C) UNIT WISE PARTIAL ENERGY LOSS DATA (DAY WISE IN MWh)

Name Of Station	Unit No.	Unit Capacity in MW	Energy Loss due to fuel shortage	Energy Loss due to low system Demand	Energy Loss due to system constraints	Energy Loss due to Equipment Problems	Remarks, if any
Station 1							
Station 2							

(D) ADDITIONAL INFORMATION IN BRIEF, IF ANY

$$\text{Partial loss in MWh} = (Cr_1 \times Hr_1 + Cr_2 \times Hr_2 + \dots + Cr_n \times Hr_n) / 1000$$

Where  $Cr_1, \dots, Cr_n$  are "the reduction in the output of the operating units in MW due to constraints in Auxiliaries/equipments or any other causes." and  $Hr_1, \dots, Hr_n$  are the duration in hours of operation of the units at reduced output during the period considered (day or month).

NOTE: (I) Following categories of capacities of units/stations are monitored:

- a. Thermal (Steam) units having station capacity of more than 20 MW.
  - b. All gas/diesel units supplying committed power to grid.
  - c. Hydro stations having capacity of 2 MW and above.
- (II) Wherever actual auxiliary consumption is not being metered, proportionate auxiliary consumption may be furnished.

(III) \*From the date of synchronisation to the date of commercial operation

## Monthly Operation Data of Power Stations

Data for the Month:

Name of the organization:

**(A) UNIT WISE GENERATION, UNIT AUX. & STATION AUX. POWER CONSUMPTION**

Name Of Station	Unit No.	Unit Capacity in MW	Gross Energy generated during the Month in MkwH	Unit Aux. Consumption in MkwH	Station Aux. Consumption in MkwH	Unit Peak Load during the month ( MW )	Station Peak Load during the month ( MW )
Station 1							
Station 2							
Data for newly commissioned units (if any):*							

**(B) UNIT WISE OUTAGES ( Planned/Forced)**

(i) Details of Units remained out of bars & Units tripped/ taken out of the bars during the Month

Name Of Station	Unit No.	Tripping Date & Time	Expected date of return	Outage Reason (s)	Reason (s) of extended outage, if any	Remarks
<u>Planned outage</u>						
<u>Forced outage</u>						

(ii) Details of Units revived during the month

Name Of Station	Unit No.	Tripping Date & Time	Synchronization Date & Time	Outage Duration in Hours- Minutes	Outage Reason (s)	Generation Loss in MkwHs
<u>Planned outage</u>						
<u>Forced outage</u>						



**Typical Hourly Load data for system**

(All figures in MW)

HOURS	OWN GENERATION					DRAWL FROM CENTER	TOTAL LOAD (5+6)	LOAD SHEDDING (W.O. PLR)	LOAD SHEDDING (DUE TO PLR)	Total LOAD SHEDDING
	GGSSTP	GNDTP	GHTP	HYDRO	TOTAL (1+2+3+4)					
	1	2	3	4	5					
00:00-01:00	1220	280	935	998	3433	4919	8352	0	0	0
01:00-02:00	1220	280	933	877	3310	4871	8181	0	0	0
02:00-03:00	1220	280	930	758	3188	4960	8148	0	0	0
03:00-04:00	1230	280	935	758	3203	4924	8127	0	0	0
04:00-05:00	1230	280	934	758	3202	4891	8093	0	0	0
05:00-06:00	1260	280	933	758	3231	4886	8117	0	0	0
06:00-07:00	1260	280	934	758	3232	4822	8054	0	0	0
07:00-08:00	1260	280	933	758	3231	4794	8025	0	0	0
08:00-09:00	1260	280	934	818	3292	4794	8086	110	0	110
09:00-10:00	1260	280	933	818	3291	4789	8080	310	0	310
10:00-11:00	1260	280	933	878	3351	4604	7955	310	0	310
11:00-12:00	1260	280	933	878	3351	4509	7860	310	0	310
12:00-13:00	1160	267	873	758	3058	4349	7407	310	0	310
13:00-14:00	1120	280	837	758	2995	4254	7249	310	0	310
14:00-15:00	1110	280	922	758	3070	3804	6874	310	0	310
15:00-16:00	1260	270	941	758	3229	3815	7044	310	0	310
16:00-17:00	1110	215	827	758	2910	4162	7072	310	0	310
17:00-18:00	1060	240	792	749	2841	4604	7445	310	0	310
18:00-19:00	1060	280	818	757	2915	4513	7428	210	0	310
19:00-20:00	1255	280	934	967	3436	4332	7768	310	250	460
20:00-21:00	1050	280	943	1119	3392	4503	7895	0	800	800
21:00-22:00	1050	280	942	1119	3391	4313	7704	0	800	800
22:00-23:00	1050	261	943	1118	3372	4304	7676	55	650	705
23:00-24:00	1050	261	940	878	3129	4844	7973	110	0	110
TOTAL (MWH)	28275	6554	21912	20312	77053	109557	186610	3585	2500	6085

Actual Generation (LUs)	286.800	66.280	220.410	203.709	777.199
Auxiliary Consumption (LUs)	22.820	8.492	18.195	0.405	49.912
Sent Out (LUs)	263.980	57.788	202.215	203.304	727.287

**Hydraulic Data (RSD)**

a) Level (14-Jul-2011)	508.88 m
Level (13-Jul-2011)	508.88 m
Last Year Level	502.03 m
b) Inflow (14-Jul-2011)	10513 cusec
Inflow (13-Jul-2011)	12320 cusec
Last Year Inflow	11231 cusec
c) Discharge (14-Jul-2011)	12354 cusec
Discharge (13-Jul-2011)	19448 cusec
Last Year Discharge	14160 cusec

ANY OTHER INFORMATION:-

Station	Unit #	From		To		Expected Date of Revival	Reason
		Date	Time	Date	Time		
RTP	3	14/07/11	20:35				BTL
BTI	4	14/07/11	16:40	14/07/11	17:40		

**Sample Display and reports for Network Management System**

		CPU Utilization				Memory Utilization			
		Current		History		Current		History	
		Graph	Tabular	Graph	Tabular	Graph	Tabular	Graph	Tabular
servers									
	ALARM								
	Front end								
	user interface								
	NMS								
	Operating System								
	Data SCAN								
	Data r Backup								
	Transfer to Historian/web								
	...								
	.....								



*Current Data collection periodicity:- 5 minute to 60 minutes user configurable  
Data availability in Current window- 15 minutes to 60 minutes user configurable*

*History Data collection periodicity:- 15 minutes average  
Data availability for one year*

Tabular data would have the summary row at the end with average, current and peak values.

**Events and Alarms**

Time	Events
10:03:41	ALARM CPU utilization on Server1 crossed threshold limit Current 91 Limit 58
11:43:35	ALARM services on server1 Not available
11:43:58	Data BACKUP between from server2 to Server1 not available/failed

Alarms, events archiving, and availability would have the similar time frame as for SCADA alarms.

		Port Utilization				Packet Error			
		Current		History		Current		History	
Device/Port	Alias Name	Graph	Tabular	Graph	Tabular	Graph	Tabular	Graph	Tabular
Switch1	Main Switch1								
port1	EMS1 LAN1								
Port2	Printer1								
Port3	Router2								
Router 1	Main Router 1								
Port1	G703 ER Link1								
Port2	V35 ER Link2								

*Current Data collection periodicity:- 5 minute to 60 minutes user configurable  
Data availability in Current window- 15 minutes to 60 minutes user configurable  
History Data collection periodicity:- 15 minutes average  
Data availability for one year*

Tabular data would have the summary row at the end with average, current and peak values

**Events and Alarms**

Time	Events
10:03:41	Main Switch 1 EMS 1 LAN1 port utilization crossed threshold limit Current 91 Limit 58
11:43:35	Switch 1 EMS 1 LAN1 Not available
11:43:58	Main router1 G703 ER link1 is not available.



Alarms and events archiving and availability would have the similar time frame as for SCADA alarms.

servers				SCADA Server		NMS Server		ICCP Server		Web Server		CMC
				EMS1	EMS2	NMS1	NMS2	OAG1	OAG2	WEB1	WEB2	
LAN1	Current	Graph										
		Tabular										
	History	Graph										
		Tabular										
LANB	Current	Graph										
		Tabular										
	History	Graph										
		Tabular										
CPU Usage	Current	Graph										
		Tabular										
	History	Graph										
		Tabular										
Disk Usage	Current	Graph										
		Tabular										
	History	Graph										
		Tabular										
Page fault	Current	Graph										
		Tabular										
	History	Graph										
		Tabular										
Memory Utilization	Current	Graph										
		Tabular										
	History	Graph										
		Tabular										

*Current Data collection periodicity:- 5 minute to 60 minutes user configurable  
Data availability in Current window- 15 minutes to 60 minutes user configurable  
History Data collection periodicity:- 15 minutes average  
Data availability for one year*

Tabular data would have the summary row at the end with average, current and peak values

### B3. Miscellaneous Reports

#### B3. (A) Daily Data regarding Loss of generation

Daily Data regarding Loss of Generation on account of Shortage of Coal, Gas & Unrequisitioned Liquid Fired Capacity in \_\_\_\_\_ Region

Date: \_\_\_\_\_

S.NO.	Name of State/ Station	Installed Capacity (MW)	Fuel Type	Loss of Gen. for the Day (MkWh)
<b>State Sector</b>				
1.				
2.				
3.				
4.				
<b>Central Sector</b>				
1.				
2.				
3.				
4.				
	Total			

**Summary**

1. Loss of Generation due to Shortage of Coal	_____	(MkWh)
2. Loss of Generation due to Shortage of Gas	_____	(MkWh)
3. Unrequisitioned Liquid Fired Capacity	_____	(MkWh)
Total	_____	(MkWh)

FORMAT-\_\_ RPCs

### Transmission Element Outage Report

#### A. Details of Transmission Elements under Planned Outage

SL. NO.	ELEMENT NAME	TYPE	VOLTAGE LEVEL	OWNER	OUTAGE		REVIVAL		EXPECTED DATE OF REVIVAL	REASONS	REMARKS
					DATE	TIME	DATE	TIME			
1											
2											
3											

**B. Details of Transmission Elements under Forced Outage**

SL. NO.	ELEMENT NAME	TYPE	VOLTAGE LEVEL	OWNER	OUTAGE		REVIVAL		EXPECTED DATE OF REVIVAL	REASONS	REMARKS
					DATE	TIME	DATE	TIME			
1											
2											
3											

**C. Details of Transmission Elements Opened manually due to High Voltage**

SL. NO.	ELEMENT NAME	TYPE	VOLTAGE LEVEL	OWNER	OUTAGE		REVIVAL		EXPECTED DATE OF REVIVAL	REASONS	REMARKS
					DATE	TIME	DATE	TIME			
1											
2											
3											

**Generation Elements Outage Report**

**Generating Unit Outage Report For  
15-May-22**

<b>A. Planned Outages</b>										
SL. NO.	Station	Location	Owner	Unit No	Capacity	Reasons	Outage	Expected Revival Date	Remarks	
							Date	Time		
<b>CENTRAL SECTOR</b>										
1										
2										
3										
4										
<b>TOTAL CENTRAL SECTOR</b>										
<b>STATE SECTOR</b>										
1										
2										
3										
4										

<b>B. Forced Outages</b>											
SL. NO	Station	Location	Owner	Unit No	Capacity	Reasons	Outage		Expected Revival Date		Remarks
							Date	Time	Date	Time	
<b>CENTRAL SECTOR</b>											
1											
2											
3											
4											
<b>TOTAL CENTRAL SECTOR</b>											
<b>STATE SECTOR</b>											
1											
2											
3											
4											
<b>TOTAL CENTRAL SECTOR</b>											
<b>Total Forced Outage (CS+SS)</b>											

<b>C. Generating Units Revived during last day which were out before 15 May, 2022</b>											
SL. NO.	Station	Location	Owner	Unit No	Capacity	Reasons	Outage		Revival		Remarks
							Date	Time	Date	Time	
<b>STATE SECTOR</b>											
1											
2											
3											
4											
<b>TOTAL STATE SECTOR</b>											
<b>Total Outage (CS+SS)</b>											

<b>D. Short Duration Outages during the day</b>											
SL. NO.	Station	Location	Owner	Unit No	Capacity	Reasons	Outage		Revival		Remarks
							Date	Time	Date	Time	
<b>NO DATA FOR CENTRAL SECTOR AND STATE SECTOR</b>											
<b>Total N/A</b>											
<b>Total Outage (CS+SS):</b>											

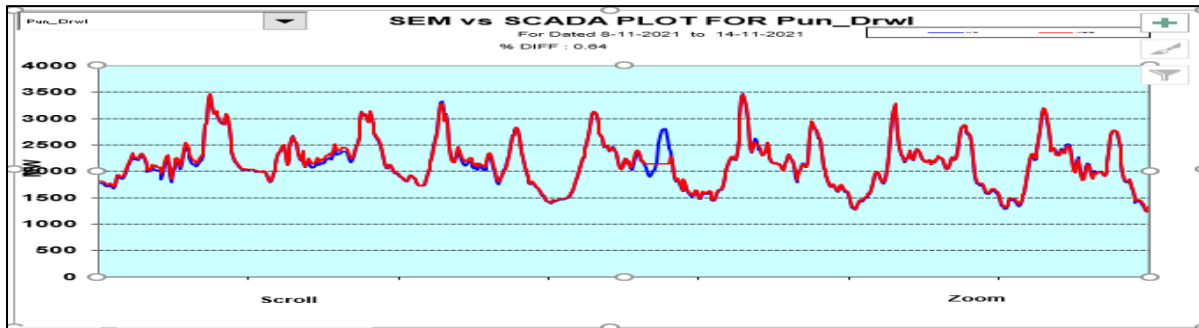
E. Outages due to low Demand										
SL. NO.	Station	Location	Owner	Unit No	Capacity	Reasons	Outage		Expected Revival Date	Remarks
							Date	Time		
STATE SECTOR										
1										
2										
3										
4										
TOTAL STATE SECTOR										
Total Outage (CS+SS):										

### ICCP Data Report

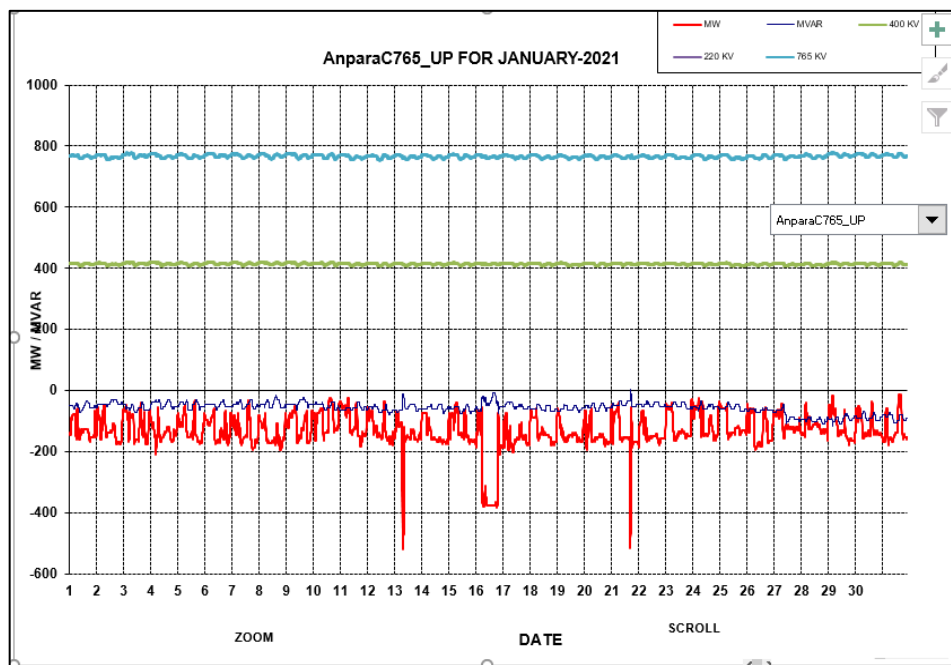
POWER SYSTEM OVERVIEW (Real-Time Database)	Show MW Data only	Show 220kV Volt	Show Units MW only	Show NR MW only	Show WR MW only	Show ER MW only	Show SR MW only	Show NER MW only	Show 400kV MW	Show 400kV Volt	Show 400kV Unit MW	Show 400kV NR MW	Show 400kV WR MW	Show 400kV ER MW	Show 400kV SR MW	Show 400kV NE MW	Show 400kV MVAR only	Show Freq. only	Show Units MVAR	Show NR MVAR only	Show WR MVAR only	Show ER MVAR only	Show SR MVAR only	Show NER MVAR only	Show 400kV MVAR	Show 400kV Freq.	Show 400kV Unit M	Show 400kV NR MVAR	Show 400kV WR MVAR	Show 400kV ER MVAR	Show 400kV SR MVAR	Show 400kV NER MVAR	Show 400kV MVAR
	Navigation...																																
	Substation	Device Type	Line Identification	Flow (MW/MVAR)	ID_Analog	Quality of Data			Division	Area	ICCP	Time																					
	D_THM_NT	LINE	F_D_THM_GNODA1	948.35 MW		✓	✓	✓	NRCS	NRCS	MLOAG	29-May-2012 1																					
SIPAT_CS	ZBR	G_SEON_SIPAT1	805.90 MW		✓	✓	✓	WRCS	WRCS	MLOAG	29-May-2012 1																						
SIPAT_CS	ZBR	G_SEON_SIPAT2	765.05 MW		✓	✓	✓	WRCS	WRCS	MLOAG	29-May-2012 1																						
RIHND_NT	LINE	F_RHNHV_RIHND1	731.74 MW		✓	✓	✓	NRCS	NRCS	MLOAG	29-May-2012 1																						
RHNHV_PG	LINE	F_RHNHV_DADHV1	664.05 MW		✓	✓	✓	NRCS	NRCS	MLOAG	29-May-2012 1																						
RHNHV_PG	LINE	F_RHNHV_DADHV2	662.70 MW		✓	✓	✓	NRCS	NRCS	MLOAG	29-May-2012 1																						
CHDPR_MS	ZBR	F_CHDPR_CHPSU1	648.00 MW		✓	✓	✓	MSEB	MSEB	MLOAG	29-May-2012 1																						
CHDPR_MS	ZBR	F_CHDPR_CHPSU2	644.00 MW		✓	✓	✓	MSEB	MSEB	MLOAG	29-May-2012 1																						
RAIFR_CS	LINE	F_BH40_RPR401	642.28 MW		✓	✓	✓	WRCS	WRCS	MLOAG	29-May-2012 1																						
NPTHA_NJ	LINE	F_NALAG_NPTHA1	601.78 MW		✓	✓	✓	NRCS	NRCS	MLOAG	29-May-2012 1																						
NPTHA_NJ	LINE	F_NALAG_NPTHA2	597.71 MW		✓	✓	✓	NRCS	NRCS	MLOAG	29-May-2012 1																						

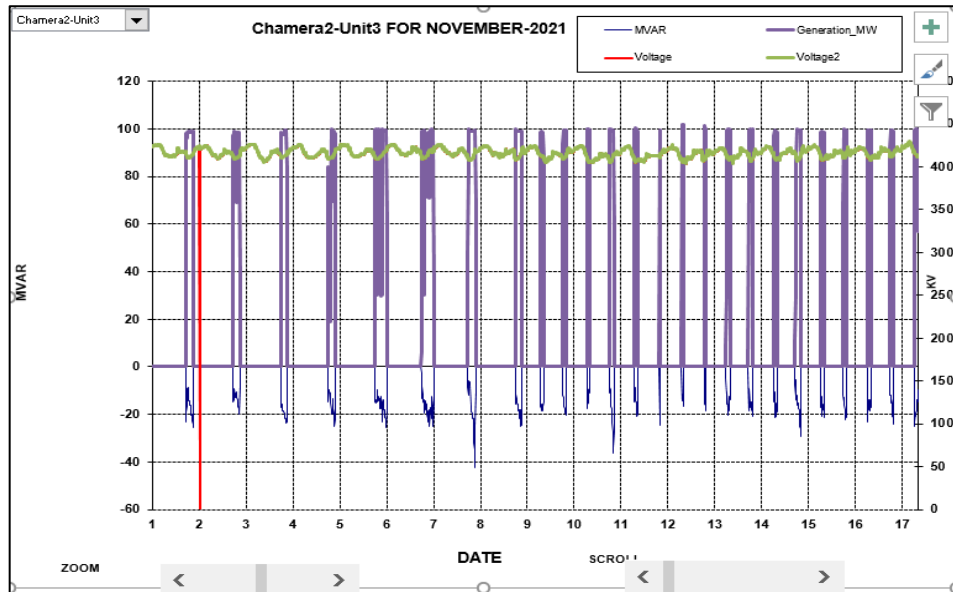
POWER SYSTEM OVERVIEW (Real-Time Database)	Show MW Data only	Show 220kV Volt	Show Units MW only	Show NR MW only	Show WR MW only	Show ER MW only	Show SR MW only	Show NER MW only	Show 400kV MW	Show 400kV Volt	Show 400kV Unit MW	Show 400kV NR MW	Show 400kV WR MW	Show 400kV ER MW	Show 400kV SR MW	Show 400kV NE MW	Show 400kV MVAR only	Show Freq. only	Show Units MVAR	Show NR MVAR only	Show WR MVAR only	Show ER MVAR only	Show SR MVAR only	Show NER MVAR only	Show 400kV MVAR	Show 400kV Freq.	Show 400kV Unit M	Show 400kV NR MVAR	Show 400kV WR MVAR	Show 400kV ER MVAR	Show 400kV SR MVAR	Show 400kV NER MVAR	Show 400kV MVAR
	Navigation...																																
	Substation	Device Type	Line Identification	Flow (MW/MVAR)	ID_Analog	Quality of Data			Division	Area	ICCP	Time																					
	D_THM_NT	LINE	F_D_THM_GNODA1	948.35 MW		✓	✓	✓	NRCS	NRCS	MLOAG	29-May-2012																					
SIPAT_CS	ZBR	G_SEON_SIPAT1	805.90 MW		✓	✓	✓	WRCS	WRCS	MLOAG	29-May-2012																						
SIPAT_CS	ZBR	G_SEON_SIPAT2	765.05 MW		✓	✓	✓	WRCS	WRCS	MLOAG	29-May-2012																						
RIHND_NT	LINE	F_RHNHV_RIHND1	731.74 MW		✓	✓	✓	NRCS	NRCS	MLOAG	29-May-2012																						
RHNHV_PG	LINE	F_RHNHV_DADHV1	664.05 MW		✓	✓	✓	NRCS	NRCS	MLOAG	29-May-2012																						
RHNHV_PG	LINE	F_RHNHV_DADHV2	662.70 MW		✓	✓	✓	NRCS	NRCS	MLOAG	29-May-2012																						
CHDPR_MS	ZBR	F_CHDPR_CHPSU1	648.00 MW		✓	✓	✓	MSEB	MSEB	MLOAG	29-May-2012																						
CHDPR_MS	ZBR	F_CHDPR_CHPSU2	644.00 MW		✓	✓	✓	MSEB	MSEB	MLOAG	29-May-2012																						
RAIFR_CS	LINE	F_BH40_RPR401	642.28 MW		✓	✓	✓	WRCS	WRCS	MLOAG	29-May-2012																						
NPTHA_NJ	LINE	F_NALAG_NPTHA1	601.78 MW		✓	✓	✓	NRCS	NRCS	MLOAG	29-May-2012																						
NPTHA_NJ	LINE	F_NALAG_NPTHA2	597.71 MW		✓	✓	✓	NRCS	NRCS	MLOAG	29-May-2012																						

### B3. (B) SCADA/ SEM Report

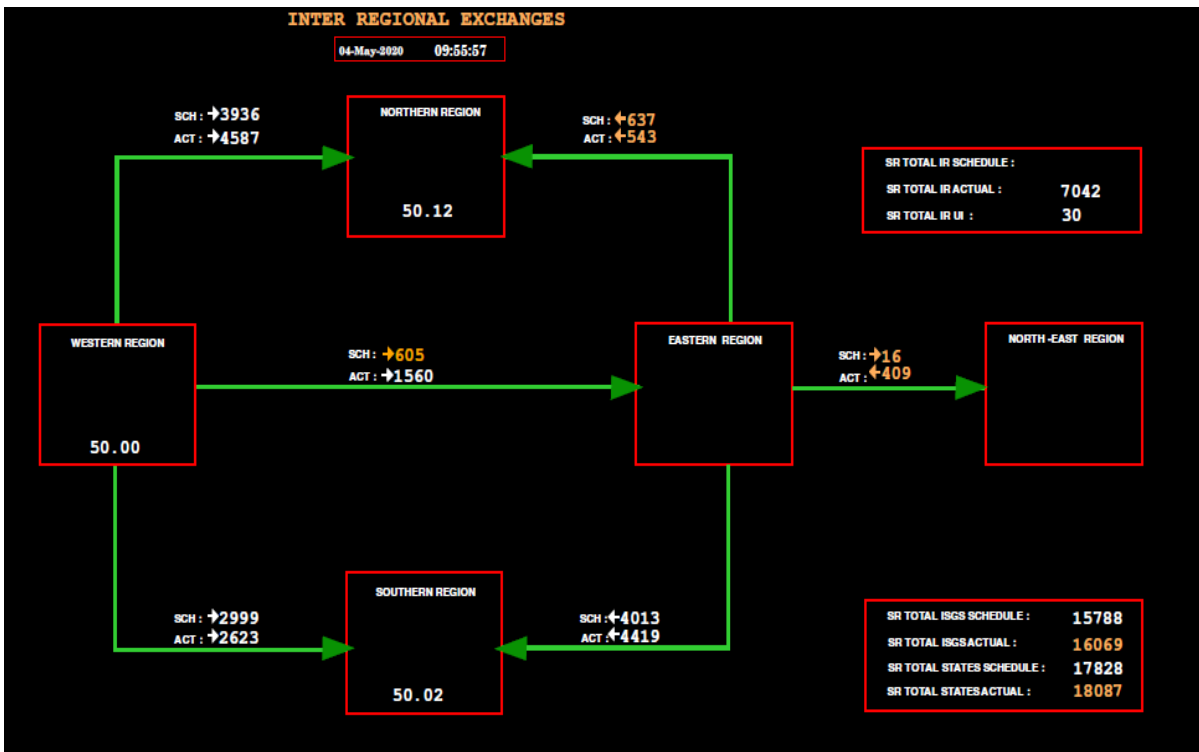


### B3. (C) Generating Unit wise Reports



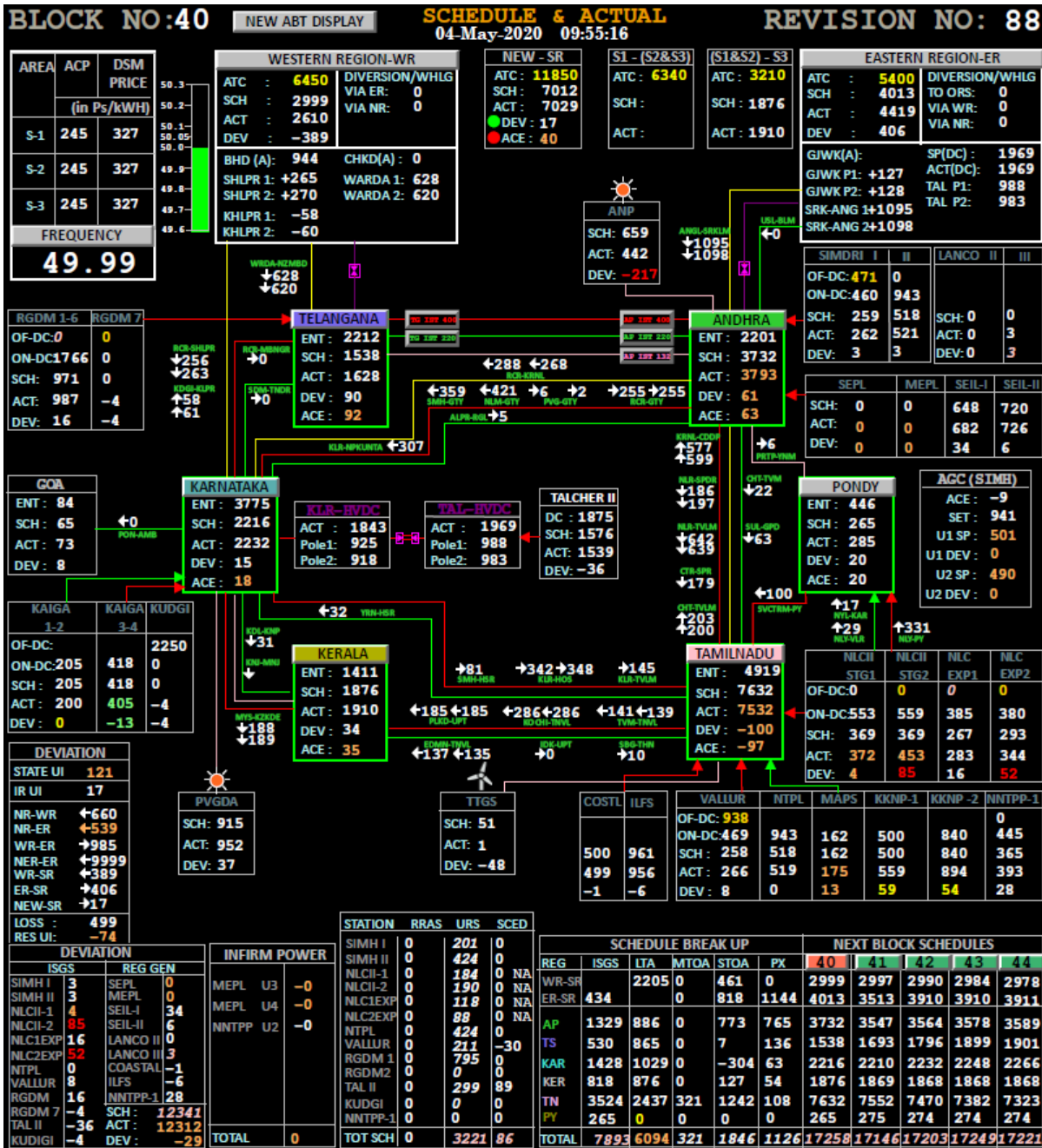


### B4. Inter Area Exchange Display





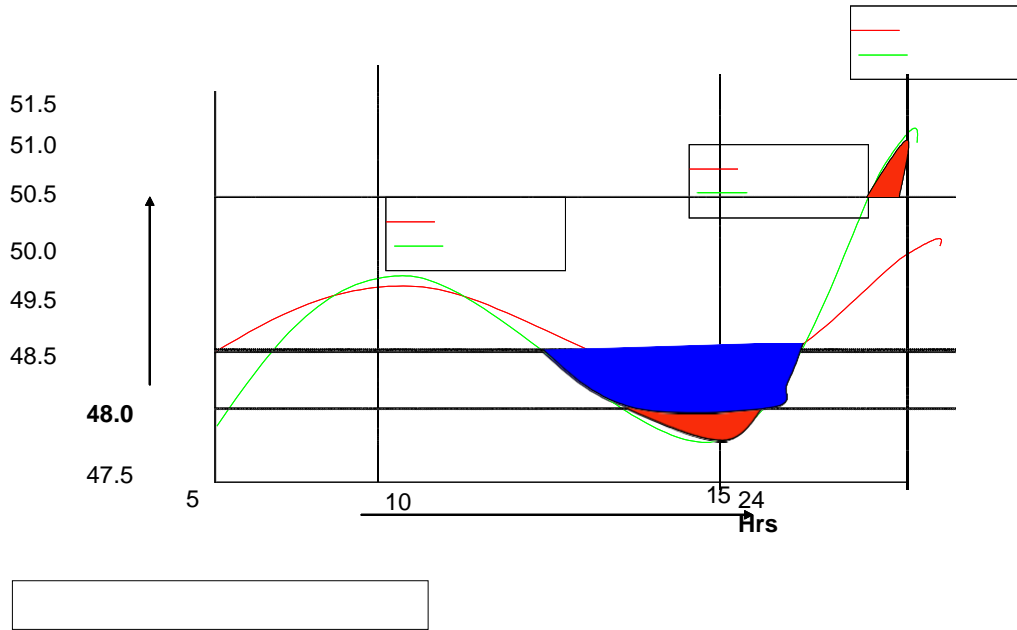
B5. Typical Inter-regional Links Display for a pair of state



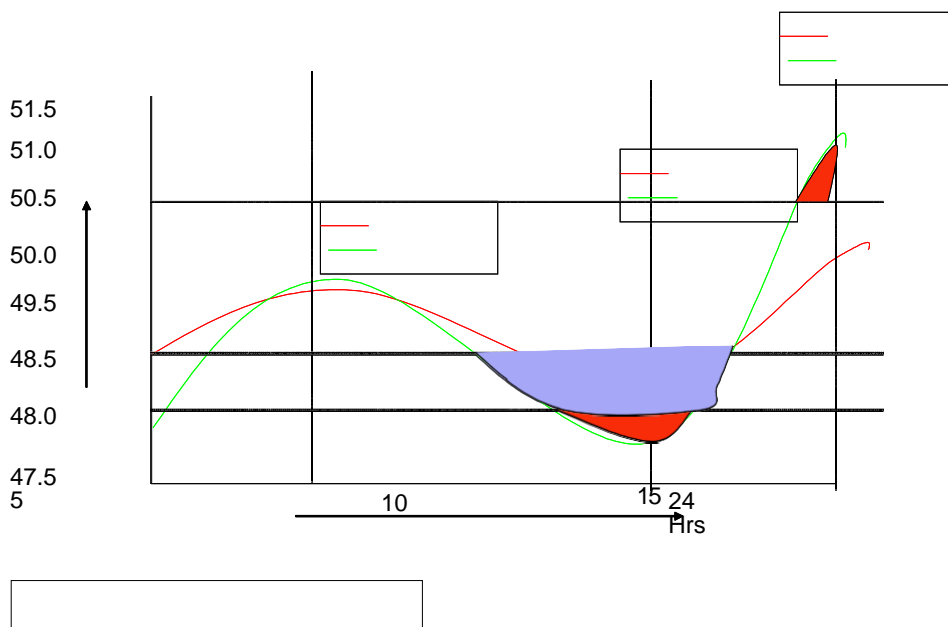


### B6. Sample Trend Displays

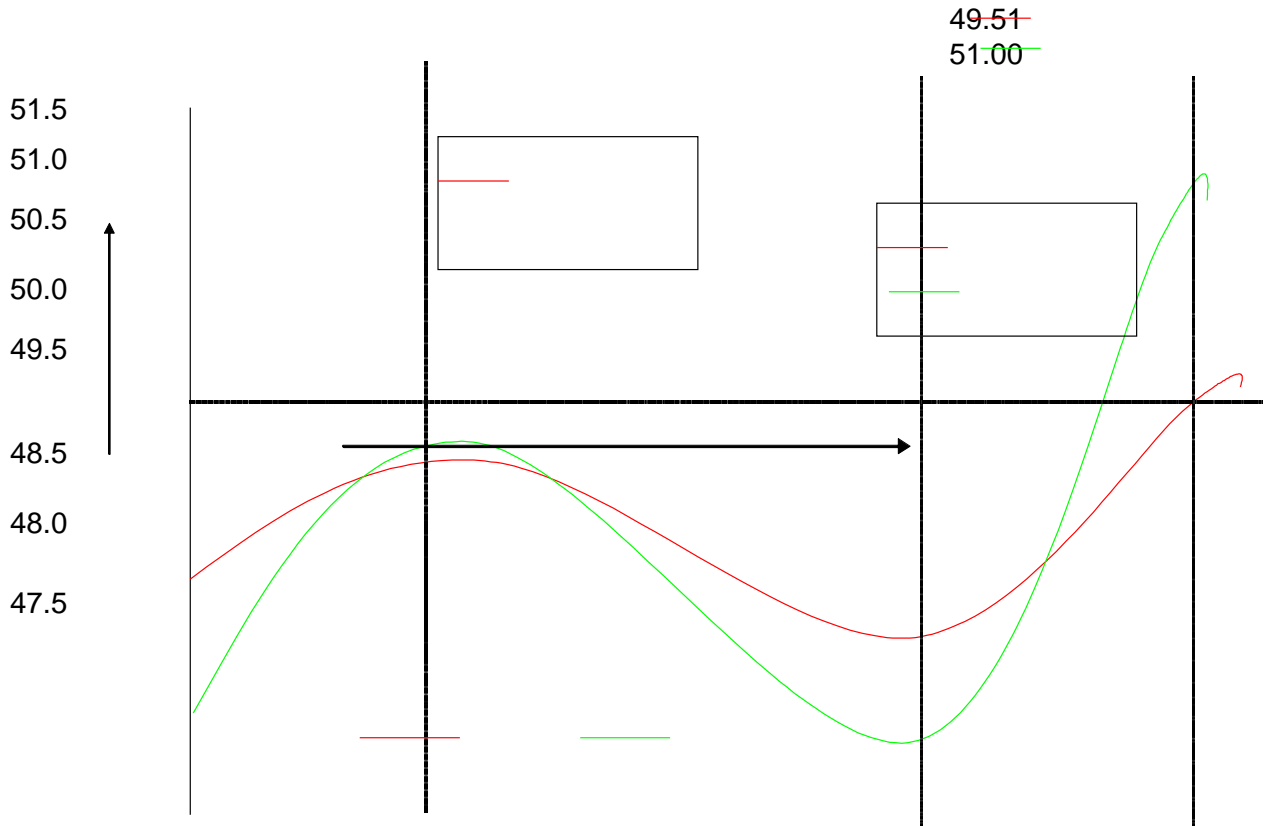
#### (A) Frequency Chart with past day



#### (B) Trend of Frequency of two regions

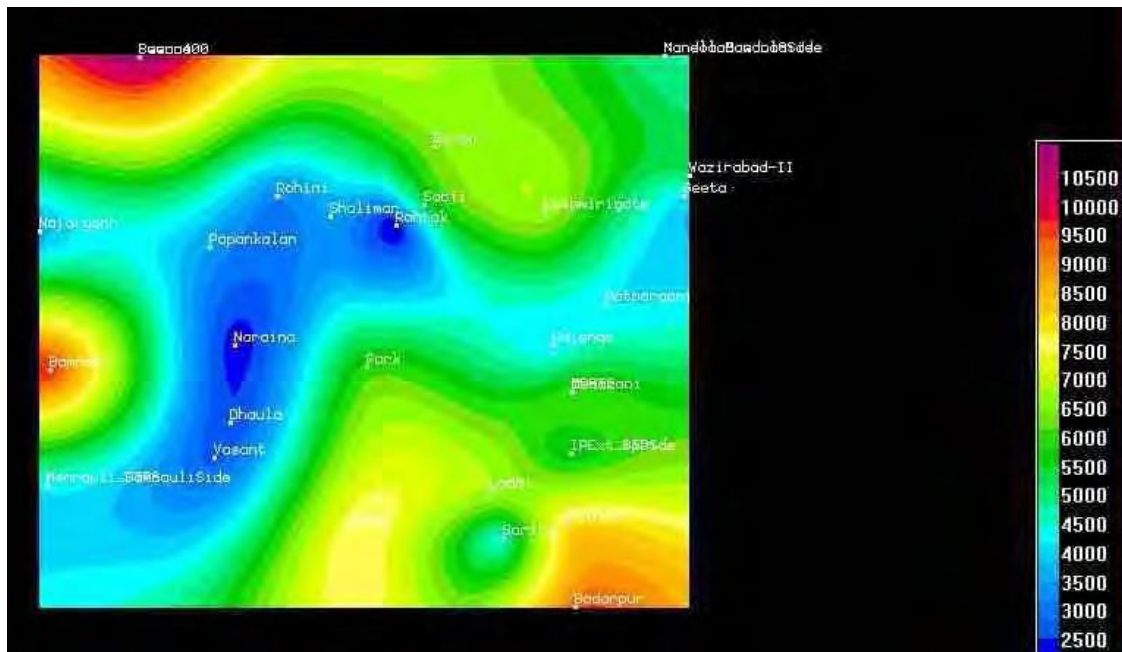
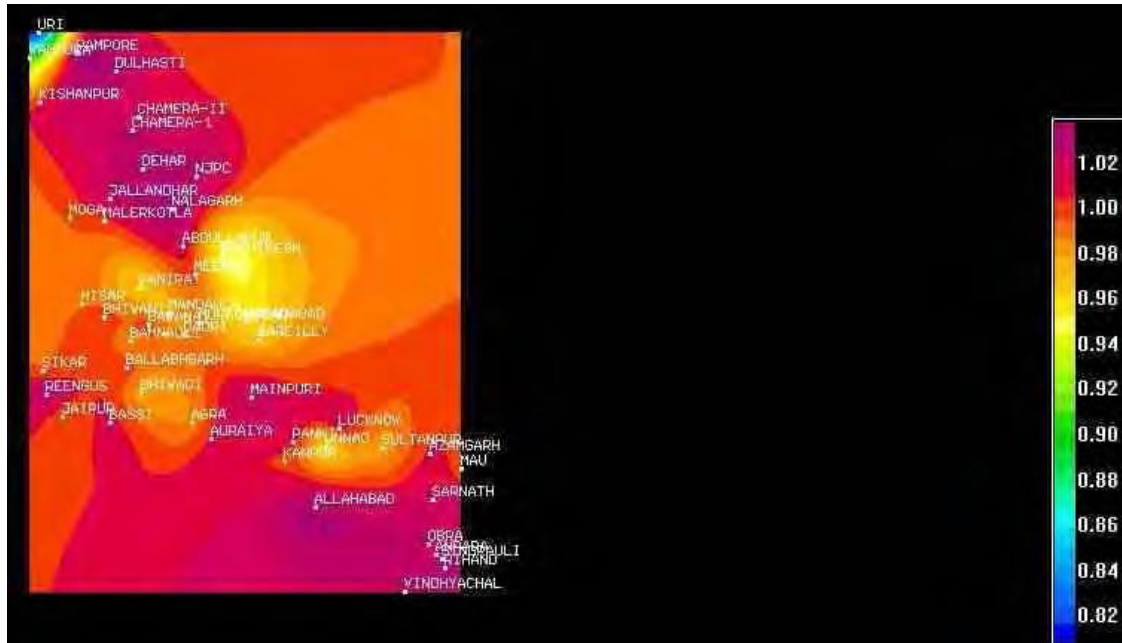


**(C). Trend of Frequency of two regions**

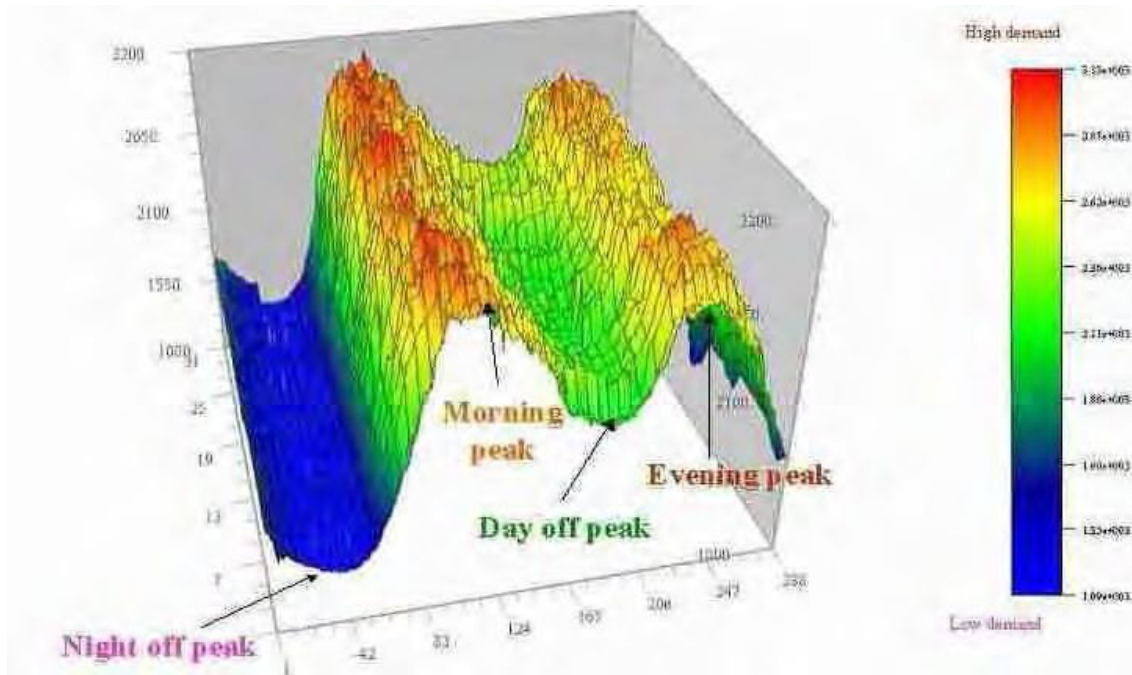


# Situational Awareness Alarms:

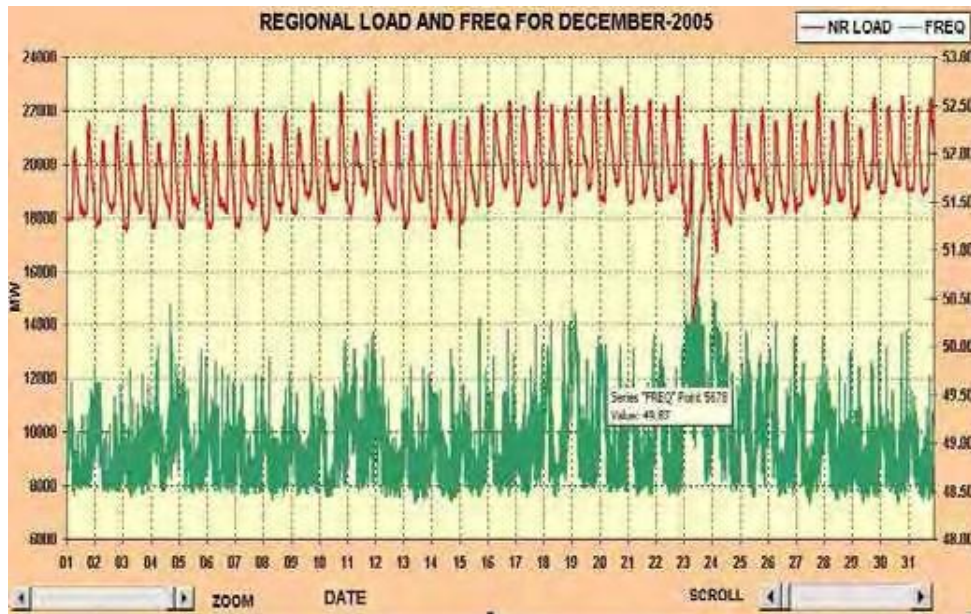
## B7. Sample Contour Display



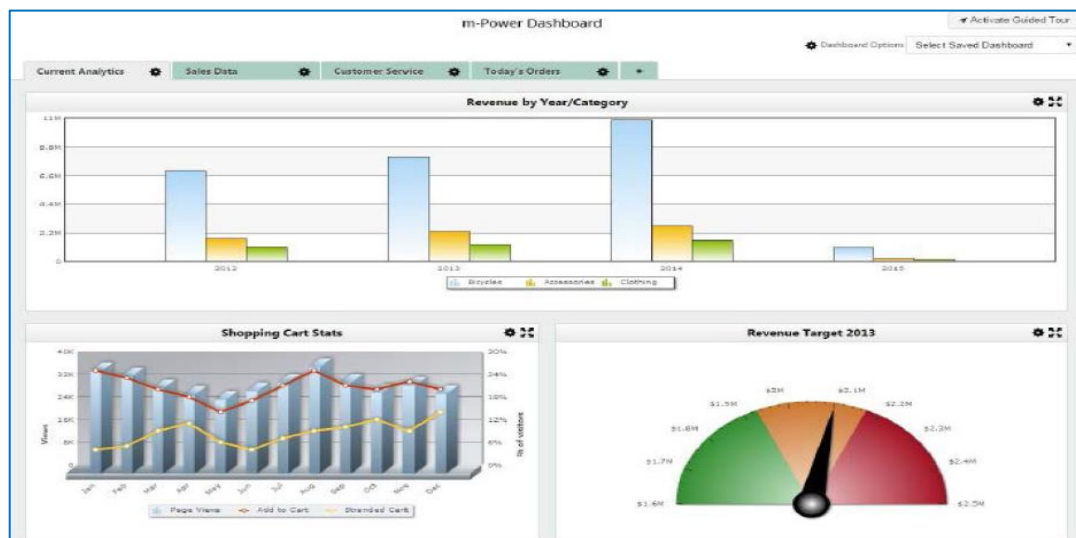
### B8. Sample Three-Dimensional Display



### B9. Sample Zooming and Panning on the Trend

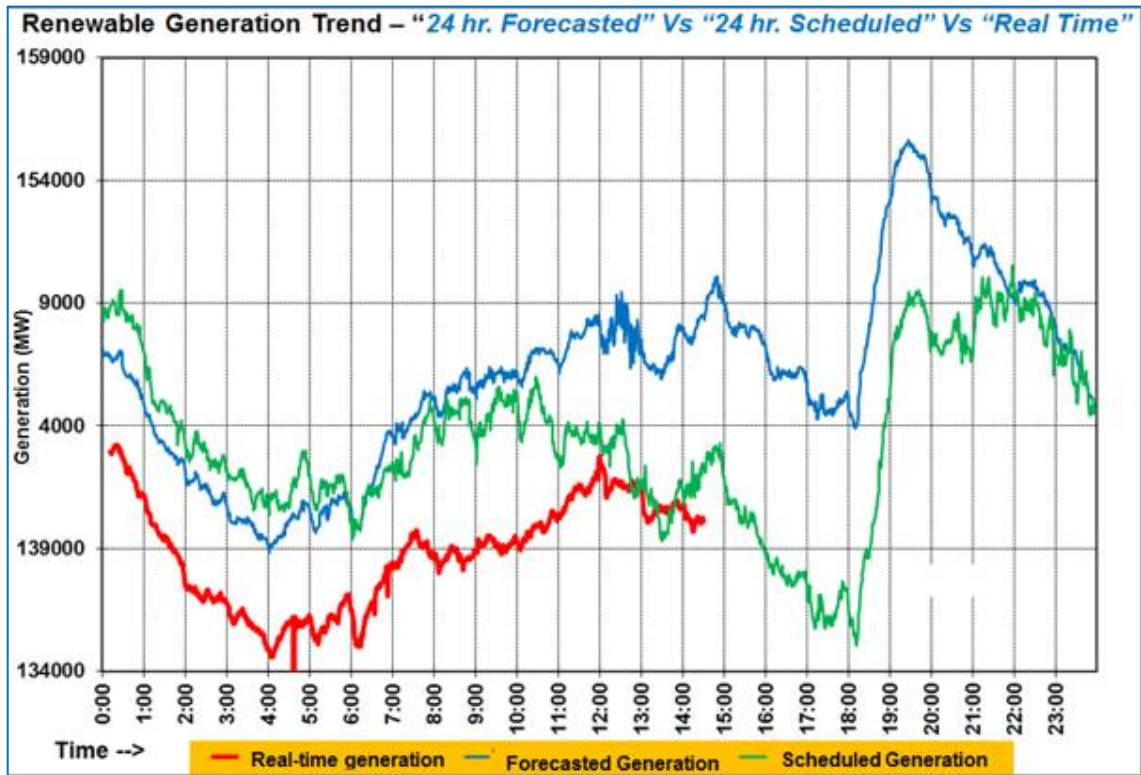


### B10. Dynamic Dashboard

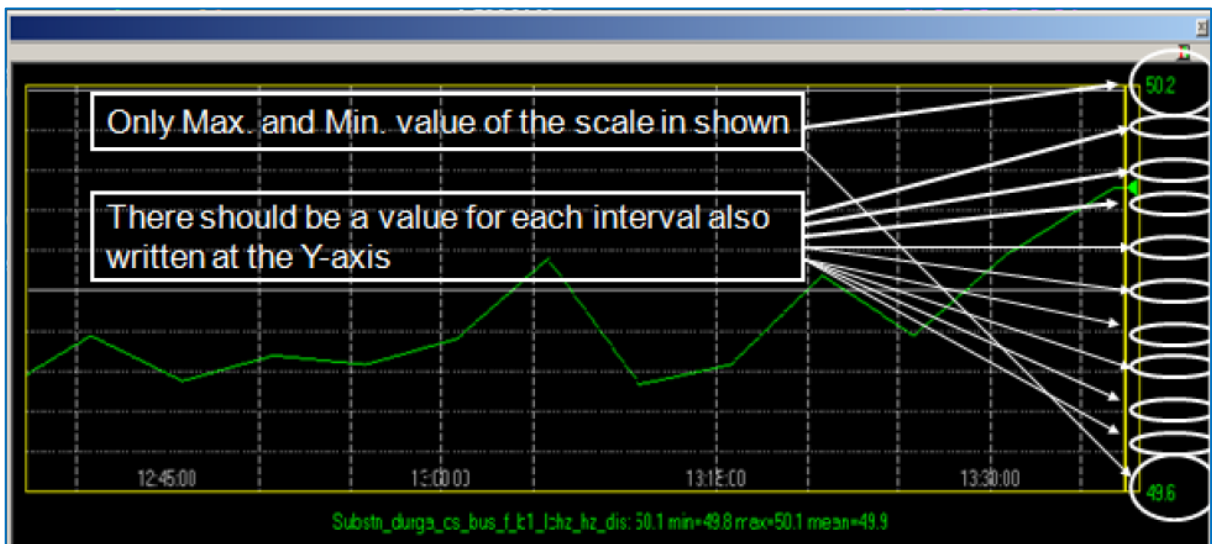




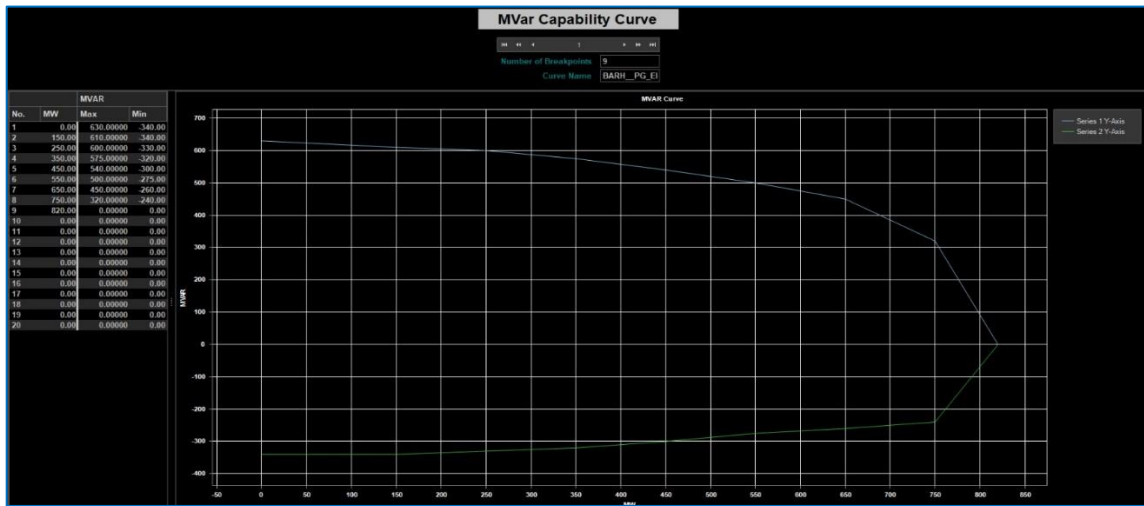
**B11. Real Time vs. Forecasted vs. Scheduled data**



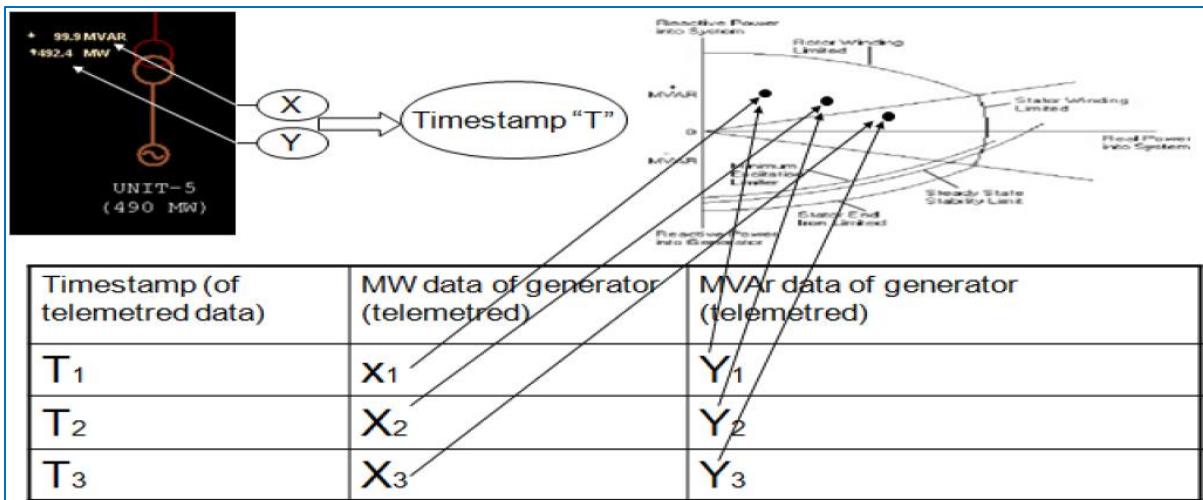
**B12. Value on Axis for each Interval**



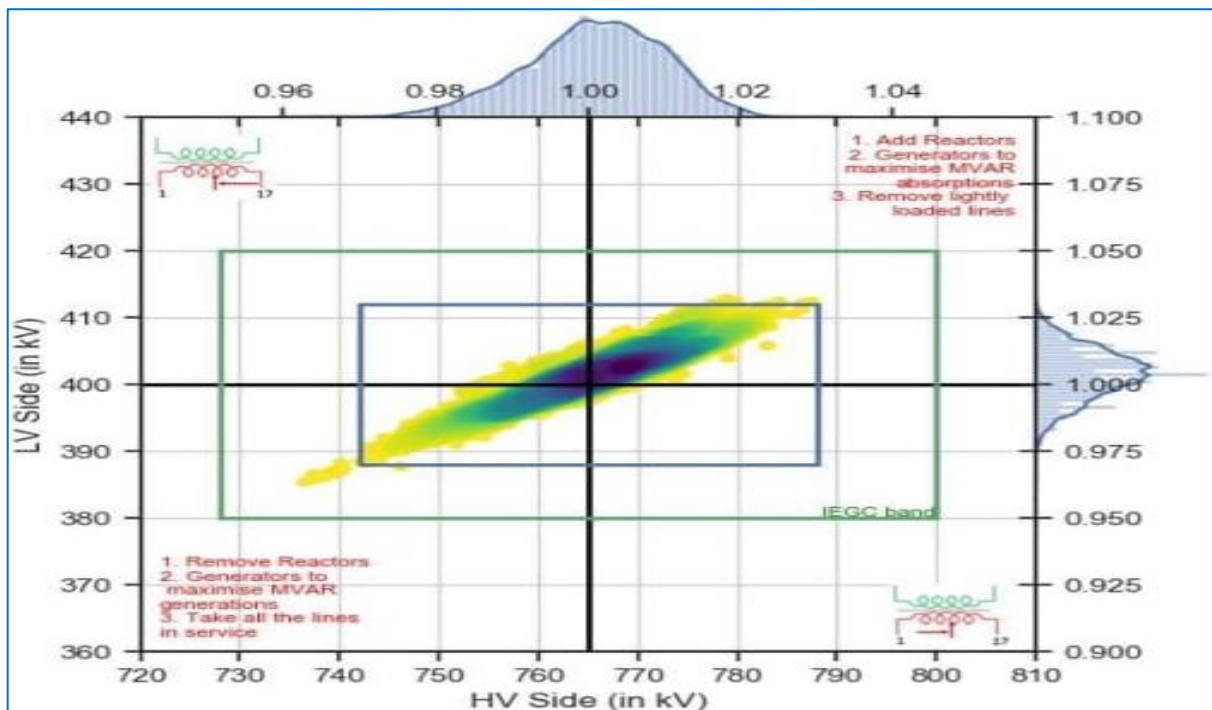
### B13. Generator Capability Curve Displays



### B14. Generator Capability Curve with P,Q Operating Point

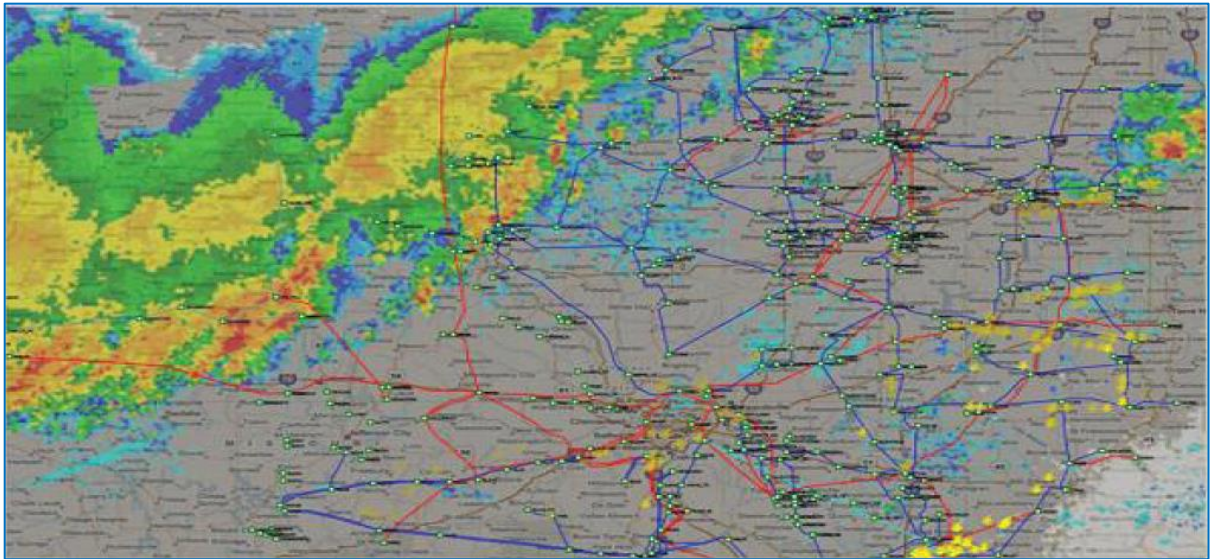


**B15. Real-time data trail on operating curves/quadrant of special power system devices**

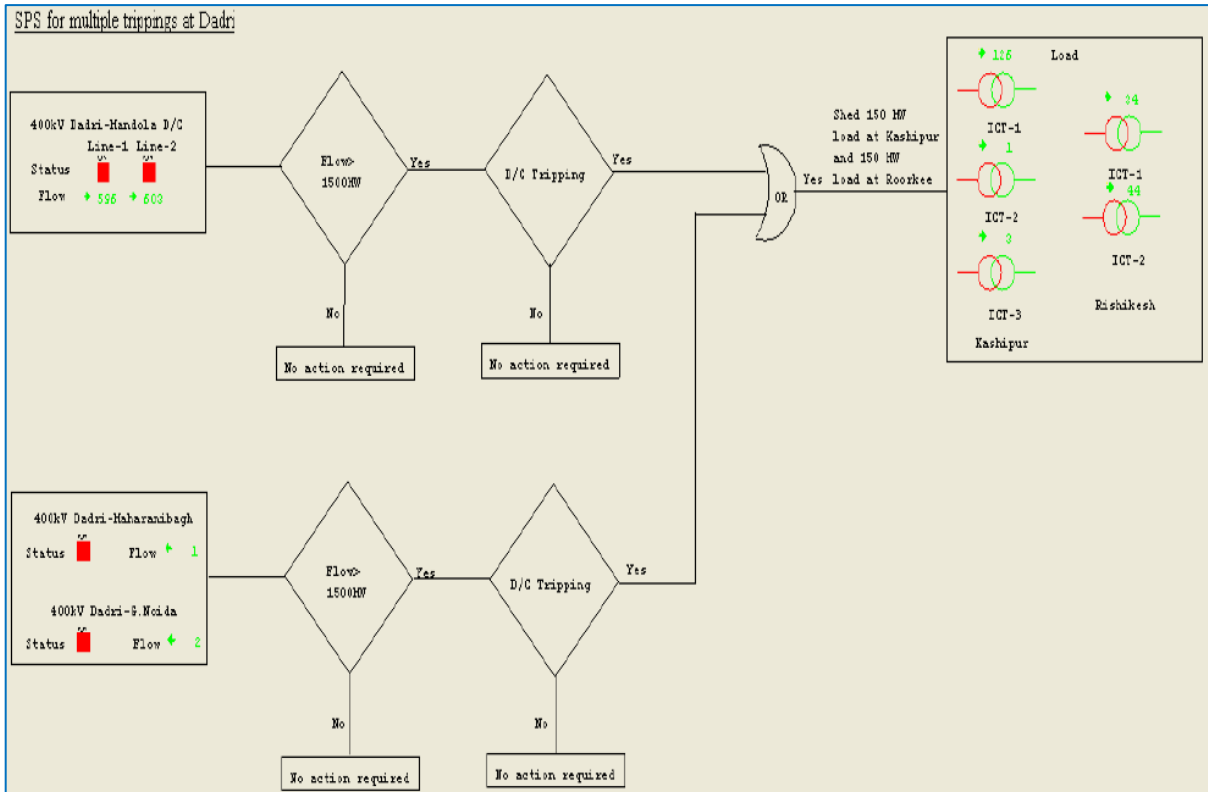




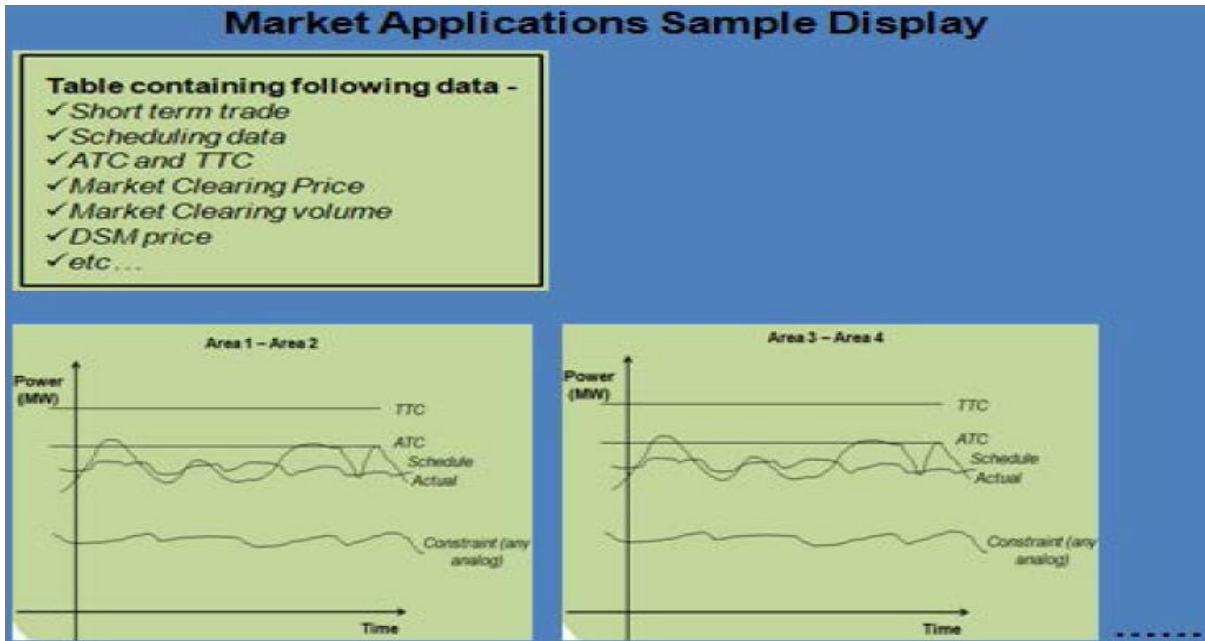
### B16. Weather data on Geographical map display



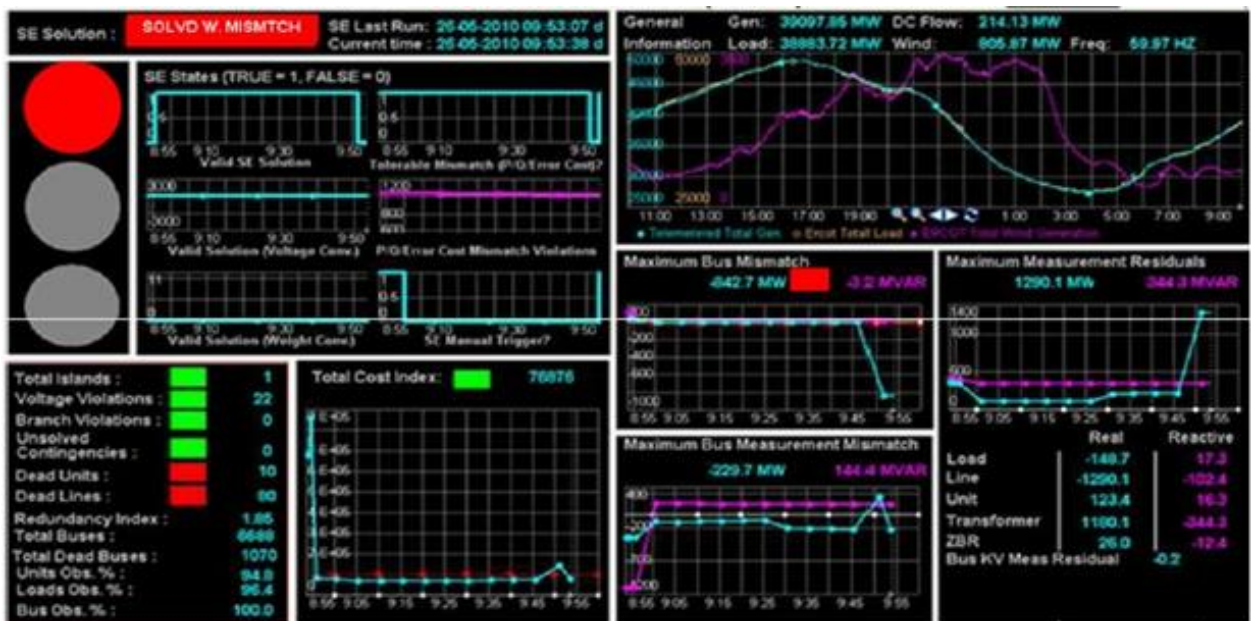
### B17. SPS display



### B18. Market Applications Display



### B19. State Estimator Dashboard Tool





### Re-Initialize SE parameter After few Iterations

The screenshot shows the 'Initial State Estimation Conditions' window. Key settings include:

- Iteration type:** Factor
- Reset STDEV and Bias:** Date/Time of Reset: 08-May-2013 13:22. Checked for Analog Measurement, Transformer Tap, Load Area Model, and Voltage Regulation.
- Suppress SE Alarming or violations Alarmed by Scada:** Checked.
- Enable External Regulation:** Unit Type-Switching, Voltage Tap, Phase-Shifting Tap, and Capacitor/Reactor are unchecked.
- Enable Quality code copy to SCADA:** Unchecked.
- Initialize Coldinit and other flags:** after 2 SE runs: 1.

Callouts explain:

- Flags getting set as per the Re-initialization settings required for SE:** Points to the 'Reset STDEV and Bias' section.
- Flag triggering initializing function:** Points to the 'Suppress SE Alarming' checkbox.
- Number of SE runs:** Points to the 'after 2 SE runs: 1' field.

### Bus Symbolic View – EMS Applications

The screenshot displays the 'Bus Symbolic View' for station D\_THM\_NT NRCS. It shows a central bus (3213) with various measurements and connections to other buses.

Callouts explain:

- Station ID and Area:** Points to 'D\_THM\_NT NRCS'.
- Bus Number:** Points to 'Bus: 3213'.
- Island Number:** Points to 'Island: 1'.
- Estimated and Measured voltage of bus (as value):** Points to '384.7 KV' and '396.8 KV'.
- Estimated and Measured voltage of bus (as per unit):** Points to '0.962 PU' and '0.992 PU'.
- Estimated Angle of the bus:** Points to '36.1 DEG'.
- Provision to "Remove" and "Restore":** Points to the 'Remove' and 'Restore' buttons.
- Total station Generation and Load:** Points to 'Station Total Generation: 629.3 MW 288.1 MVAR' and 'Load: -1840.8 MW 384.8 MVAR'.
- Observability status of the bus:** Points to the 'Remove' button.
- Link to the position in other station bus "summary diagram":** Points to the 'To Station:' field.
- Estimated and measured value with direction indication:** Points to the MW/MR arrows.
- Device name:** Points to the device name (e.g., F\_D\_THM\_DADHV2).
- Measurement in "white" colour if the quality is "suspect":** Points to the white text of the measurement.
- Different generator bus in the same station view in case of explicit modeling:** Points to the 'Unit F\_G5' and 'Unit F\_G6' sections.

### User Calculation feature for SE data

Function: **SR\_UI\_N** Is: **Enabled** Selected by Client: \_\_\_\_\_  
 Period: **2** (seconds) USERCALC status: **RUNNING**  
 Start: \_\_\_\_\_ Next run time: **29-May-2012 12:24:47**  
 Stop: **30-Apr-2010 10:00:23**  
 Message: \_\_\_\_\_

Select box to insert first VARIABLE Record      Select box to insert first LINE FORMULA Record      [Clear Calculation](#)

Variable Name	Type	Source	Record R Index	SCADAMOM Substn ID	Point / Analog Reference Devtype ID	Device ID	ID	Value	Validity
FREQ			( 33995 )	SMMHL_CS	BUS	F_B1	HZ	49.6018	Valid
A1			( 0 )					4960.1821	Valid
A2			( 0 )					4962.0000	Valid
A3			( 0 )					49.6200	Valid
UI			( 62932 )	REP_NLDC	UI	SR_UI_RATE	MW	591.0000	Valid

```

IF (FREQ.LT.49.50)THEN
UI=873
ELSEIF (FREQ.EQ.49.50)THEN
UI=826
ELSEIF((FREQ.GT.49.50).AND.(FREQ.LT.49.70))THEN
A1=FREQ*100
    
```

### Transmission-Corridor Capability Monitoring (TCM)

**Study TCM**

Data Retrieval... **STCA** **STUDY** **COMPLETE**

Process Status: **COMPLETE** [Start Process](#) [Stop Process](#) [Input Setup...](#)

Last Result: **No Violations** User Abort:  Abort TTC/ATC Iterationst:  [Study Results](#)

Time of Study: **12-Aug-2015 10:31:32** Time of Last Execution: **02-Feb-2017 12:47:30**

Status: Creating Base savecas with title:TCM\_0\_BC, Please wait...

**1. Initialize TCM Study**

[INITIALIZE TCM for new study](#)

1. Clear TCM Summary
2. Clear TTC Iterations
3. Disable all CTG Groups
4. Disabel all USETCM\_LDAREA
5. Disable all MANUAL\_LDAREA
6. Update/Clear TCM Interface

**2. Prepare Base Case**

[Disable CTG Groups](#) [Enable CTG Groups](#)

[\(Unit AGC Control\)](#) [\(CTG Group Activation Display\)](#)

[Run Powerflow / CA](#)

No. of Violations: 0 [\(Violations Display\)](#)

No. of Hrm/Uns CTGs: 0 / 0 [\(CTG Results Display\)](#)

[Create Savecase \(Base Case\)](#)

**Summaries**

[\(TCM Interface Tabular Display\)](#)

1. Observe the current Interface Flows
2. Basecase / TTC / ATC Flows
3. Update / Edit the Interface Lines

[\(TCM Summary Display\)](#)

1. Observe UTC, TTC, ATC, and RM

**3. TTC Study**

[\(LOAD AREAS Display\)](#)

1. Select Load Areas for Update in TCM
2. Give Large and Small % Step

UTC MW:

[Run TTC Iterations](#)

1. Enable all CTG Groups
2. Run TTC Iterations

[\(TTC Iteration Display\)](#)

TTC MW:

[Create Savecase \(TTC\)](#)

**4. RM and ATC**

RM MW:

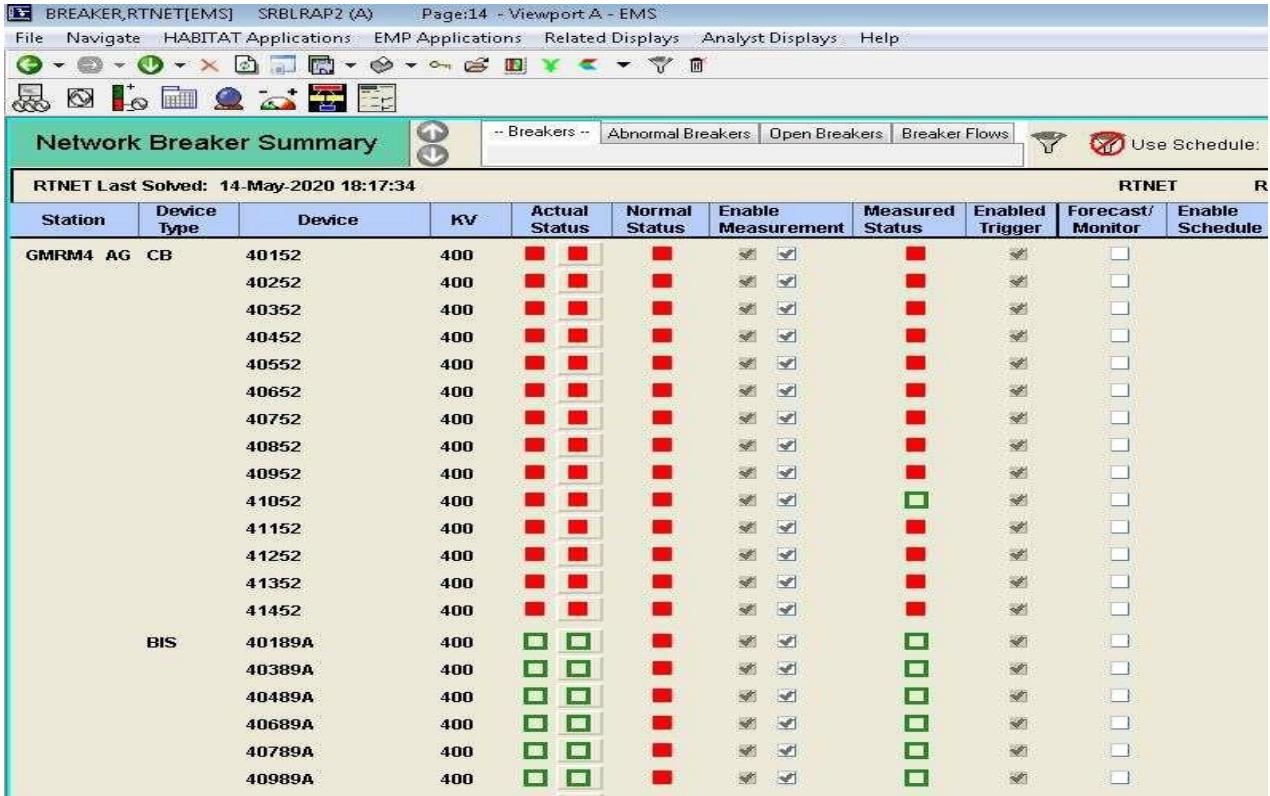
[Calculate ATC](#)

ATC = TTC - RM

ATC MW:

[Create Savecase \(ATC\)](#)

**Comparison of Breaker Status – “SCADA Status taken in SE” Vs “Status Output of SE after Topology Processing” in EMS**  
**Network Breaker Summary:**



The screenshot shows the 'Network Breaker Summary' window in an EMS application. The window title is 'BREAKER, RTNET[EMS] SRBLRAP2 (A) Page:14 - Viewport A - EMS'. The interface includes a menu bar (File, Navigate, HABITAT Applications, EMP Applications, Related Displays, Analyst Displays, Help) and a toolbar. Below the toolbar, there are tabs for 'Breakers', 'Abnormal Breakers', 'Open Breakers', and 'Breaker Flows'. A 'Use Schedule' checkbox is also present. The main data area shows 'RTNET Last Solved: 14-May-2020 18:17:34' and a table of breaker data.

Station	Device Type	Device	KV	Actual Status	Normal Status	Enable Measurement	Measured Status	Enabled Trigger	Forecast/Monitor	Enable Schedule
GMRM4	AG CB	40152	400	■ ■	■	✓ ✓	■	✓	□	
		40252	400	■ ■	■	✓ ✓	■	✓	□	
		40352	400	■ ■	■	✓ ✓	■	✓	□	
		40452	400	■ ■	■	✓ ✓	■	✓	□	
		40552	400	■ ■	■	✓ ✓	■	✓	□	
		40652	400	■ ■	■	✓ ✓	■	✓	□	
		40752	400	■ ■	■	✓ ✓	■	✓	□	
		40852	400	■ ■	■	✓ ✓	■	✓	□	
		40952	400	■ ■	■	✓ ✓	■	✓	□	
		41052	400	■ ■	■	✓ ✓	□	✓	□	
		41152	400	■ ■	■	✓ ✓	■	✓	□	
		41252	400	■ ■	■	✓ ✓	■	✓	□	
		41352	400	■ ■	■	✓ ✓	■	✓	□	
		41452	400	■ ■	■	✓ ✓	■	✓	□	
		BIS		40189A	400	□ □	■	✓ ✓	□	✓
40389A	400			□ □	■	✓ ✓	□	✓	□	
40489A	400			□ □	■	✓ ✓	□	✓	□	
40689A	400			□ □	■	✓ ✓	□	✓	□	
40789A	400			□ □	■	✓ ✓	□	✓	□	
		40989A	400	□ □	■	✓ ✓	□	✓	□	

**Telemetered Network Data:**



TELEMETERED\_STATUS, RTNET[EMS] SRBLRAP2(A) Page: 133 - Viewport A - EMS

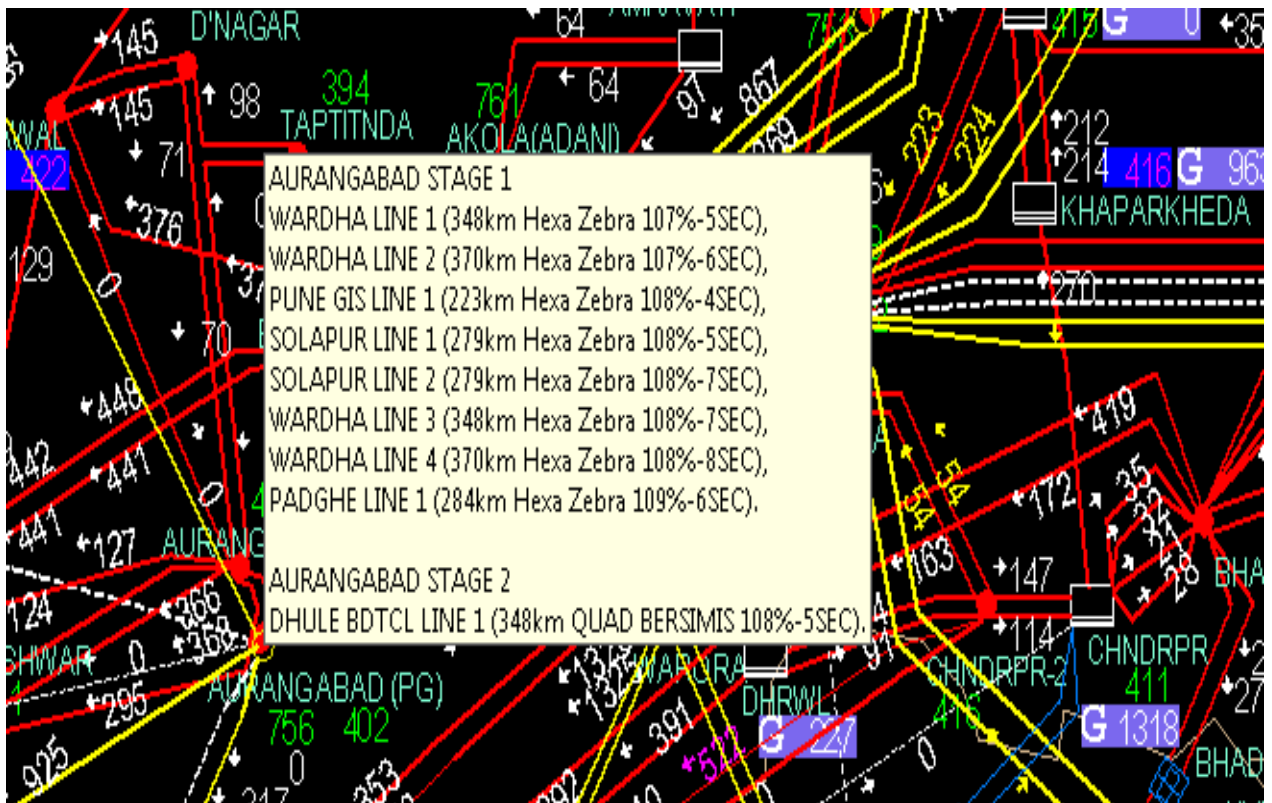
File Navigate HABITAT Applications EMP Applications Related Displays Analyst Displays Help

Telemetered Network Data By Station Sorted/Filtered Anomalous Special --Status-- Summed Measurement

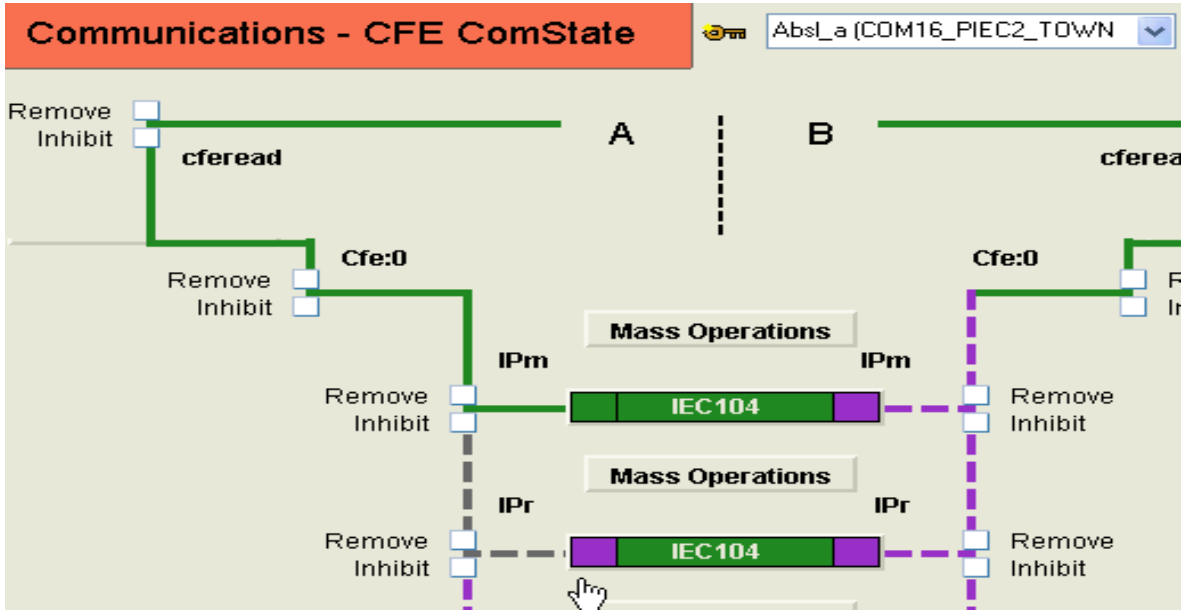
Last Solved: 14-May-2020 18:17:34 --CB-- Non-CB Enable All Stations RTNET REALTIME SOLVD W. MI

Device Type	Device Name	SCADA Stat ID	Availability Status	Estimated Status	Open Enable	SCADA Status	Enable	Data Quality
SRPDR_PG							<input checked="" type="checkbox"/>	Enable PMU Measurements ST: <input type="checkbox"/>
CB	40152	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
CB	40252	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
CB	40352	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
CB	40452	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
CB	40552	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
CB	40652	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
CB	40652R	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
CB	40752	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
CB	40852	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
CB	40952	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
CB	40952R	STTS	Available	<span style="color:green">■</span> <span style="color:green">■</span>	<input checked="" type="checkbox"/>	<span style="color:green">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
CB	41052	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
CB	41152	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
BIS	40189	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
BIS	40389	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
BIS	40489	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
BIS	40689	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
BIS	40789	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
BIS	40989	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
BIS	41089A	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
BIS	41089B	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ
BIS	41189	STTS	Available	<span style="color:red">■</span> <span style="color:red">■</span>	<input checked="" type="checkbox"/>	<span style="color:red">■</span>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Good ⓘ

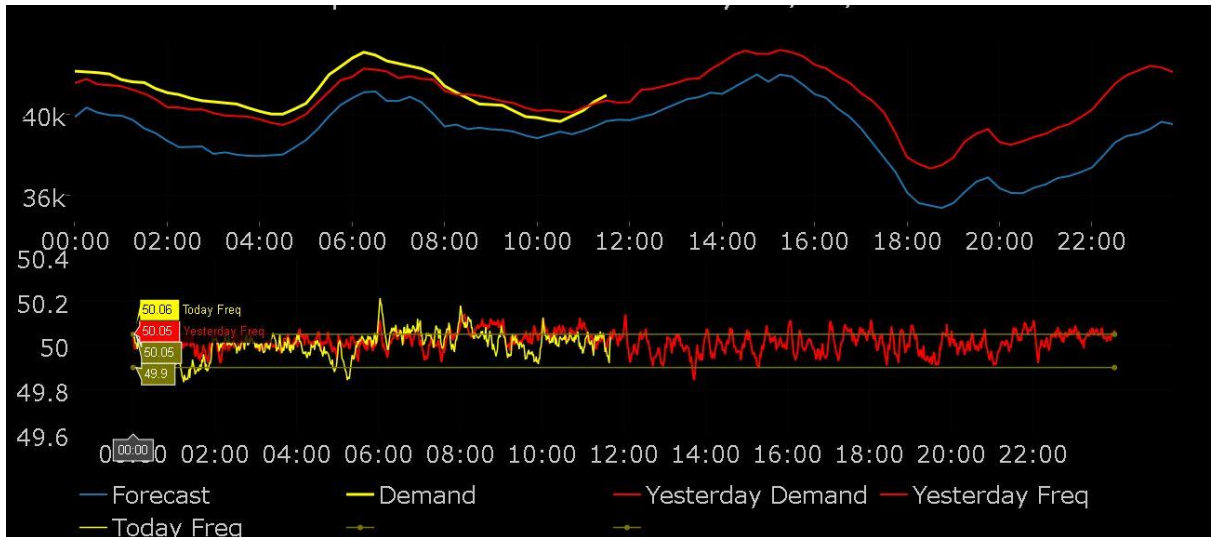
### B20. Tool Tip Facility



**B21. RTU Communication Diagram**



**B22: Trending of Forecast, Previous day and Current day display**

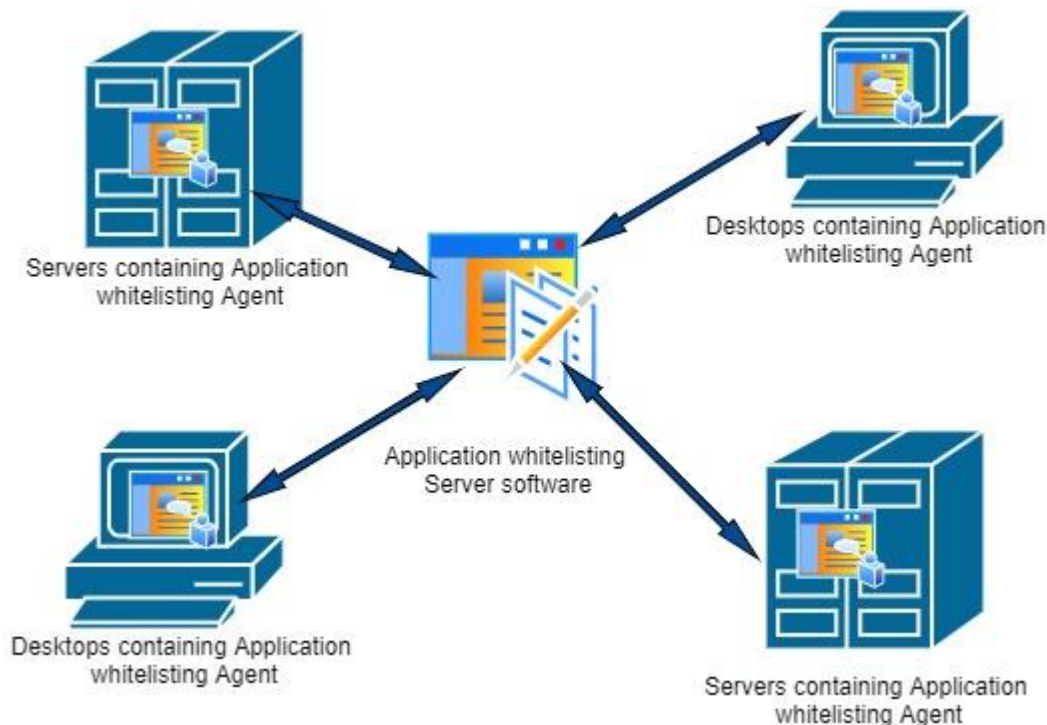


### B23. Comparison of Breaker Status – “SCADA Status taken in SE” Vs “Status Output of SE after Topology Processing” in EMS

#### Network Breaker Summary:

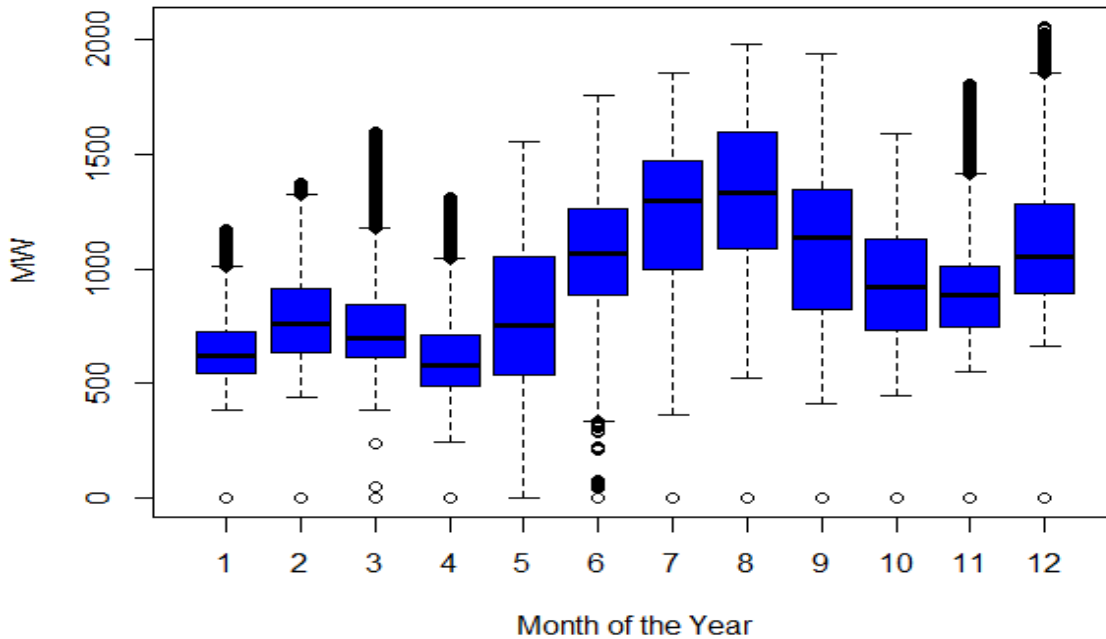
Breaker Record	Name	Type	Status	Telemetered Status	Disable Status Meas	From Region	From Station	From Energization	From Voltage Class	From Voltage	From Angle	To Region	To Station	To Energization	To Voltage Class	To Voltage	To Angle
1	40789A BIS	Switch	CLOSED	CLOSED	YES	NR	BGLHR_JK	OUTAGED	400	0	0	NR	BGLHR_JK	OUTAGED	400	0	0
2	22289A BIS	Switch	CLOSED	OPEN	YES	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
3	22289B BIS	Switch	CLOSED	CLOSED	YES	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
4	22252 CB	Breaker	CLOSED	CLOSED	NO	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
5	22289L LIS	Switch	CLOSED	CLOSED	YES	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
6	22289C BIS	Switch	CLOSED	OPEN	YES	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
7	22189A BIS	Switch	CLOSED	CLOSED	YES	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
8	22189B BIS	Switch	CLOSED	OPEN	YES	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
9	22152 CB	Breaker	CLOSED	CLOSED	NO	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
10	22189L LIS	Switch	CLOSED	CLOSED	YES	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
11	22189C BIS	Switch	CLOSED	OPEN	YES	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
12	22089A BIS	Switch	CLOSED	OPEN	YES	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
13	22089B BIS	Switch	CLOSED	CLOSED	YES	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
14	22052 CB	Breaker	CLOSED	CLOSED	NO	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
15	22089L LIS	Switch	CLOSED	CLOSED	YES	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
16	22089C BIS	Switch	CLOSED	OPEN	YES	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
17	21989A BIS	Switch	CLOSED	CLOSED	YES	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
18	21989B BIS	Switch	CLOSED	OPEN	YES	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
19	21952 CB	Breaker	CLOSED	CLOSED	NO	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
20	21989L LIS	Switch	CLOSED	CLOSED	YES	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
21	21989C BIS	Switch	CLOSED	OPEN	YES	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
22	21789A BIS	Switch	CLOSED	OPEN	YES	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
23	21789B BIS	Switch	CLOSED	OPEN	YES	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08
24	21752 CB	Breaker	OPEN	OPEN	NO	NR	UNCH1_NT	ENERGIZED	220	225.12	-13.08	NR	UNCH1_NT	OPEN-ENDED	220	225.12	-13.08

### B24: Generic Architecture of Application Whitelisting Tool





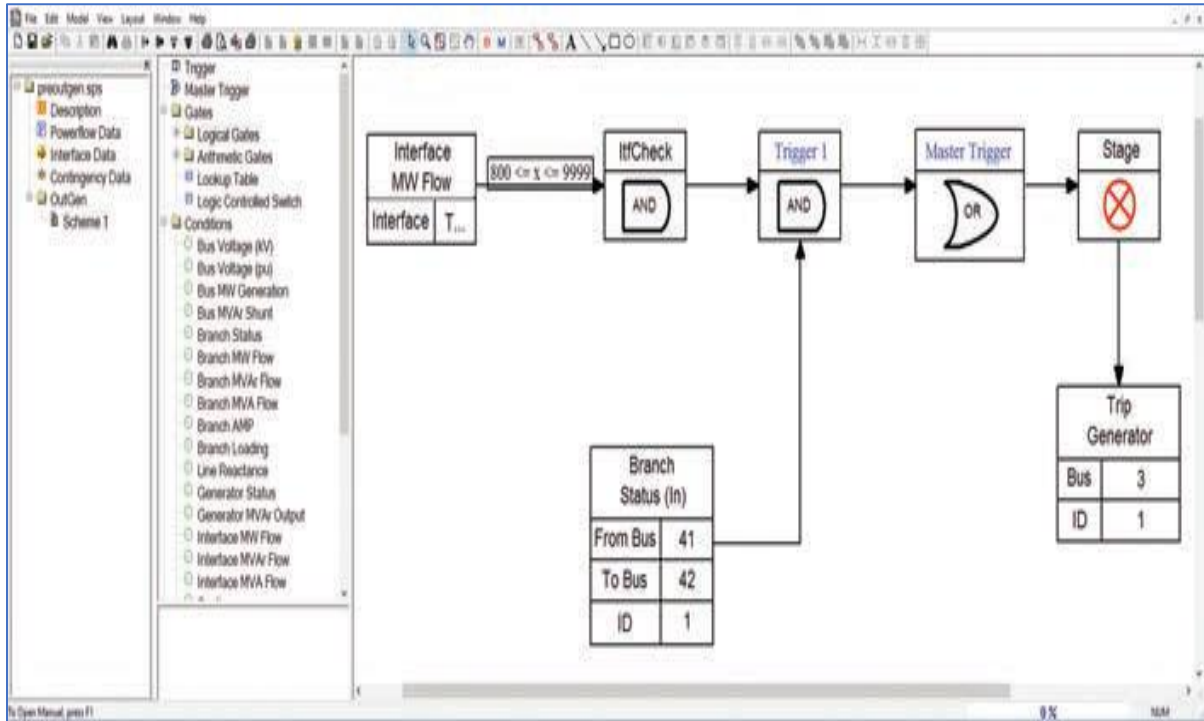
**B25: Box Plot Report/display**



**Fig.5(d)**

(box-plots in Fig.5(d) are similar to one-way scatter plots in that they require a single axis; instead of plotting each and every observation, however, they display only a summary of the data. The central box extends to the 25th percentile to 75th percentile. The 25th and the 75th percentiles of a data set are called the quartiles of the data. The line running between the quartiles marks the 50th percentile of the data set. Half the observations are less than 50th percentile and half are greater. The line projecting out from the box extends to adjacent values. The adjacent values are the most extreme observations that are not more than 1.5 times the height of the box beyond either quartile. All points outside this range are considered to be outliers, which are not typical of the rest of the data)

### B26: Voltage Security Assessment Tool



## B27: Text Transfer in ICCP:

### 8.4 Block 4 (Information Messages)

Block 4 provides a general message transfer mechanism that also includes the ability (by agreement of the two parties) to transfer ASCII text or binary files. Block 4 adds the Information Message Transfer Set server object with the associated Information Buffer data object.

One use of this service might be for a utility to notify other utilities within its inter-connection that an event more complex than that represented by simple power system data values, has occurred. For example:

- notification of a decision to implement an inter-connection wide time error correction action.
- notification of the boundaries of identified electrical islands during a disturbance.
- request for emergency use of pool reserves.

These messages might be simple formatted ASCII text messages with data from the SCADA/EMS incorporated into the body of the message. These could be used as alarm text or text reports for display on a receiving operator console or for logging.

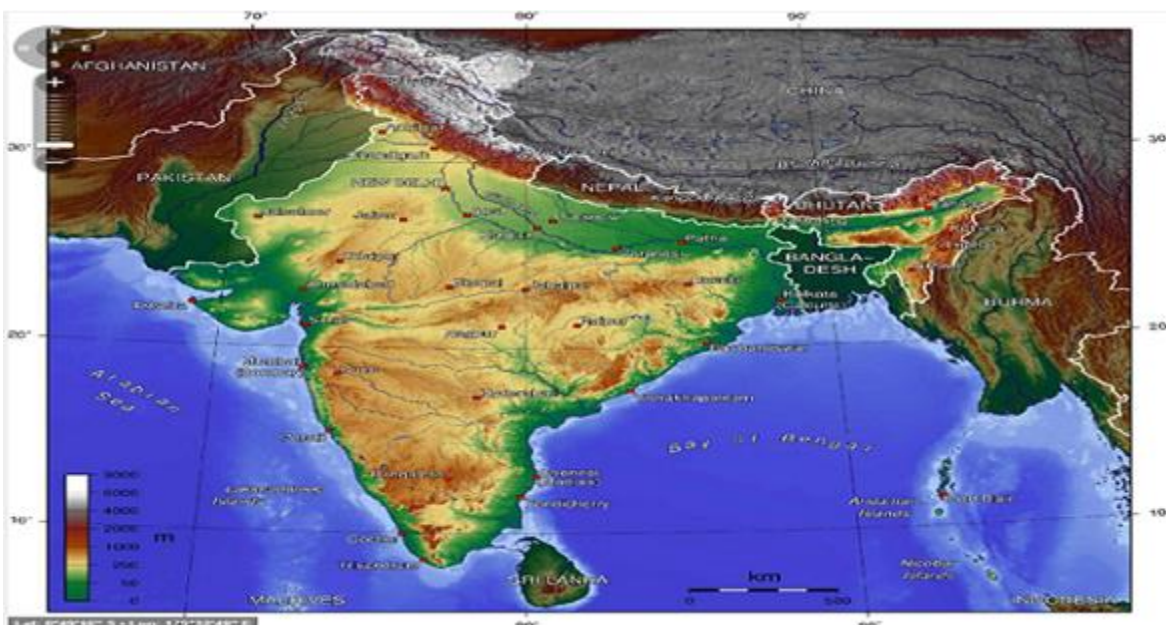
The InformationBuffer object provides a unique identifier (InfoReference) and a local identifier (LocalReference). The MessageID identifies the particular instance of a message. The Size attribute is the length in octets of the actual data being transferred.

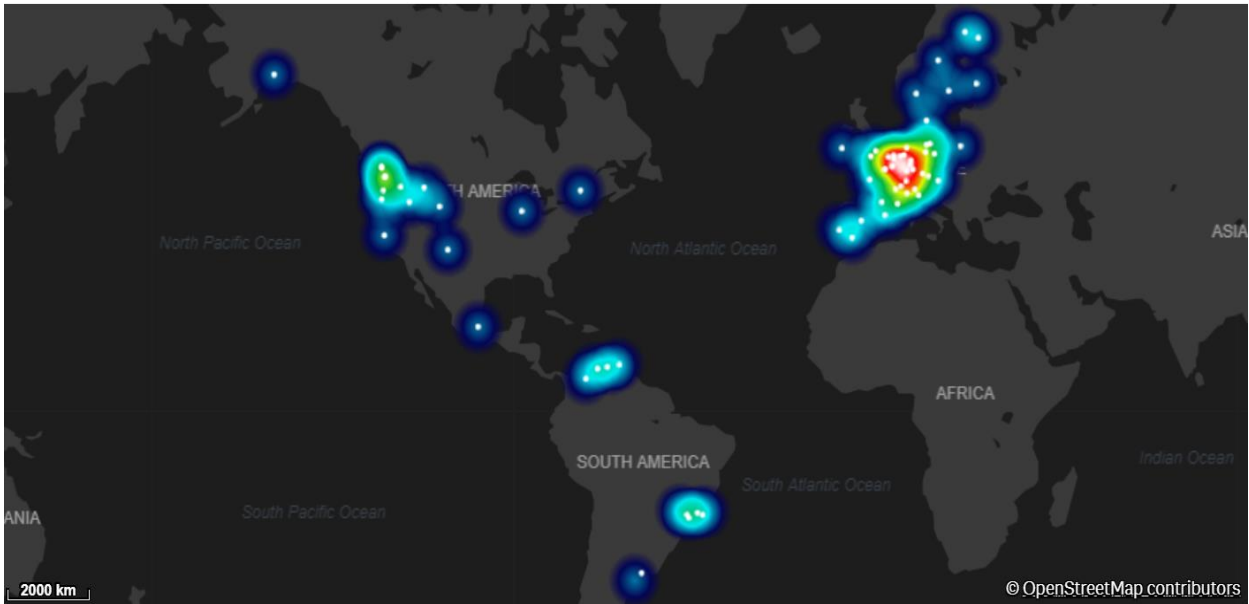
This object also provides a mechanism for simple, small, binary file transfer. These transfers are limited in size by MMS to the maximum PDU size negotiated when an association is established. The InfoReference and LocalReference attributes could be used to identify a process that would receive the binary information buffer and store it in a local file. The information stored could, by agreement, be an Excel or Word Perfect file that would later be accessed by the client or server. Individual instances of this file being transferred (the June, July or August instances) would be distinguished by the MessageID attribute.

Another possible use would be to send files formatted as Extensible Markup Language (XML) files, which are ASCII text with the tag structure defined in the XML standard.

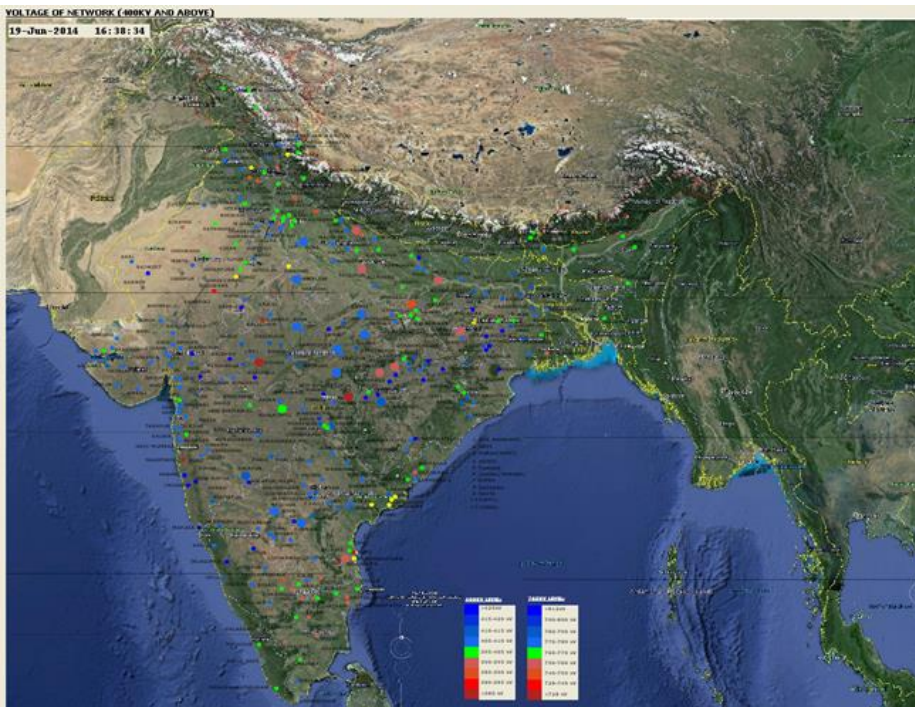
An informal description of the Information Message can be found in 60870-6-503 Section 5.1.6 and a formal description can be found in Section 5.2.8. The Information Buffer object is described in 60870-6-802 Section 5.4, the type descriptions in Section 6.4 and the mappings to MMS in Section 7.4.

## B28: Heat/Contour Map and Dark Map -Geo Spatial





### B29: System Voltage -Geo spatial



**B 30. Sample Reports & Displays**

Oct-21

Monthly Circuit Breaker % Availability of RTUs/SASs of State		
Sr. No.	SUBSTATION	% AVAILABILITY
1	Substation_1	93.85
2	Substation_2	89.95
3	Substation_3	79.81
4	Substation_4	95.74
5	Substation_5	92.68
6	Substation_6	98.74
7	.....	.....
<b>AVERAGE % AVAILABILITY (Whole Month)</b>		<b>93.89</b>



FREQUENCY SPECTRUM FOR THE MONTH OF						
October-21						
DATE	AVERAGE FREQUENCY IN HZ					
	00:00HRS TO 06:00HRS	06:00HRS TO 12:00HRS	12:00HRS TO 18:00HRS	18:00HRS TO 24:00HRS	17:00HRS TO 23:00HRS	00:00HRS TO 24:00HRS
10/1/2021	50.02	50.01	49.98	49.94	49.95	49.99
10/2/2021	49.97	50.04	50.01	50.01	50.01	50.01
10/3/2021	50	50	50.01	49.98	49.99	50
10/4/2021	49.97	49.97	49.97	49.95	49.94	49.97
10/5/2021	49.95	49.96	49.92	49.92	49.92	49.94
10/6/2021	49.98	50.02	49.97	49.95	49.92	49.98
10/7/2021	49.96	49.95	49.88	49.92	49.89	49.93
10/8/2021	49.96	49.97	49.93	49.93	49.92	49.95
10/9/2021	49.94	49.99	49.95	49.93	49.91	49.95
10/10/2021	50.01	50.02	50.02	50	50.02	50.01
10/11/2021	49.94	49.98	49.93	49.94	49.92	49.95
10/12/2021	49.9	49.99	49.94	49.92	49.94	49.94
10/13/2021	49.88	50	49.94	49.97	49.95	49.95
10/14/2021	50	50.01	49.99	50.01	50	50
10/15/2021	50	50.01	50.02	49.97	49.99	50
10/16/2021	49.99	49.98	49.92	49.98	49.96	49.97
10/17/2021	50	50.01	50	50.03	50.03	50.01
10/18/2021	50	49.99	49.98	50	50	50
10/19/2021	49.99	49.97	49.93	49.96	49.94	49.96
10/20/2021	49.97	50.01	49.98	50.03	50.03	50
10/21/2021	50.01	50.04	49.95	50.01	50.01	50
10/22/2021	49.97	50	49.96	49.99	49.99	49.98
10/23/2021	49.96	49.99	49.97	50.01	50.02	49.98
10/24/2021	49.97	49.99	50	50.02	50.02	49.99
10/25/2021	50	49.99	49.98	50.03	50.04	50
10/26/2021	50	50.02	50	50.02	50.02	50.01
10/27/2021	50.01	49.99	50.02	50.01	50.03	50.01
10/28/2021	49.99	50	49.98	50	50.01	49.99
10/29/2021	50	49.96	49.99	50.01	50	49.99
10/30/2021	50.01	50.03	49.99	49.99	49.99	50
10/31/2021	49.95	49.97	49.96	50	50	49.97
<b>Average</b>	<b>49.98</b>	<b>49.99</b>	<b>49.97</b>	<b>49.98</b>	<b>49.98</b>	<b>49.98</b>

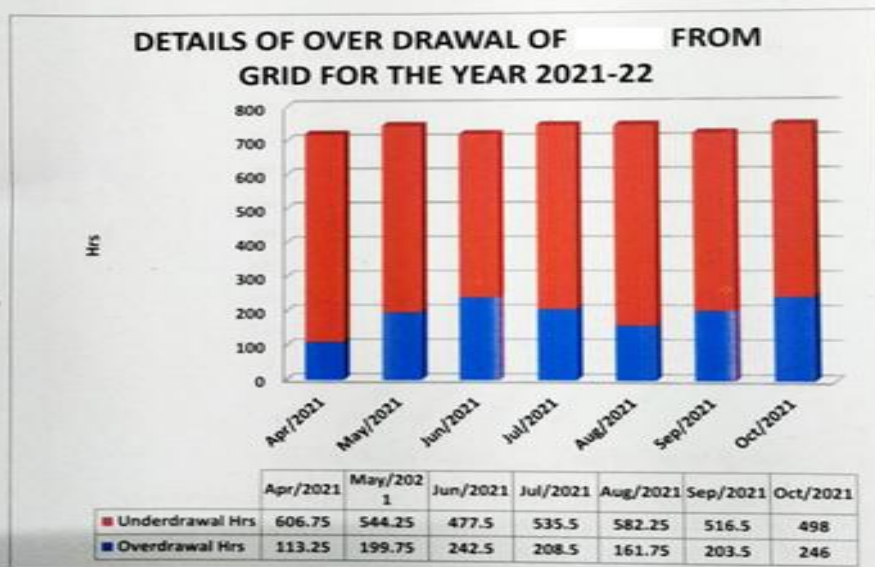
STATEMENT SHOWING SUBSTATION WISE TRANSFORMER LOADING (CONNECTED LOAD) AT THE TIME OF OCCURANCE OF PEAK DEMAND MET IN STATE								
OFF Peak load (MW)		1709						
Date		Sunday, October 31, 2021						
Time		03:15:13						
SL. NO.	NAME OF THE GRID	220/66 & 220/33 KV		LOAD (MW)		BUS VOLTAGE		
		INSTALLED CAPACITY (MVA)	TRANSMISSION CAPACITY (MW)					
				MW	MVAH	220KV	66KV	33KV
<b>AREA-1</b>								
1	Site-1	300	240	138	3	220	62	
2	Site-2	460	368	161	-2	221	67	
3	Site-3	.....	.....	.....	.....	.....	.....	
	<b>TOTAL</b>	<b>4000</b>	<b>3200</b>	<b>537</b>	<b>-89</b>			
<b>AREA-2</b>								
1	Site-1	520	416	76	40	219	64	
2	Site-2	520	416	65	22	219	66	
3	Site-3	.....	.....	.....	.....	.....	.....	
	<b>TOTAL</b>	<b>2820</b>	<b>2256</b>	<b>338</b>	<b>-76</b>			

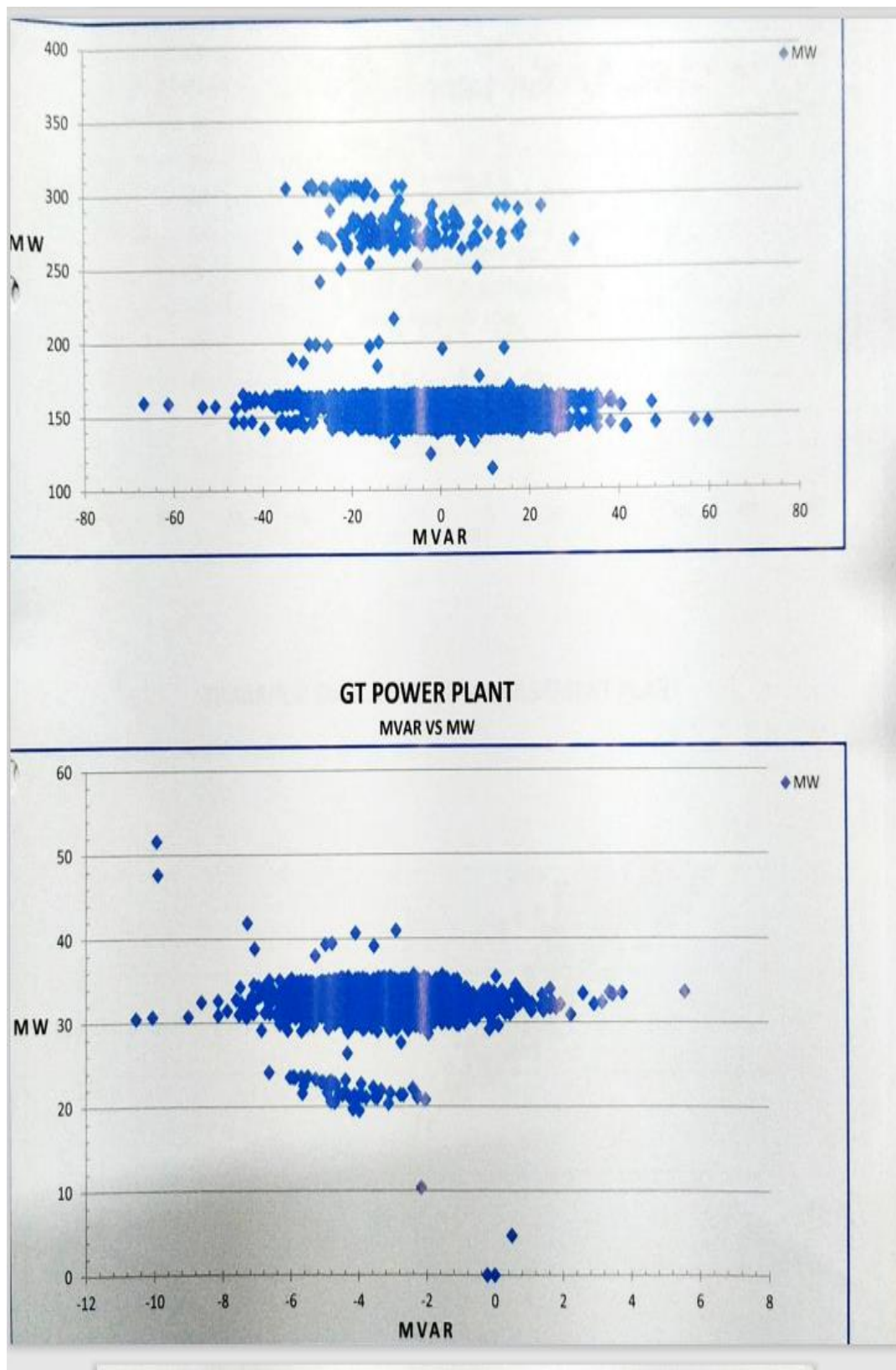
		GENERATION	Loading of ICTs	Total load
Area-1	MW	34	-23	10
	MVAR	7	-23	-16
Area-2	MW	0	0	7
	MVAR	0	0	-14

STATEMENT SHOWING SUBSTATION WISE TRANSFORMER LOADING (CONNECTED LOAD) AT THE TIME OF OCCURANCE OF PEAK DEMAND MET IN STATE								
Peak load (MW)		5548						
Date		09-07-2021 15:37:55 PM						
Time		09/07/2021 15:37:55 PM						
SL. NO.	NAME OF THE GRID	220/66 & 220/33 KV		LOAD (MW)		BUS VOLTAGE		
		INSTALLED CAPACITY (MVA)	TRANSMISSION CAPACITY (MW)					
				MW	MVAH	220KV	66KV	33KV
<b>AREA-1</b>								
1	Site-1	300	240	138	3	220	62	
2	Site-2	460	368	161	-2	221	67	
3	Site-3	.....	.....	.....	.....	.....	.....	
	<b>TOTAL</b>	<b>4000</b>	<b>3200</b>	<b>1697</b>	<b>65</b>			
<b>AREA-2</b>								
1	Site-1	520	416	181	40	219	64	
2	Site-2	520	416	202	22	219	66	
3	Site-3	.....	.....	.....	.....	.....	.....	
	<b>TOTAL</b>	<b>2820</b>	<b>2256</b>	<b>1074</b>	<b>96</b>			

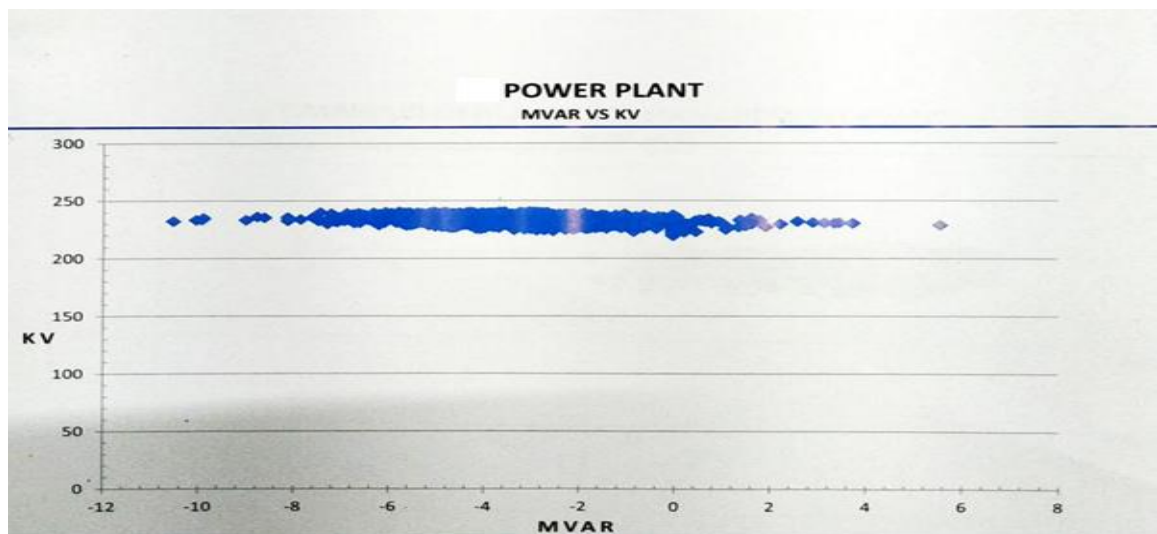
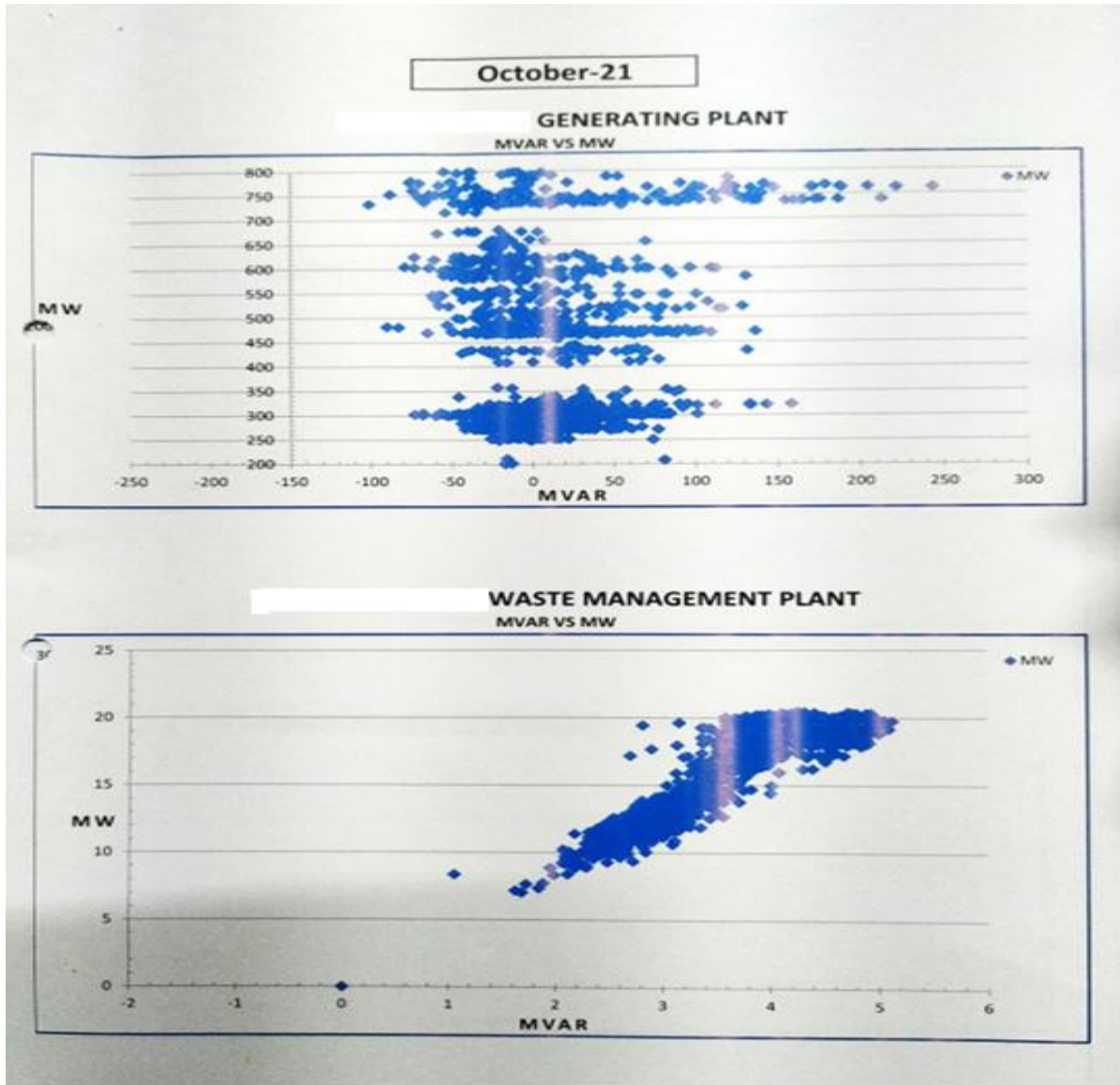
		GENERATION	Loading of ICTs	Total load
Area-1	MW	1	90	91
	MVAR	6	-2	4
Area-2	MW	0	0	28
	MVAR	0	0	-2

STATE LOAD DESPATCH CENTRE-					
DETAILS OF OVERDRAWAL OF FROM GRID for the year 2021-22					
MONTH	TOTAL NO. OF HOURS	TOTAL NO OF HOURS OVERDRAWAL		OVERDRAWAL (in Mus)	%age OF TIME OVERDRAWAL
		HRS	MINS		
Apr/2021	720	113	15	4.57	15.73
May/2021	744	199	45	9.97	26.85
Jun/2021	720	242	30	19.85	33.68
Jul/2021	744	208	30	14.77	28.02
Aug/2021	744	161	45	10.42	21.74
Sep/2021	720	203	30	9.98	28.26
Oct/2021	744	246	0	14.57	33.06

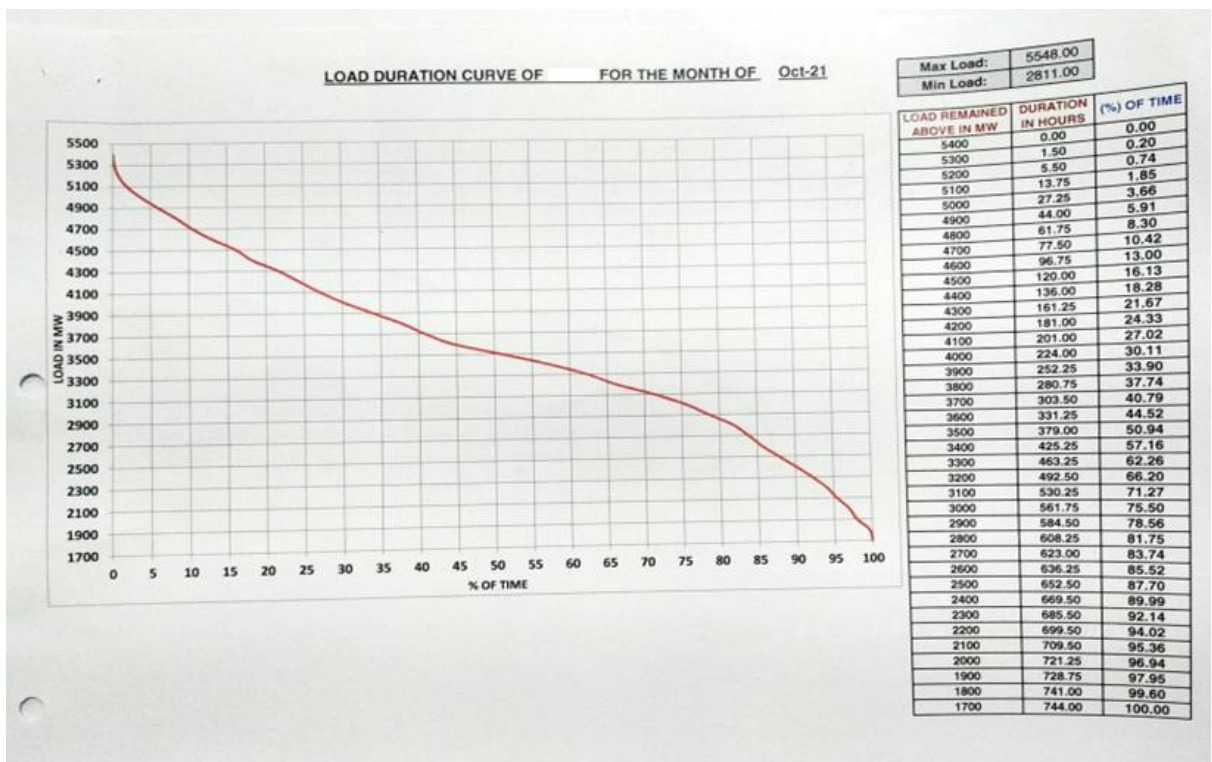
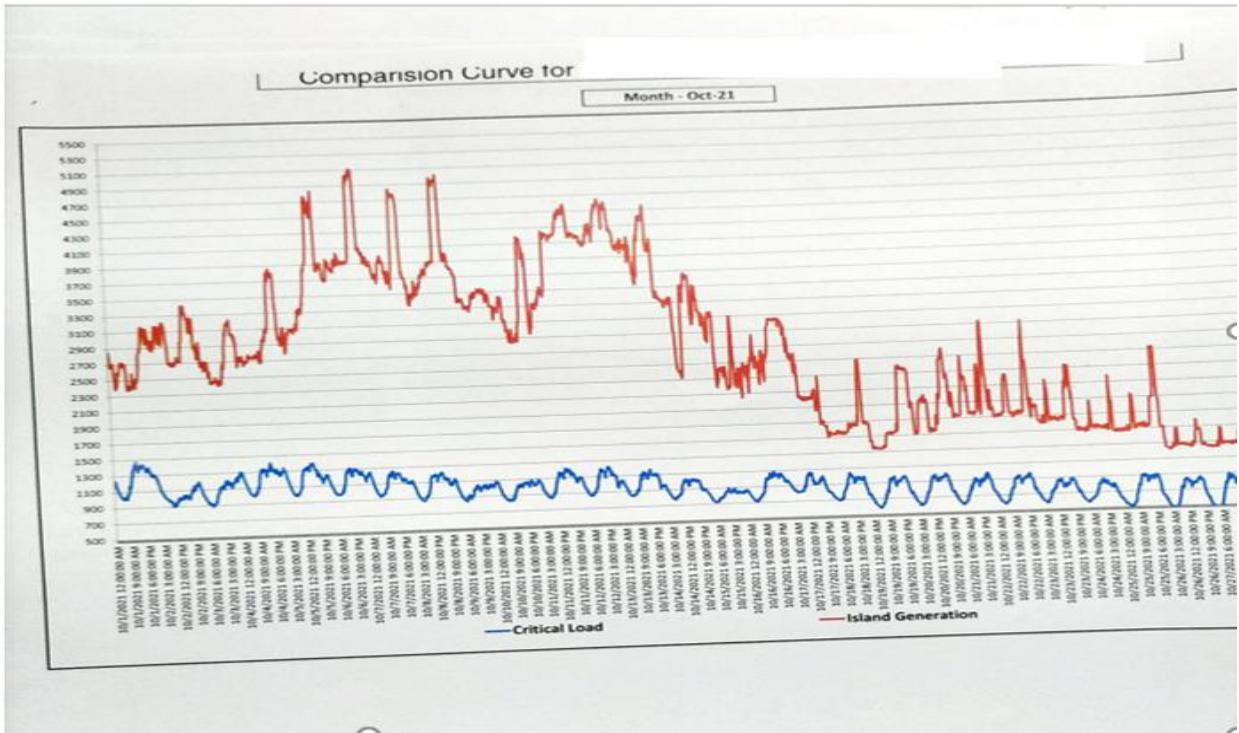


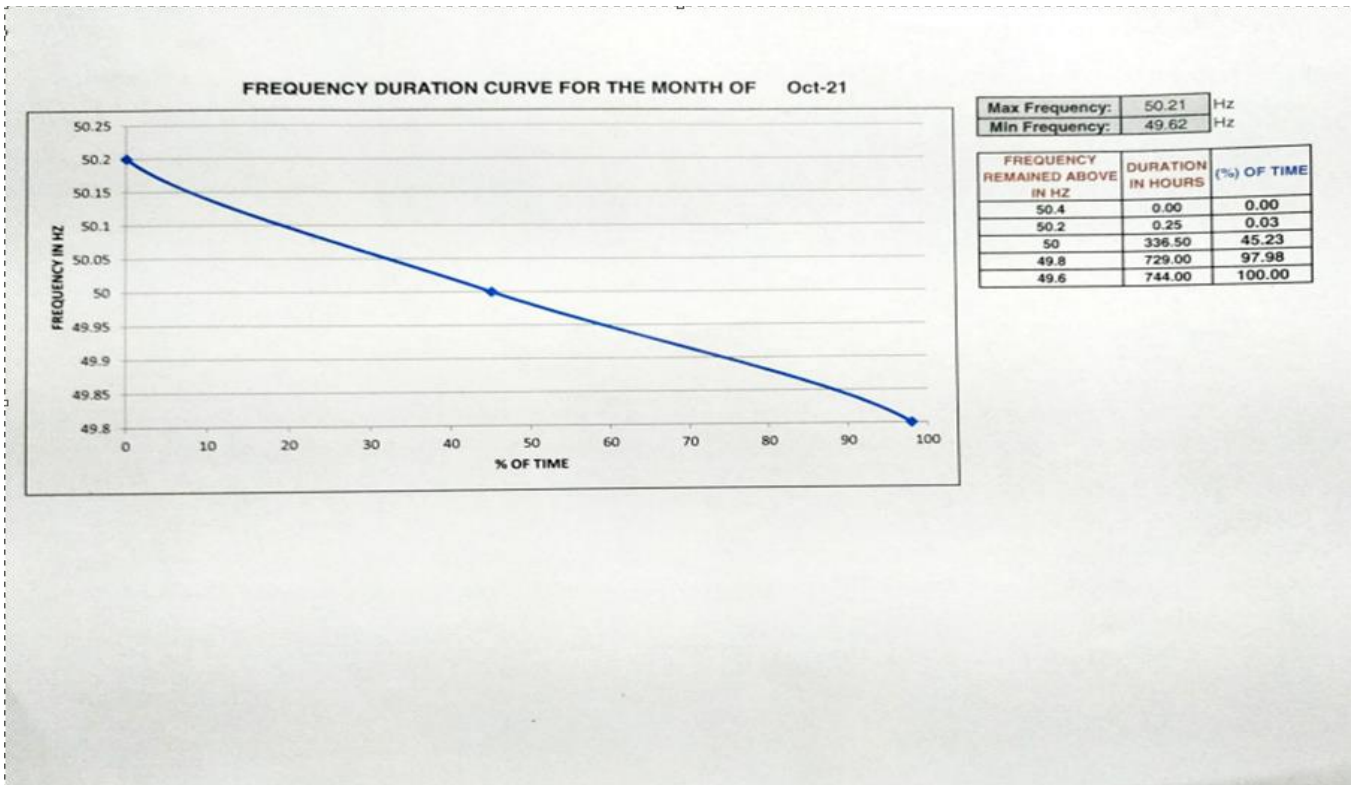












STATE LOAD DESPATCH CENTRE (NAME OF STATE)						
VOLTAGE FLUCTUATION REPORT						
MONTH	Oct-22					
NAME OF SUBSTATION	Time during which the voltage remained					
	More than upper limit		Between upper and lower limit		less than lower limit	
	hours	%	hours	%	hours	%
<b>SUBSTATION_1</b>						
Bus_1	0.00	0.00	744.00	100.00	0.00	0.00
Bus_2	0.00	0.00	744.00	100.00	0.00	0.00
400kV Line_1	88.75	11.93	655.25	88.07	0.00	0.00
400kV Line_2	272.75	36.66	471.25	63.34	0.00	0.00
220kV Line_1	0.00	0.00	744.00	100.00	0.00	0.00
400kV Line_3	117.75	15.83	626.25	84.17	0.00	0.00
400kV Line_4	174.11	23.39	570.00	76.61	0.00	0.00
220kV Line_2	0.00	0.00	744.00	100.00	0.00	0.00
<b>Note: Upper limit is 110% and lower limit is 90% in case of 220kV level</b>						
<b>Upper limit is 105% and lower limit is 95% in case of 400kV level</b>						

## OD UD REPORT FORMAT

Time	Frequency (Hz)	NRLDC Drawl (MW)	NRLDC Schedule incl. bilat.outside state(MW)	OD/UD (MW) (+/-)	Own Generation including Biomass, Solar & Wind (MW)	Isgrs net (MW)	Bilateral purchase outside state (MW)	CPP (MW)	Total Schedule (MW)	RVPN Drawl (MW)
		(A)	(B)	(C=A-B)	(D)	(E)	(F=B-E)	(G)	(B+D+G)	(A+D+G)
00:15	50.04	893.93	949.14	-55.21	6713.73	1764.93	-815.79	0	7662.87	7607.66
00:30	50.01	824.62	860.72	-36.1	6699.55	1791.59	-930.87	0	7560.27	7524.17
00:45	49.94	703.35	738.12	-34.77	6707.16	1797.16	-1059.04	0	7445.28	7410.51
<b>AVERAGE</b>	<b>50.01</b>	<b>2776.94</b>	<b>2831.88</b>	<b>-54.94</b>	<b>8008.55</b>	<b>1956.02</b>	<b>875.86</b>	<b>0.00</b>	<b>10840.44</b>	<b>10785.50</b>
TIME(Hrs.)	AV.FREQ.	TIME(Hrs.)	AV.FREQ.	TIME(Hrs.)	AV.FREQ.	TIME(Hrs.)	AV.FREQ.	TIME(Hrs.)	AV.FREQ.	
0-4	49.99	4-9	50.01	9-14	50.04	14-19	50.02	0-4&23-24	50.00	
		19-23	49.99	23-24	50.03					
TIME(Hrs.)	AV.DEMAND	TIME(Hrs.)	AV.DEMAND	TIME(Hrs.)	AV.DEMAND	TIME(Hrs.)	AV.DEMAND	TIME(Hrs.)	AV.DEMAND	TIME(Hrs.)
0-4	7127	4-8	10102	8-12	13604	12-16	12708	16-19	12348	19-24

NRLDC Schedule	<b>679.65 LU</b>									
NRLDC Drawl	<b>666.47 LU</b>			Own Gen		<b>1922.05 LU</b>				
OD/UD (+/-)	<b>-13.19 LU</b>			Total Raj Drawl		<b>2588.52 LU</b>				
Av. Freq. over 24 Hrs.	<b>50.01 Hz</b>									
Max Raj. Drawl (Av. 15 min.)		14236 MW at 09:15-09:30 Hr.		49.99 Hz	523.01 MW	MAX. OD	<b>768.69 MW</b>	at	09:45	
Min Raj. Drawl (Av. 15 min.)		6622 MW at 04:00-04:15 Hr.		49.99 Hz	-194.43 MW	MAX UD	<b>-1031.81 MW</b>	at	12:00	
		BLOCKS	VOIATION		MAX OD	CPP (Bilateral Inside state)				<b>0.00</b>
FREQ <49.7 Hz		0	0		0 MW	BIOMASS				<b>5.01</b>
FREQ >=49.7 Hz AND <49.9Hz		2	0		0 MW	SOLAR				<b>155.54</b>
FREQ >=49.9 Hz AND <50Hz		27	3		632 MW	WIND				<b>187.49</b>
FREQ >=50 Hz AND <50.05Hz		52	7		769 MW					
FREQ >=50.05 Hz AND <50.10Hz		13	1		263 MW					
FREQ>=50.1Hz		2	1		0 MW					

## APPRAISAL SHEET

S.No.	Data for appraisal	30-Dec-21					
1	Average Frequency of the day	50.01	Hz				
2	Maximum Block Frequency	50.15	14:15	state DEMAND	12449	OD/UD	-172
3	Minimum Block Frequency	49.88	20:45	state DEMAND	10019	OD/UD	-130
4	FREQUENCY SPECTRUM	HRS					
a	FRQ>= 50.2HZ	0					
b	50.0 <=FRQ< 50.2HZ	18					
c	49.8<=FRQ< 50.0HZ	6					
d	49.7<=FRQ<49.8HZ	0					
e	49.5<=FRQ<49.7HZ	0					
f	49.2<=FRQ<49.5HZ	0					
g	FRQ< 49.2 HZ	0					
	NET ( LU)	-13.19					
5	Net OD(LU)	21.94					
6	Net UD(LU)	35.12					
7	Area 1 Net OD/UD(LU)	-58.39					
8	Area 2 Net OD/UD(LU)	-27.08					
9	Area 3 Net OD/UD(LU)	81.18					

		NO OF BLOCKS	NO. OF OD BLOCKS	NO OF BLOCKS WHERE OD >250 MW	NO. OF UD BLOCKS	NO OF BLOCKS WHERE UD < -250 MW	Max Over Drawl	Max (Time)	FREQ OF THAT BLOCK	Max UNDER Drawl	Max (Time)	FREQ OF THAT BLOCK
10	FREQ <49.7 Hz	0	0	0	0	0	0		#N/A	0		#N/A
11	FREQ >=49.7 Hz AND <49.9Hz	2	0	0	2	0	0		#N/A	-136	21:00	49.89
12	FREQ >=49.9 Hz AND <50Hz	27	12	3	15	2	632	10:15	49.96	-338	22:15	49.99
13	FREQ >=50 Hz AND <50.05Hz	52	22	7	30	13	769	9:45	50.00	-632	23:00	50.04
14	FREQ >=50.05 Hz AND <50.10Hz	13	3	1	10	5	263	13:15	50.09	-1032	12:00	50.07
15	FREQ>=50.1Hz	2	0	0	2	1	0		#N/A	-963	12:15	50.12

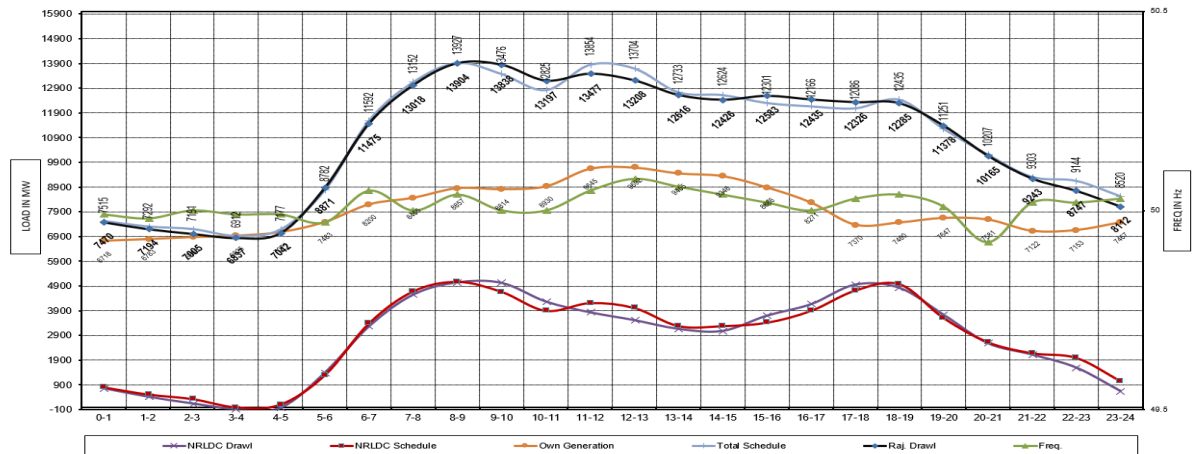
					OD/UD	LOAD SHEDDING	UNRES. DEMAND			
16	Max Raj. Drawl (Av. 15 min.)	14236 MW	at 09:15-09:30 Hrs.		49.99 Hz	523.01 mw				
17	Min Raj. Drawl (Av. 15 min.)	6622 MW	at 04:00-04:15 Hrs.		49.99 Hz	-194.43 mw				
			AT	FREQ	RAJ DEMAND	NO OF BLOCKS				
18	MAX. OD	769	09:45	50	13903	Overdrawl	37			
19	Max Underdrawl	-1032	12:00	50.07	13274	Underdrawl	59			
		Sch	Drwl	SCHD. L/S (LU)	UNSCHD. L/S (LU)	UNRESTRICTED LOAD (LU)	OD/UD	% DEMAND(LU)	PREV. DAY DRWL	DIFFERENC E
20	Discom 1 (LU)	1014.42	956.03		0	956.03	-58.39	38.02		
21	Discom 2 (LU)	683.67	656.59		0	656.59	-27.08	26.11		
22	Discom3 (LU)	820.95	902.14		0	902.14	81.18	35.87		
S.No.	TOTAL OF DISCOMS	2519.04	2514.75	0.00	0.00	2514.75	-4.29	100.00		

	DISCOM 1	DISCOM 2	DISCOM 3
TOTAL OD(LU) FOR FREQ. BELOW 49.7Hz	0.00	0.00	0.00
TOTAL OD(LU) FOR FREQ. BETWEEN 49.7Hz & 49.9 Hz	0.00	0.00	1.02
TOTAL OD(LU) FOR FREQ. BETWEEN 49.9Hz & 50.00 Hz	5.73	2.45	17.53
TOTAL OD(LU) FOR FREQ. BETWEEN 50.00Hz & 50.05 Hz	2.52	9.21	47.16
TOTAL OD(LU) FOR FREQ. BETWEEN 50.05Hz & 50.10 Hz	0.00	0.76	13.27
TOTAL OD(LU) FOR FREQ. ABOVE 50.10	0.00	0.00	2.27
	DISCOM 1	DISCOM 2	DISCOM 3
No. of Freq Blocks <49.85 where overdrawn	0	0	0
No. of Blocks freq>=50.05Hz and UD LESS THAN 97 MW for Discom 1 /65 MW for Discom 2 / 78 MW for Discom 3	2	11	0
No. of Freq Blocks >49.85 where overdrawn	24	28	95
No. of Freq Blocks greater than 49.7 Hz where OD GREATER THAN 97 MW for discom 1 / 65 MW for Discom 2 / 78 MW for discom 3	18	25	92

### Hourly Report for 30 December, 2021

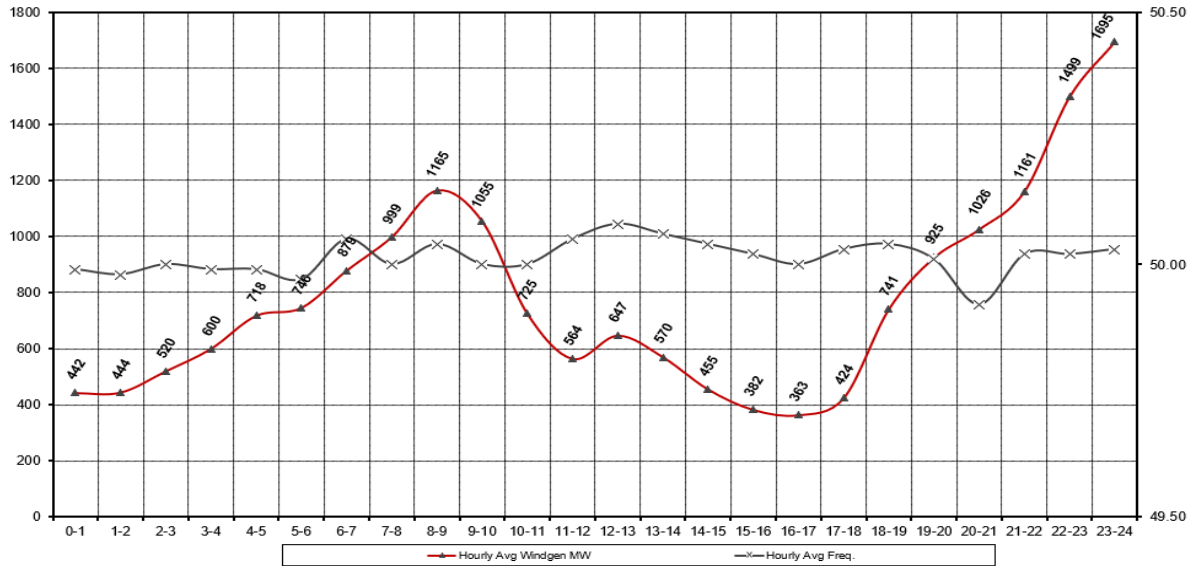
Time (Hours)	Freq. (Hz.)	(+) OD/ (-) UD (MW)	DSM Rate (Rs. /Kwh)
0-1	49.99	-45	3.11
1-2	49.98	-98	2.28
2-3	50.00	-186	2.18
3-4	49.99	-75	3.15
4-5	49.99	-135	3.50
5-6	49.97	89	4.66
6-7	50.05	-117	0.86
7-8	50.00	-134	2.44
.....	.....	.....	.....
.....	.....	.....	.....

### Load Curve of STATE for 30 December, 2021

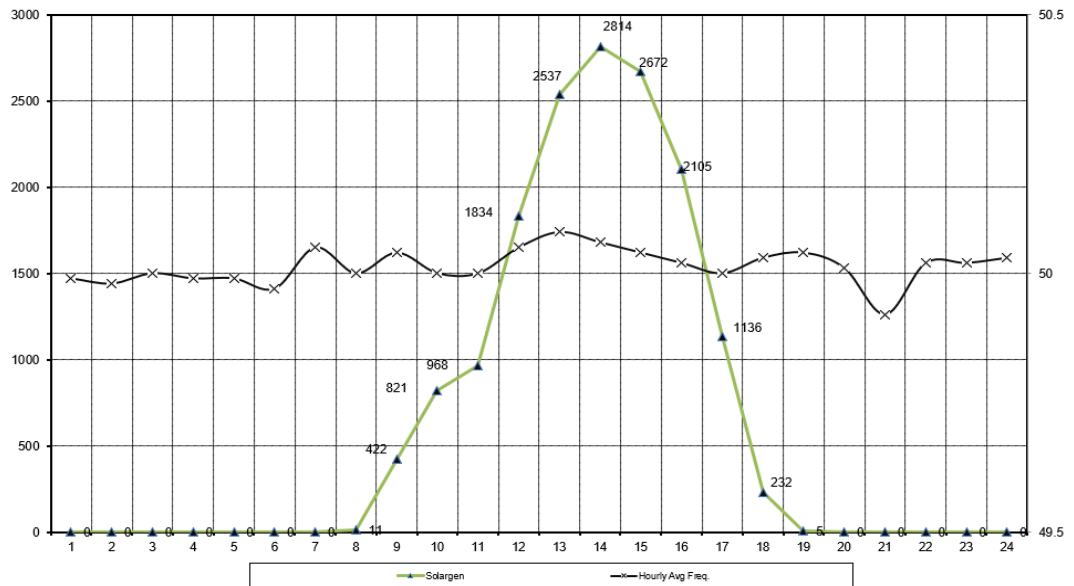


### HOURLY AVERAGE WIND GENERATION for 30 December, 2021





### HOURLY AVERAGE SOLAR GENERATION for 30 December, 2021

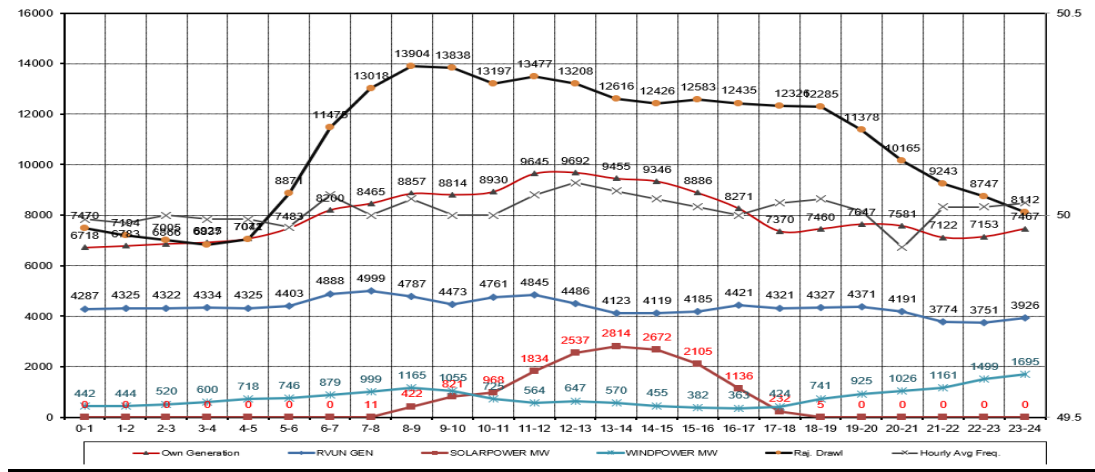


### DSM REPORT

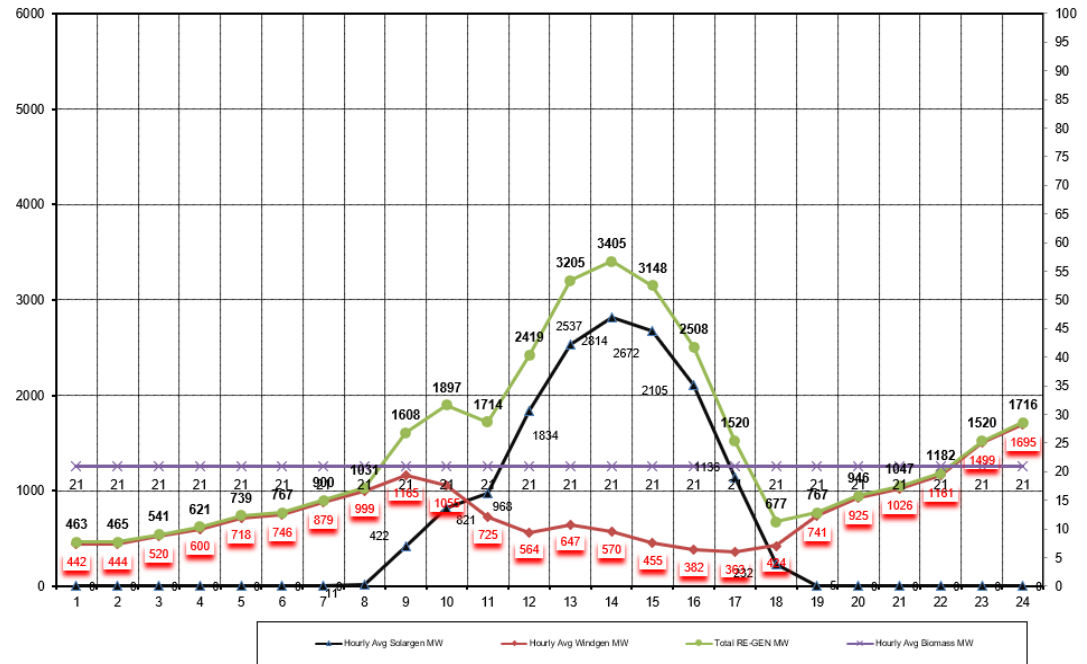
DSM Report for 30 December, 2021

Time	Frequency ( Hz)	NRLDC Drawl ( MW)	NRLDC Schedule ( MW)			CPP(MW)	Own Generation ( MW)	Total Schedule ( MW)	RVPN Drawl(MW)	OD (MW) (+)	UD (MW) (-)	DSM Rate (Rs./kWh)	WIND POWER ( MW)	Underdrawl range	no of blocks
			ISGS Net Schedule	Bill. Pur.outside state	Total										
	(A)	(B)	(C)	(D)	(E)=(C+D)	(F)	(G)	H=(E+F+G)	I=(B+F+G)	(B-E)	(B-E)			mw	
00:15	50.04	894	1765	-816	949	0	6714	7663	7608		-55	0.64	445	0-25	3
00:30	50.01	825	1792	-931	861	0	6700	7560	7524		-36	2.54	442	25-50	5
00:45	49.94	703	1797	-1059	738	0	6707	7445	7411		-35	4.99	438	50-75	6
01:00	49.95	585	1797	-1157	640	0	6752	7392	7337		-55	4.69	445	75-100	6
01:15	49.96	479	1797	-1459	339	0	6773	7112	7252	140		4.39	444	100-150	7
01:30	49.99	436	1804	-1418	385	0	6772	7158	7208	51		3.48	438	150-200	6
01:45	49.98	392	1826	-1199	627	0	6782	7409	7173		-235	3.78	437	200-250	5
02:00	50.00	336	1826	-1143	683	0	6806	7489	7142		-347	3.18	456	250-300	4
02:15	50.01	245	1800	-1141	659	0	6804	7462	7049		-414	2.54	486	300-350	5
02:30	49.99	166	1788	-1458	330	0	6856	7186	7022		-164	3.48	496	350-400	2

### HOURLY AVERAGE RVUN GENERATION for 30 December, 2021



### HOURLY AVERAGE RE GENERATION for 30 December, 2021

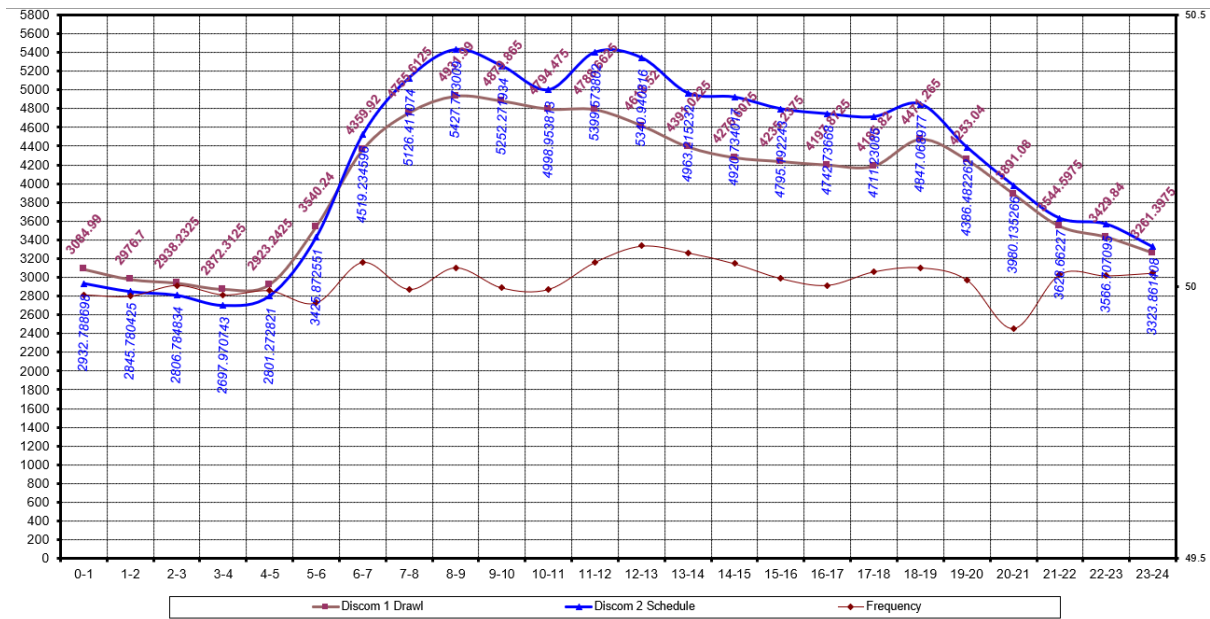


<b>SOLAR POWER (LU)</b>	155.57	RED	<b>Wind gen</b>	PURPLE	<b>Biomass gen</b>
<b>WIND POWER(LU)</b>	187.45	BLACK	<b>Solar gen</b>	GREEN	<b>Total RE gen</b>

## DISCOM REPORT

Time	Frequency (Hz)	Discom 1 schedule(with OA) (MW)	Discom 1 Drawl (with OA) (MW)	Discom 1 OD/UD (MW)	Discom 2 Schedule(with OA) (MW)	Discom 2 Drawl (with OA) (MW)	Discom 2 OD/UD (MW)	Discom 3 Schedule(with OA) (MW)	Discom 3 Drawl (with OA) (MW)	Discom 3 OD/UD (MW)
00:15	50.04	2990	3114	124	2015	<b>1646</b>	-369	2420	<b>2647</b>	227
00:30	50.01	2950	<b>3115</b>	164	1988	1618	-370	2388	2594	206
00:45	49.94	2906	3064	158	1958	1602	-356	2351	2551	200
01:00	49.95	2885	3048	163	1944	1583	-361	2335	2515	180
01:15	49.96	2776	3010	234	1871	1562	-309	2246	2492	246
AVERAGE(MW)		4227	3983	-243	2849	2736	-113	3421	3759	338
Total Demand( in LU)		1014.42	956.03	-58.39	683.67	656.59	-27.08	820.95	902.14	81.18
% OF TOTAL LU OF CURRENT DAY		38.02			26.11			35.87		
CUM.DRAWL UPTO CURRENT DATE										
CUM.% UPTO CURRENT DATE										
		DISCOM 1			DISCOM 2			DISCOM 3		
TOTAL OD(LU) FOR FREQ. BELOW 49.7Hz		0.000			0.000			0.000		
TOTAL OD(LU) FOR FREQ. BETWEEN 49.7Hz & 49.9 Hz		0.000			0.000			1.023		
TOTAL OD(LU) FOR FREQ. BETWEEN 49.9Hz & 50.00 Hz		5.731			2.452			17.529		

## Load Curve for State Discom



**HOURLY SOLAR GENERATION DATA FOR 30-12-2021**

S. No.	NAME OF POOLING STATION	ENERGY GEN (IN LU)
1	400 KV STATION 1	40.30
2	220 KV STATION 1	26.32
3	220 KV STATION 2	5.78
4	220 KV STATION 3	6.29
5	220 KV STATION 4	4.09
6	.....	.....
	<b>TOTAL</b>	<b>156.31</b>

<b>TIE_LINE REPORT FOR DATED 30-12-2021</b>		
<b>TIE LINE SUMMARY (+VE IMPORT/-VE EXPORT)</b>		
1	LINE 1_LINE 2	32.42
2	LINE 3_LINE 4	-0.03
3	LINE 5_LINE 6	4.97
4	LINE 7_LINE 8	4.39
5	LINE 9_LINE 10	0.02
6	.....	.....
7	<b>TOTAL DRAWL</b>	<b>666.18</b>

**CUMULATIVE REPORT**

Date	DISCO M 1 SCH. (LU)	DISCOM 1 DRAWL (LU)	OD/UD(L U)	DISCOM 2 SCH. (LU)	DISCOM 2 DRAWL (LU)	OD/UD(L U)	....	....	....
01-Dec-21	952.55	925.90	-26.66	641.98	610.84	-31.13	....	....	....
02-Dec-21	946.52	916.14	-30.39	637.91	581.26	-56.65	....	....	....
....	....	....	....	....	....	....	....	....	....
<b>TOTAL</b>	<b>30797.90</b>	<b>29929.92</b>	<b>-867.98</b>	<b>20756.27</b>	<b>20121.20</b>	<b>-635.07</b>	....	....	....

**GSS WISE LOAD REPORT**  
**15 Minute Wise Energy Drawl of 220 KV GSS of \_\_\_\_\_ Discom**

TIME STAMP	AREA-1	AREA-2	AREA-3	AREA-4	AREA-5	.....	TOTAL
	<b>MW</b>	<b>MW</b>	<b>MW</b>	<b>MW</b>	<b>MW</b>	.....	<b>MW</b>
00:15	222	114	113	215	36	.....	3114
00:30	222	111	116	218	36	.....	3115
00:45	222	110	115	217	36	.....	3064
.....	.....	.....	.....	.....	.....	.....	.....
<b>Total LU</b>	53.66	30.49	38.88	54.14	8.40	.....	956.26

**MONTHLY FREQUENCY REPORT**

	01-Nov-21	02-Nov-21	03-Nov-21	04-Nov-21	05-Nov-21	06-Nov-21	.....
Time	Frequency (Hz)	Frequency (Hz)	Frequency (Hz)	Frequency (Hz)	Frequency (Hz)	Frequency (Hz)	.....
00:15	50.08	49.97	50.03	49.99	50.02	49.93	.....
00:30	50.06	49.91	50.00	49.98	50.02	49.95	.....
00:45	50.02	49.94	49.99	49.99	50.01	49.91	.....
01:00	50.03	49.86	49.98	49.88	49.99	49.96	.....
01:15	50.03	49.91	49.97	49.89	49.99	49.94	.....
01:30	50.00	49.89	49.98	49.89	49.95	49.99	.....
.....	.....	.....	.....	.....	.....	.....	.....

**DETAIL OF MAX**

Month Nov-21				
State Demand		Value	Date	Time
Maximum		14253	17	09:00:00
Minimum		5728	6	04:15:00

	NREB Drawl	5940
1	765kV Line 1	1138
2	400kV Line 1	1141
3	220kV Line 1	-406
4	132kV Line 1	-389
5	765kV Line 1	-282
6	.....	.....

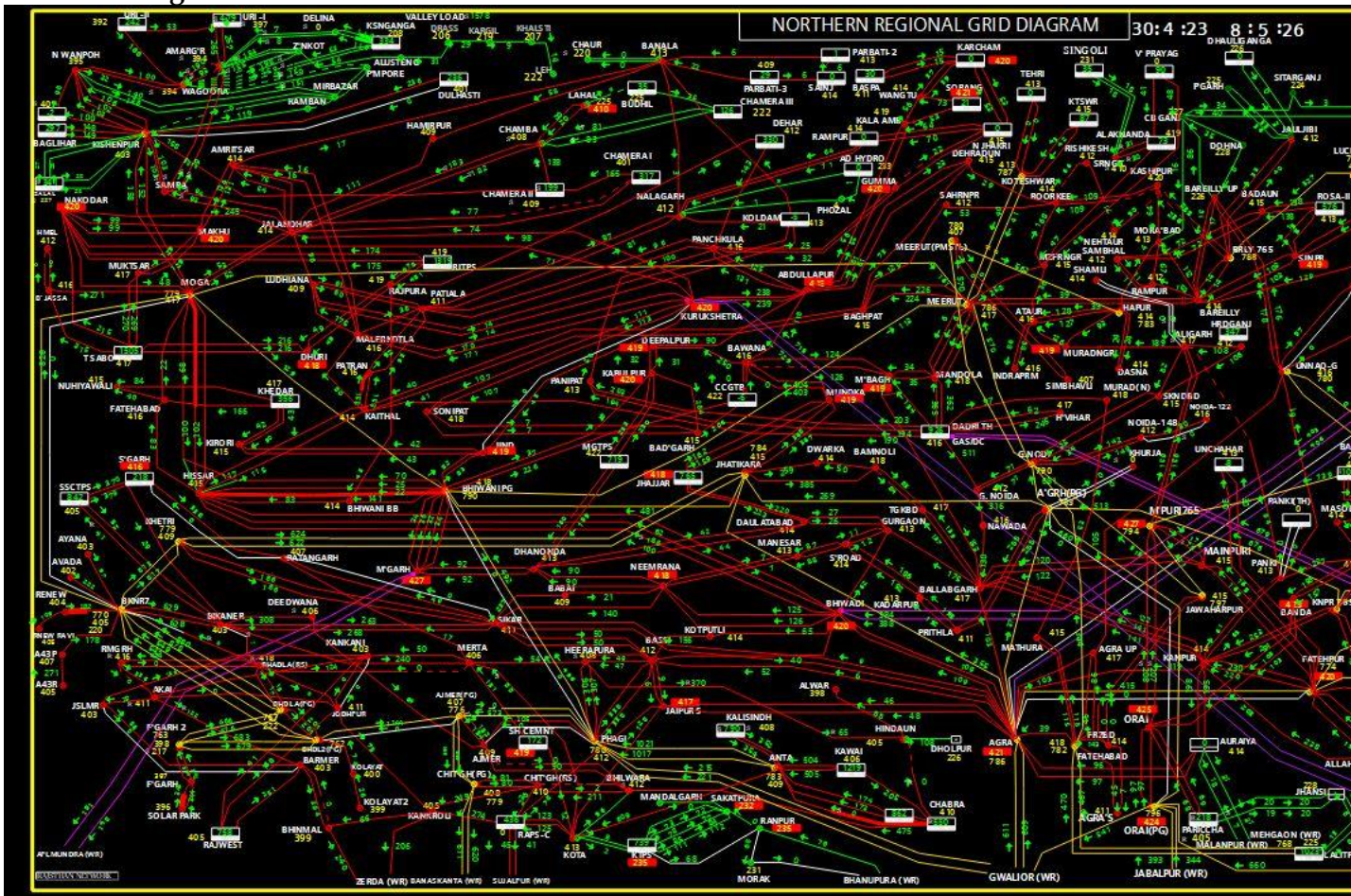
	Own Generation	8313
1	STPS Unit 1	176
2	STPS Unit 2	192
3	STPS Unit 3	0
4	STPS Unit 4	231
5	STPS Unit 5	0
6	.....	....
1	<b>BIOMASS</b>	<b>27</b>
2	<b>SOLAR</b>	<b>1151</b>
3	<b>WIND POWER</b>	<b>662</b>
4	<b>CPP</b>	<b>0</b>
<b>State Demand</b>		<b>14253</b>



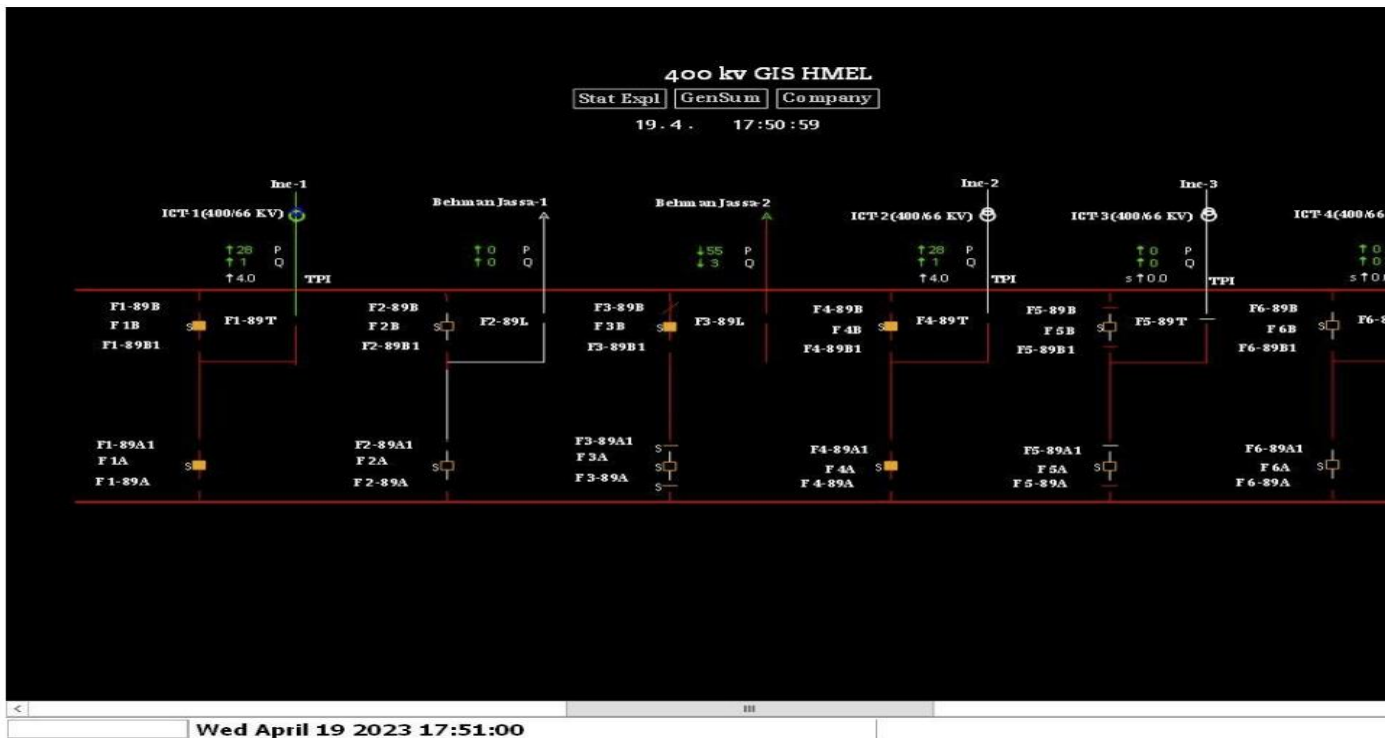
## PREV DAY VS CURRENT DAY REPORT

REB SCH./DRAWL FROM 00Hrs To 05Hrs							DATED 30-Dec-2021					
Time	Frequency (Hz)	Regional Drawl (MW)	Regional Schedule incl. bilat.outside state (MW)	OD/UD(MW) (+/-)	Own Generation Including Biomass (MW)	Interstate Generation Schedule Net(MW)	Bilateral Purchase		Total Schedule (MW)	State Drawl (MW)	State Drawl Prev.day (MW)	Diff.from prev.day (MW)
							Outside State(MW)	Inside State(MW)				
00:15	50.04	894	949	-55	6714	1765	-816	0	7663	7608	7234	374
00:30	50.01	825	861	-36	6700	1792	-931	0	7560	7524	7156	369
00:45	49.94	703	738	-35	6707	1797	-1059	0	7445	7411	7090	320
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
<b>AVERAGE</b>	<b>50.00</b>	<b>807.30</b>	<b>849.33</b>	<b>-42.03</b>	<b>6706.81</b>	<b>1784.56</b>	<b>-935.23</b>	<b>0.00</b>	<b>7556.14</b>	<b>7514.11</b>	<b>7159.97</b>	<b>354.14</b>
<b>TOTAL L.U.</b>		<b>6.05</b>	<b>6.37</b>	<b>-0.32</b>	<b>50.30</b>	<b>13.38</b>	<b>-7.01</b>	<b>0.00</b>	<b>56.67</b>	<b>56.36</b>	<b>53.70</b>	<b>2.66</b>
							<b>WIND 27.25 LU</b>					

### Network Diagram



Sample SLD



**Note: The figures/data shown above are indicative only and are calculated based on data acquired from remote locations in over existing communication links. These data are not meant for commercial purpose.**

**VOL. II, PART-B**  
**APPENDIX - C**  
**SYSTEM DESIGN PARAMETERS**

## APPENDIX-C

### System Design Parameters

The SCADA/EMS system shall be designed as per the technical parameters defined in the specification and as specified here.

The SCADA/EMS system sizing such as databases, network elements, ICCP (no. of Control Centers), etc. shall be done to accommodate expansion as per the system sizes and future requirement sizes specified in Appendix F for respective control centers and calculated value sizing requirements specified in Appendix C. Further, the delivered RTUs Communications system interface (CFE capacity, serial ports etc.) shall be designed to accommodate expansion of RTUs as specified in the BOQ during AMC period also.

Based on the above requirement, exact hardware and software sizing requirements may be different for RLDC/SLDC.

The Historian system sizing shall be such as to accommodate expansion by future requirement sizes specified in Appendix F for respective control centers and calculated value sizing requirements specified in Appendix C. The import data from past history shall be over and above the expansion requirement sizes mentioned.

The auxiliary memory utilization of any of the computers shall not exceed 25% of its delivered capacity. This memory utilization includes the memory used for storage of data (including expansion requirement defined in above para) for the defined duration as specified in the technical specification.

The following tables specify the design capacities, execution rate, and response times required. Depending on the type of item, the design capacity represents either the total number of that item to be supported by the installed computer system or the rate at which that item shall be processed. No. of points specified under Design Capacity shall include the expansion requirements also.

The execution rate indicates how frequently a function shall execute if it is a periodic function. Some functions execute periodically as well as upon request and/or as a result of external conditions. Other functions execute strictly as needed, upon request, and/or as required by the external conditions.

The response time indicates the maximum acceptable wall-clock time to complete a function and to present and/or store the results, as appropriate. In the case of data exchange between the computer systems, the delivery time is the elapsed time between initiation of the data transmission request by one system and storage in the application function database of the receiving system, assuming there is no delay due to the communication. This appendix is organized as:

**Table 1 -Design Parameters for SCADA Functions**

**Table 2 - Design Parameters for Historian Functions**

**Table 3 - Design Parameters for EMS Functions**

**Table 4 - Design Parameters for User Interface**

**Table 5 - Design Parameters for Configuration Characteristics**

**Table 6 - Design Parameters for DSA**

**Table 7 - Design Parameters for Dispatcher Training Simulator System**



**TABLE 1 – DESIGN PARAMETERS FOR SCADA FUNCTIONS**

Section Ref	FUNCTION DESCRIPTION	DESIGN CAPACITY	EXECUTION RATE	RESPONSE TIME
<b>1.1.1</b>	<b>RTU Data Acquisition</b>			
	Scan Rates	8	1 sec to 1 hour	
	Status Data Update	No. of status points specified in Appendix- F	by exception and an integrity scan every 10 mins	
	Analog Data Update	No. of analog points specified in Appendix- F	by exception and periodic 5 secs	
<b>1.1.1.3</b>	RTU in Test Mode	5 RTUs at same time		
<b>1.1.1.5</b>	RTU Time synchronization		Every 10 minutes and on startup	
<b>1.1.1.4</b>	<b>Telemetry failure and Delete from Scan</b>			
	No. of communication retries	10		
	Exploratory scan	2	30 sec to 10 minutes	
<b>1.2.1</b>	<b>Data Exchange with Control Centres</b>			
	Status Data Update	No. of points specified in Appendix-F	by exception and integrity scan every 10 mins	1 sec
	Analog Data Update	No. of points specified in Appendix-F	periodic 5 sec	1 sec
<b>1.2.3</b>	<b>Data exchange with other/external computer system application</b>			
	Real-time data & Alarms	No. of points specified in Appendix-F	5 sec	1 sec
	Historical data	No. of points specified in Appendix-F	Scan Rate	5 sec
	CSV data processing	5000 points per CSV file	On demand	5 second per file

Sec Ref	FUNCTION DESCRIPTION	DESIGN CAPACITY	EXECUTION RATE	RESPONSE TIME
<b>1.3.1</b>	<b>Data Processing- Analog Data</b>			
<b>1.3.1(a)</b>	Reasonability Limit checking	High and Low reasonability limits per analog point	Each time the value is received in SCADA	1 sec
<b>1.3.1(c)</b>	Limit Monitoring (Operational, Alarm, Emergency limits)	High and Low for each limit per analog point	Each time the value is received in SCADA	1 sec
<b>1.3.1(b)</b>	Zero dead band processing	One dead-band %	0.1% to 2%	1 sec
<b>1.3.1(e)</b>	<b>Data Validity tests</b>			
	Bus imbalance MW	No. of buses	Each time the value is received in SCADA	1 sec
	Redundant line imbalance	No. of lines		1 sec
	Bus imbalance V/ frequency	No. of buses		1 sec
<b>1.3.3</b>	<b>Calculated Data Processing: (The internal points used for calculation shall be additional)</b>			
	Arguments for analog calculations	200	Each time a value is received in SCADA	
	Arguments for status calculations	200	Same as above	
	No. of calculated analog data (Real time Min, Max & Avg for each 5-minute time duration and three more calculated data)	6 X Total no. of analog points defined in Appendix-F	Each time the value is received in SCADA	
	No. of calculated Status data	2 X Total no. of status points defined in Appendix-F	Each time the value is received in SCADA	
<b>1.3.3.1</b>	MVA and Power Factor Calculations	No. of feeders and transformers	Same as above	

1.3.3.2	Megawatt and Mega VAR Integration	No. of feeders, generators and transformers	Same as above	
<b>Sec Ref</b>	<b>FUNCTION DESCRIPTION</b>	<b>DESIGN CAPACITY</b>	<b>EXECUTION RATE</b>	<b>RESPONSE TIME</b>
1.3.3.3	Rate of change	no. of analog points defined in Appendix-F	Same as above	
<b>1.3.5</b>	<b>Continuous Real-time data storage &amp; playback</b>			
	Sizing	No. of points specified in Appendix-F (all analog points periodicity shall be considered as five seconds and all status points 4 second for deciding storage capacity)	Each time the data is received in SCADA	
	Data storage	1 year	Scan rate	
1.3.6	<b>Redundant data Source processing</b>	As per specification	As per specs	
1.4	<b>Network Status processor</b>	For all status points defined for power system size	Triggered by status change	1 sec after updation in SCADA database
<b>1.5</b>	<b>Sequence-of-Events recording</b>			
	<b>Sequence-of-Events recording</b>	10000 events circular buffer in the real-time SCADA database	Each time the value is received in SCADA	1 sec

**TABLE 2 – DESIGN PARAMETERS FOR HISTORIAN FUNCTIONS  
(Specification Reference Section 2)**

<b>FUNCTION DESCRIPTION</b>	<b>DESIGN CAPACITY</b>	<b>EXECUTION RATE</b>	<b>RESPONSE TIME</b>
<b>Real-time database snapshot</b>			
No. of data points	Total no. of points defined in Appendix-F (different rates for different values, set at 10 seconds for deciding storage capacity)	5 seconds to 1 hour	2 sec
Real-time Data Storage	7 years current system data plus 10 years previous system data		
<b>Storage of SCADA/EMS system statistics and Communication statistics</b>			
<b>RTU Communication statistics</b>			
RTU Communication statistics	No. of RTUs	Hourly	
Duration of Online storage in Historian System	7years		
<b>ICCP Communication statistics</b>			
ICCP Communication statistics	No. of ICCP connections	15 minutes	1 minute
Duration of Online storage	7 years of new SCADA	As per Spec	
<b>Historical information</b>			
Storage of files and save cases	20 save cases and 20 output results of each EMS Application	As per spec	5 minutes
<b>Application Logs Storage &amp; Retrieval</b>			
No. of logs storage	100000 entries per day	15 minutes	
Online storage	12 months		
<b>Historical trend (Historian)</b>	On demand for any of the stored analog value	As per spec	5 sec
<b>Reports</b>	100	As per spec	10 sec per report-consisting of 500 distinct Data Points

**TABLE 3 - DESIGN PARAMETERS FOR EMS FUNCTIONS**

NAME	DESIGN CAPACITY	EXECUTION RATE	RESPONSE TIME
<b>Outage Scheduler (As per section 8)</b>	2X (No. of all modelled devices) including at least 25 revisions per schedule	On demand Daily	10 Seconds
<b>Load Forecasting</b>			
Daily Forecast (quarter hourly)	Minimum 2 two days in future	On demand	1 minute
Output Save cases	4 save cases		
Historical day File	25 months		
Load profiles	30 profile		
Dynamic adjustments		15 minutes	10 second
<b>Power System Analysis</b>			
Real-Time Mode		2 minutes Event trigger On demand	30 seconds
<b>Multi-User Study Mode</b> Number of Concurrent Users	20 users	<b>On demand</b>	30 seconds
State Estimation		2 minutes Period, Event trigger and Demand execution	30 seconds
Bus Load Forecast	420 sets (12x7x5)	2 minutes	5 seconds
<b>Contingency Analysis</b>		10 minutes Periodic and on demand	1 minute
Predefined Contingencies	1000 cases		
Dynamically defined contingencies	20 cases		
<b>Optimal Power Flow (Real Time)</b>		10 minutes	1 minute
Optimal Power Flow (Study Mode)			
With optimization		On demand	1 minute



Without optimization			5 seconds
<b>Transmission/Corridor Capability Monitor</b>		5 minutes on demand	5 seconds
<b>Short Circuit Analysis</b>		5 minutes on demand	30 seconds
<b>NAME</b>	<b>DESIGN CAPACITY</b>	<b>EXECUTION RATE</b>	<b>RESPONSE TIME</b>
<b>Web System (As per section 8)</b>			
Update of display	On 2 Mbps link		3 sec

**TABLE 4 - DESIGN PARAMETERS FOR USER INTERFACE**

NAME	DESIGN CAPACITY	EXECUTION RATE
<b>Function and Data Access Security</b> Operating jurisdictions	16	
<b>User Interface Environment</b>		
Layers	50	
Declutter Levels	50	
Panning	50-pixel steps	
Zooming	50 steps	
Tag Placement & Removal		
Tag Types	4	
Tags per device	4	
<b>TREND (Online) in SCADA</b>		
a) Trend	For each data points as defined in appendix F.	
b) Variables per trend viewport/window	8	
c) Samples per trend variable	10,000	
d) Configurable Sampling rate	Scan Rate to 15 minutes	
e) Time period of trend	At least 1 month	
<b>ALARMS</b>		
Alarm priority levels	16	
Alarm Message Recording on auxiliary memory	1,00,000	
<b>EVENTS</b>		
Event Message Recording on Auxiliary memory	1,00,000	
Function & Data Access Security Operating Jurisdictions	16	

**TABLE 5 - DESIGN PARAMETERS FOR CONFIGURATION CHARACTERISTICS  
(Specification Reference -Section 4 & 6)**

DESCRIPTION	DESIGN CAPACITY	EXECUTION RATE	RESPONSE TIME
<b>Single Line Display</b>			
Backup Databases Data backup		30 seconds or event driven	5 seconds
Server Errors and failure detection			10 seconds
Device Errors and failure detection			10 seconds
<b>Server failover</b>			60 seconds
<b>Server Start-Up</b>			
Hot Start			2 minutes
Warm Start			3 minutes
Cold Start			5 minutes
Device Failover			30 seconds
<b>Main and Backup Control centre</b>			
Real-time data Update		10 seconds	2 seconds
Integrity scan		10 Minutes	
Monitoring of each other's Availability		2 minutes	2 seconds

**TABLE 6 - Design Parameters for DSA (Specification Reference- Section 2)**

<b>NAME</b>	<b>DESIGN CAPACITY</b>	<b>EXECUTION RATE</b>	<b>RESPONSE TIME</b>
Voltage Stability Assessment		15 minutes On Demand	30 seconds
Transient Stability Assessment		15 minutes On Demand	1 minute
Verification of remedial measures; such as to bring the power system back to operational security such			
i. additional load- generation shedding		15 minutes On Demand	30 seconds
ii. topology changes		15 minutes On Demand	30 seconds
Concurrent study cases	5 cases		
<b>Model Time Step</b>	As per spec		

**TABLE 7 - DESIGN PARAMETERS FOR Dispatchers Training Simulator  
(Specification Reference Section 2)**

DESCRIPTION	DESIGN CAPACITY	EXECUTION RATE	RESPONSE TIME
<b>Dispatcher Training Simulator</b>			
Power System Model (Electrical Islands)	10		
Load Modelling		5 minutes	
Hydro System Model		5 minutes	
<b>DTS Performance and Sizing</b>	<b>Same as Real-time System</b>		
DTS Network Solution - <b>Average</b>		3 seconds	3 seconds
DTS Network Solution - <b>Maximum</b>		5 seconds	5 seconds
Dynamic Equations: Energy/Freq		1 second	1 second
Number per Control center Simulation			
Load Curves	125	5 minutes	5 seconds
DTS Base Cases	100	5 minutes	5 seconds
Scenarios	100	5 minutes	5 seconds
Event Groups	250	5 minutes	5 seconds
Events per Group	1000	5 minutes	5 seconds
Session Snapshots	100	5 minutes	5 seconds
Conditional Events	500	5 minutes	5 seconds
Terms per Conditional Event	1000	5 minutes	5 seconds
Variables in Conditional Events	1000	5 minutes	5 seconds



# **VOL. II, PART-B APPENDIX – D PERFORMANCE REQUIREMENT**

## APPENDIX-D

### PERFORMANCE REQUIREMENTS

The SCADA/EMS system shall be designed as per the technical parameters defined in the specification and as specified here. The SCADA/EMS system (such as databases, network elements, RTU, number of points, number of Control Centres (ICCP connections etc.) shall be sized to accommodate expansion as specified size in Appendix –C. The system shall be tested with the full ultimate size i.e., proposed sizing along with expansion requirement mentioned in Appendix- F for respective control centers.

The auxiliary memory utilization of any of the computers shall not exceed 25% of its delivered capacity. This memory utilization includes the memory used for storage of data for the defined duration as specified in the technical specification.

Failure to meet the performance criteria shall require the Contractor to provide all necessary hardware and software modifications and additions until the performance criteria are satisfied.

This appendix is organized as:

#### TABLE 1 – PERFORMANCE REQUIREMENTS

#### TABLE 2 – NORMAL LEVEL OF ACTIVITIES

#### TABLE 3 – PEAK LEVEL OF ACTIVITIES

The performance specified here are the maximum times required of the user interface during average and peak loading conditions. Averaged or other statistically processed response and update times will not be acceptable. The execution periodicity and response rate mentioned in Appendix-C of Part-B shall be maintained for all the application software. The performance analysis shall be part of the Technical proposal in the bid.

An updated performance analysis to reconfirm the ability of each system to meet owner’s performance requirements will be submitted by the Contractor after completion of detailed system design.

Failure to meet the performance criteria shall require the contractor to provide all necessary hardware and software modifications and additions until the performance criteria are satisfied.

***Test mentioned under this section shall be conducted on size defined under the Appendix-F and future expansion requirement mentioned in Appendix- F for respective control centers.***

**Table 1- PERFORMANCE REQUIREMENTS**

**(a) User interface requirements**

At no time the SCADA/EMS system shall delay the acceptance of User request or lockout console operations due to the processing of application functions. Response time for following user interface is defined below

Item no.	User Interface Requirements	Response time
(i)	Requests for call-up of displays shall be acknowledged with an indication of request is being processed	Within 2 sec
(ii)	Any real time display and application display (except database displays) on workstation console, Complete display & data values shall appear on screen	Within 3 sec after acknowledgement of request
	Database Displays/Reports for online data	10 sec
(iii)	Manual Data entry of the new value shall appear on screen	Within 2 sec
(iv)	Display (including Trends) update rate	Every 2 sec for 4 displays together to be completed in 0.5 secs
(v)	Panning of a world display from one end of screen to other end of screen in a continuous manner	Within 2sec
(vi)	Response time for display of Alarm and event after receipt in SCADA system	Within 2 sec of receipt in system
(vii)	Alarm and event acknowledgement	Within 2 sec
(viii)	Requests for printing of displays shall be acknowledged with an indication of request is being processed	Within 2 sec
(ix)	Requests for generation of reports shall be acknowledged with an indication of request is being processed	Within 2 sec
(x)	Video projection system display update rate (Shall be performed during SAT)	Every 2 sec for 4 displays together to be completed in 0.5 secs
(xi)	Export of trend data (8 trends, one day)	1 sec
(xii)	Supervisory Control	2 second plus scan time + device operation time + communication time
(xiii)	User request to jump to a different zoom factor shall cause display to be presented	Within 2 sec

Item no.	User Interface Requirements	Response time
(xiv)	Historical playback set-up for at least 48 hours' time span shall be ready for playback	Within 1 minute
(xv)	Display of real-time trends in SCADA of at least 100 points (1 day data)	Within 5 sec
(xvi)	Requests for generation of reports for at least 100 points (15 min average- block wise) for a period of 1 month	Within 2 minutes
(xvii)	Data inserted from external sources directly to SCADA System shall be transferred to other control centre through ICCP	Within 20 sec

**(b) Utilization**

This utilization shall be applicable to all the servers and end user devices.

Description	Average Utilization	Comments
<b>PROCESSOR UTILIZATION</b> Server, Workstation, VPS	15% 25%	Normal loading Peak loading
<b>LOCAL AREA NETWORKS</b> Unconditional Access (e.g., Ethernet)	15% 20%	Normal loading Peak loading
<b>AUXILIARY MEMORY</b> Access & Transfer capacity	15% 25%	Normal loading Peak loading
<b>RAM UTILIZATION</b> Server, Workstation, VPS	30 % 40 %	Normal loading Peak loading

**NMS functionality Impact**

The NMS shall not impact the availability and performance of SCADA/EMS system and shall not load more than 3% of any host CPU, 1% Network Bandwidth and shall have secure communication.

Description	Shall not load more than	Comments
PROCESSOR UTILIZATION of any host CPU.	3%	Peak loading
NETWORK Bandwidth	1%	Peak loading

**Table 2- NORMAL LEVEL OF ACTIVITIES**

The normal level of activity shall simulate system activities spread over one hour period to generate normal loading scenario. During the testing, the response times and the average utilizations shall not exceed the specified values. The following conditions define normal level of system activity to generate the normal loading scenario. Test simulation shall be done using software tool to generate this loading within 1 hour. Staggering of loads during the test duration of 1 hour is permitted but there shall be at least one hour crossing.

- (a) All RTU data shall be scanned and processed at rates specified in **Appendix-C of Part-B.**
- (b) All data exchange with other systems shall occur as specified in the Specification.
- (c) Average, Maximum and minimum value shall be calculated on its own for 100% of the analog as per Miscellaneous Sample Reports Appendix-I of Appendix-B.
- (d) 80% of the analog values shall be changing in every scan.
- (e) All periodic functions shall be executed at the rates defined in **Appendix-C of Part-B.**
- (f) The following SCADA/EMS functions shall be executed on-demand:

**SCADA/EMS FUNCTION**

S. No.	Function	Number of demand executions
A	<b>SCADA Functions</b>	
1	Network Status processor	50 state changes
2	SOE	500 SOE Point Reported
B	<b>EMS Functions</b>	
1	Contingency Analysis	4 Studies



S. No.	Function	Number of demand executions
2	Optimal Power Flow	4 Studies
3	Transmission/Corridor Capability Monitor	4 Studies
4	Short Circuit Analysis	4 Studies
5	Transient Stability Analysis	4 Studies
6	Outage Scheduler	Define 30 new Schedule and two revisions of 5 schedules
7	Load Forecast	4 Studies
<b>C</b>	<b>DSA Functions</b>	
1	Voltage Stability Assessment	2 Studies
2	Transient Stability Assessment	2 Studies
3	Small Signal Analysis	2 Studies
4	Load Flow Analysis	2 Studies

- (g) Alarms (30 X no. of substations) per hour shall be generated. Each alarm shall be acknowledged individually within 5 seconds.
- (h) Events (30 X no. of substations) per hour shall be generated.
- (i) 60 Supervisory control actions shall be performed over the 1-hour test period using normal supervisory control procedure.
- (j) 1 display per workstation per minute shall be called up.
- (k) Communication channels shall be monitored as specified.
- (l) Fail and restore 1 RTU per 5 minutes
- (m) Fail and restore 1 ICCP server connection every 30 minutes (communication port enable/disable)
- (n) Exchange at least 10000 data points with offline System in real time through Web Services.
- (o) Web servers to be accessed by 200 people simultaneously
- (p) The following user interface actions shall be perform

### USER INTERFACE ACTIONS

Display Selection	30 per operator workstation
Display Updates	Each operator workstation shall display 3 updating and 1 non-updating display window per monitor. <b>Updating displays:</b> - alarm summary list - Geo display containing a S/S SLD - Network display <b>Non-updating displays:</b> - SCADA/EMS System Display
Data Entry	5 data entry actions from any single display
Display Trending	8 display trends, each trending 4 variables
Reports	Prepare and printing of 10 reports as described in <b>Appendix-B of Part-B.</b>

(q) Communications channel monitoring shall be performed.

(r) The following maintenance activities shall be performed:

### MAINTENANCE ACTIVITIES

Function	Task
On-Line Database Editing	Modify 20 data points in each of the 5 Substations
Display Generator and Management	Modify 5 single-line diagram and 5 tabular display
Storage of EMS data files as per section 2	(a) Transfer and store 1 save case for each application (b) Transfer and store 2 files of selected 10 minutes duration of continuous real-time data for playback and trending
Storage of DSA data files as per section 2	(a) Transfer and store 1 save case for each application. (b) Transfer and store 1 file of selected 15 minutes duration of assessment.

- (s) Display of real-time trends in SCADA of at least 2000 points (1 week period)
- (t) Following backup and system update activities shall be performed

Image backup	SCADA/EMS Servers, ICCP Servers and FEP servers
Data Archival	Archival of Historian data
Security Patch update	All machines shall be updated using patch management system.
Backup Control Centre synchronization	Real time data every 10 second

**Table-3: PEAK LEVEL OF ACTIVITIES**

The peak level of activity is in addition to the normal level of activity described in **NORMAL LEVEL OF ACTIVITIES** above to generate peak loading scenario. The peak level of activity shall be applied for a five-minute period. During the next ten minutes, only the normal level of system activity shall be applied. This test shall be repeated for four consecutive fifteen-minute periods, for a total peak level test time of one hour. The five-minute peak loading period shall coincide with SCADA/ EMS system period where all periodic software is scheduled for execution and at least one five minute period shall span an hour boundary to consider the scheduled hourly periodic activities. There shall be no restrictions on the period when the five-minute peak can occur.

The software execution rates, response times and performance requirements defined in **Appendix-C & D of Part-B** shall not exceed during the peak loading conditions. The following conditions shall define the additional peak level of system activity:

- (a) System Alarms
  - (1) 300 alarms in a scan cycle starting the five-minute period (50% status changes and 50% analog limit violations)
  - (2) 200 alarms per minute for five minutes (50% status changes and 50% analog limit violations)
  - (3) 50% of the alarms shall be acknowledged within the five-minute period (automatic acknowledgement is unacceptable).
- (b) Display Requests - 6 display requests per minute per console
- (c) Supervisory Control- 4 supervisory control actions per minute
- (d) Reports - Prepare 30 reports(containing minimum 100 points).
- (e) Fail and restore 5 RTU per minute
- (f) Fail and restore communication with 1 ICCP server every 30 minutes
- (h) Fail and restore with one other control center every 15 minutes
- (i) 100% of the analog values shall be changing in every scan instead of 80% considered during the normal level of activities.

# **VOL. II, PART-B APPENDIX - E QUESTIONNAIRE**



## Appendix E QUESTIONNAIRE

The following set of questions has been prepared to aid in evaluation of the SCADA/EMS proposals. The Bidder shall submit answers to all questions. **A question that requires a lengthy reply that is already contained in the body of the proposal may be answered by providing an exact volume, section, page and paragraph reference.**

### **Ref. Part A: General Information Project**

1. Please describe how the Communication with existing RTU will be established in the new Control Centre without interrupting the operations in the existing System?
2. How does the bidder propose to acquire and merge all the regional Sequence of events (SoE) data from all RLDCs and other control centers? How the names of SoE tags from SLDCs/RLDCs will be mapped corresponding to RLDCs/NLDC database names?
3. The existing historical database is in proprietary time-series database of Instep eDNA historian. How will this data be imported into new Historian server?
4. How will the bidder import the existing SCADA-EMS database into new system?

### **Ref. Section 1: SCADA Functions**

5. When was the offered release of product released? What percentages of the current users are on the offered release of product or say one version earlier? What is the roadmap for the next release? How many users are on version older than 7 years?
6. Describe how the security provision in bidder’s system confirms to IEC 62351 Standard?
7. List the non-critical functions of SCADA/EMS System Applications offered?
8. How the security certificates for ICCP shall be generated and managed for implementation of Secure ICCP? How Secure ICCP will be configured when ICCP at another end is not Secure ICCP compliant? What policy is recommended for renewal of certificates and Certificate renewal List (CRL) for Secure ICCP implementation?
9. Could the system be able to send multiple controls without feedback from

individual control command?

10. In case of cold start how all digital points and analog points will be initialized, whether it will be the default values provided during database build or from telemetry?
11. In case of hot start of the SCADA system whether all good values which were available before the hot start of the system will be retained?
12. How will the vendor ensure implementation of secure IEC-104 in SCADA System and what are the requirements at the field site??
13. **Remote Terminal Unit (RTU) related Queries:**
  - a) Please explain where in the Control Centre network, Existing RTU Configuration Tools can be connected for downloading information to/from Existing RTUs.
  - b) Describe the RTU communication monitoring, recording and statistics function provided with the SCADA/EMS system and its transfer to the historian System.
  - c) Please provide the storage capacity required for RTU communication statistics to meet the requirement specified in **Appendix C of Part-B** with supporting calculation details.
  - d) Describe the procedure for defining or changing scan rates and assigning RTU points to specific scan rate groups.
  - e) How can demand scan be done by user for individual scan groups and collectively? What functionalities are available to initiate request / demand for RTU/SAS scan on group basis?
  - f) Describe how an RTU is placed in Test mode? How are the Test displays different than the real-time displays? How is the communication error history maintained for each RTU in Test mode? Please attach the snapshot of the error history of RTU in test mode.
  - g) Describe the procedure followed for the RTU Time synchronization by the SCADA/EMS system? How will the proposed solution achieve the time synchronization of existing RTUs.
  - h) Please describe the ability of the system to download configuration files of existing RTU and generate S9R files for configuring new RTU. If not available, please explain where in the network, existing RTU Configuration Tools can be connected for downloading information from Existing RTUs.
  - i) How can a virtual RTU be created and integrated with SCADA System for data

exchange?

**14. Inter Control Centre Communication Protocol (ICCP) related queries:**

- a) How is the ICCP Backup communication channel tested periodically?
- b) Please provide the storage capacity required for ICCP communication statistics to meet the requirement specified in Appendix C of Part-B with supporting calculation details.
- c) Describe the details of ICCP profile to be implemented by vendor in proposed system. Provide the PICS statement and ICCP Association Information Exchange Form (EPRI) for the ICCP protocol provided with the SCADA/EMS system?
- d) Describe the various ICCP blocks which shall be used for exchange of data and messages. Also please describe the following:
  - The API/application through which local applications interface to ICCP to send or receive data.
  - Management functions for controlling and monitoring ICCP data links including user interface to ICCP for user management of ICCP data links.
  - Failover schemes to meet availability requirements.
- e) How alternate data tag/flag shall be transferrable over ICCP between control centres?

**15. Data exchange between Main and Backup Control Centres related queries:**

- a) Please provide the Bandwidth calculation requirement for data exchange (real time and historian data synchronization) between the Main and Backup Control Centres?
- b) Which protocol will be used for Main-Backup Control Centre Communication? If Proprietary, what are the advantages of using proprietary protocol between Main and Backup Control Centre compared to Standard ICCP?
- c) Can Remote Consoles Connected to Main SLDC access Backup Control Centre upon failure of Main Control Centre if Communication between Main and Backup Control is not affected.
- d) Which protocol will be used for Main-Backup Control Centre Communication? If Proprietary, what are the advantages of using proprietary protocol between Main and Backup Control Centre compared to Standard ICCP?

16. In “Alternate Data Source Processing”, if none of the arguments have valid value what the data will be considered?

**17. Historian related queries:**

- a) Which Historian system is proposed to meet the requirements? Describe its features.
- b) Describe how the Historian historical information data retrieval mode will operate when displays or the SCADA/EMS database have changed since the time the Historian data was collected.
- c) How will the user archive a selected time window of interest for Real time storage and playback in Historian and retrieve the same in future? How long will the archived snapshot remain in Historian?
- d) Please elaborate the storage capacity required for Historian system to meet the storage requirement specified in **Appendix C of Part-B** for each type of data with supporting calculation details.
- e) Does historian support the storage of data at a resolution of 1 Second? If yes how
- f) In case of any change in existing SCADA data base, due to change in network etc., will any change in historian data base would be required?
- g) How unique ID in historian system will be maintained particularly in case of change in name of transmission elements which may arise due to network rearrangement such as LILO etc. Whether previous and new ID can be retained to extract the relevant data for the required period.
- h) While extracting data from historian system how user shall be able to opt data extraction in row wise and column wise as per user requirement?
- i) How 01-year data will be available for trending purpose, particularly in case of failure of communication between historian and SCADA system?
- j) How proposed system will take care buffering of data and file in case of communication failure between historian and SCADA system. How user will know buffering of data in SCADA system has started/ended. How buffered data and file will be transferred to historian automatically once communication between SCADA and historian is established?

**18. Common Information Model (CIM) related queries:**

- a) Indicate the degree of compliance to IEC 61970:
  - How will IEC compliance be achieved in the proposed EMS

configuration?

- Identify and describe specific limitations concerning the offered applications that can be integrated via the standard compliant interfaces.
  - Elaborate proposed migration in all above cases of non-conformance.
- b) Describe the structure of the power system model database and describe any restrictions to model sizing and types of model elements, including element types not listed in the Specification. Also submit the modelling parameters and give comparison w.r.t. CIM (IEC 61970) components.
19. Describe the philosophy to be followed for exchange of model data with the boundary system / control centres in case of full and equivalent model exchange and its maintenance.
  20. Please describe the OPC server features of SCADA/EMS System. How many OPC clients does it support?
  21. Is there any limitation or pre-requisite to access real time data through Personal Computer? Please mention the platform and product limitation if any for the above functionality.
  22. How to do ‘Redundant data Source processing i.e., how the best quality and highest-ranking value will be stored in the database?
  23. Please provide the storage capacity required for Continuous data storage in SCADA System to meet the requirement specified in **Appendix C of Part-B** for each type of data with supporting calculation details.
  24. How the network topology processing function would function while playing back historical data?
  25. Describe the utility specified to list the displays where specific database is used.
  26. Is it possible to take snapshot of pre-defined SCADA displays (max. 25 displays) and store them in historian automatically at a predefined periodicity?
  27. Whether stale data check is available for the analog points or limited number of analog points need to specified against this feature?
  28. Separate Quality codes are required for manual entry at remote source and at local SCADA, how it will be achieved?
  29. How data exchange will take place with other systems in master/slave configuration on ICCP and IEC 60870-5-101/104 Protocol?
  30. How many master/slave configurations in IEC 60870-5-104 Protocol shall be supported in proposed system?
  31. Elaborate the different methods of data exchange to be supported by supplied system?
  32. How to identify RTU failure and Channel/Communication failure under the



- supplied system?
33. How data exchange of SCADA/EMS system with other system/application i.e., URTDSM, REMC, IT will take place?
  34. While extracting digital status from historian system how bidder will display the status of device (i.e., Open, Close etc.) instead of displaying bit value (i.e., 0,1 etc.).
  35. Kindly specify type of functionality available for data exchange (read and write) directly from SCADA system in real time for user define interval, apart from OPC/API.

**Ref. Section 2: EMS FUNCTIONS:**

36. Explain how State Estimation estimates un-telemetered transformer tap positions.
37. How the proposed system shall use the PMU Data for State estimation? Describe the ability of Bidder's EMS application to integrate with PMU measurements if sufficient PMU data is available.
38. Can Current Phasor measurement be used as a input in Hybrid State Estimator? Explain what changes will happen in algorithm?
39. How will the functionality of automatically replacing the status of switching device to close if MW and MVAR flow on the device is more than the threshold value if open.
40. Each SLDC is expected to exchange the database model with RLDC or SLDC (through RLDC). How far the supplied system is capable of implementing CIM based model exchange in such case.
41. Describe your HVDC model experience i.e., list of projects where implemented as part of State Estimator and OPF.
42. Describe the method for calculating and updating the busload distribution factors, including the time-filtered switch parameter feature.
43. Describe the ability of system to model Generators based on Solar, Wind, Biomass and Paddy Straw.
44. Describe the ability of State estimator to run separately for following different categories wise networks to measure the state?
  - (a) Voltage level wise (all 765kV, 400kV, 220kV)
  - (b) Owner/Utilities wise (central sector, state sector)
45. Describe the modeling of power system components in the transient stability studies? Is it a separate modeling tool provided which is different from

SCADA?

46. Describe the effects of external power systems on the transient stability study of the system and extent of external system modeling required?
47. Describe the methodology of formation of reduced Equivalent network? How the reduced network is represented internally? What data is required to generate a reduced network?
48. Whether it is possible to define node/lines/network which is required to be represented as reduced equivalent?
49. What is accuracy of the solution when the reduced equivalent is used in place of full network?
50. Please describe the proposed solution to exchange data with IT application such as scheduling using web services.
51. Please list the size of database being offered in.
52. Describe the ability of DTS system to simulate the PMU data.
53. Can DTS functionality be demonstrated on a Laptop? If so, what will be the minimum hardware requirement for the laptop?
54. How the reactive power controller will regulate the reactive power exchange with the AC network within a user-adjustable dead band of a reference value set by the user where Control will be subject to constraints imposed by AC voltage limits, minimum filter requirements, and maximum connectable shunts?
55. How in DTS, power system model (PSM) the load curves shall be stored in normalized form and shall require a peak load to be specified for all separate power systems being modelled?
56. How in DTS, power system model (PSM), models of varying complexity of different energy sources shall be provided for all types of units. The first level models, which are the most complex, shall be represented with high accuracy; high computation models and includes all details of boiler turbine and other auxiliaries. The second level of models shall be simplified versions derived from the first level models. The third level models shall be fast computing approximate models and shall represent various units by changing its parameters?
57. When modeling transmission lines in database what are the main fields? Does it include line length, type of conductors, reactance & resistance per km etc.
58. Do you have standard application to meet the requirement of TCM or it will be

- a custom development for the project?
59. How much time historian will take to produce a system daily load (maximum daily load) trend for five years with system size defined in the **Appendix F of Part-B**?
  60. How much time historian will take to produce a report of system frequency consisting of monthly maximum and monthly average frequency for five years with system size defined in the **Appendix F of Part-B**?
  61. How your system (state estimator etc.) will take care of line and reactor modeling where reactors are provided with switch which can connect them to either a line or bus? Please elaborate on bus reactive power mismatch and line impedance calculation.
  62. Does the OPF application has functionality to evaluate for week ahead, month ahead security constraint unit commitment?
  63. Does the OPF application has functionality to maintain constraint for reserves based on user defined quantum?
  64. Does the OPF application has functionality to yield system cost (objective function) and sensitivity (Lagrange multiplier) corresponding to each control variables?
  65. **Automatic Generation Control Related Queries:**
    - a) For Hydro power plant modeling in AGC, can forbidden zones be handled by the proposed software? NLDC software has a custom feature.
    - b) Presently AGC software accounting is done through SCADA. Can the proposed software generate scheduled reports (say every week) for AGC accounting? The reports need to contain fields that are the average or absolute figure for a certain period of SCADA data.
    - c) Can the proposed software read and handle data from the csv, excel or IT database? For example, presently, Variable Cost, Schedule, SCED Schedule, Ramp rates, etc. are read from our IT system.
    - d) Can customized displays for the control room be built using the proposed software, which can also execute commands?
    - e) Presently as per the prevailing CERC Order, the participation factor for distributing ACE between different plants is calculated using a custom method that uses normalized variable cost and ramp rate. Can the proposed software facilitate the same and be flexible for any other changes that the regulator might suggest in the future?
    - f) Can the proposed software send multiple control signals from the AGC software to the power plant covering both digital and analog signals? For

example, presently AGC setpoint (analog) and AGC suspend status (digital) and SCED Schedule (analog) are being sent to the plant.

- g) Are multiple control signal options (like SBO-Select Before Operate, Direct, etc.) compatible with the software? Presently, different make of field equipment has different choices enabled at the site.
- h) Can the software handle multiple limits and nested limits?

**66. Dynamic Security Assessment Related Queries:**

- a) Are DSA applications and EMS Base Case inherently integrated?
- b) Can available reactive power reserve be determined from the Base Case at the execution of PV analysis?
- c) Can the user define Source and Sink for VSA execution?
- d) On what basis would PV and QV analysis of the base case identify weak buses?
- e) Can we evaluate the available reactive power reserve from the base case?
- f) For TSA applications any user defined model can be created either for Conventional Generators (Thermal and Hydro), Solar, Wind and Battery Energy Storage System?
- g) TSA execution and evaluating critical clearing time is based on contingencies (record numbers/unique ID for contingency) defined in EMS (Steady State) Applications.
- h) Should we be able to view the entire Dynamic Model Block diagram of generators and loads within the TSA application?
- i) What are the inputs required for real-time SSA application execution?
- j) What is the method of SSA analysis in the available product?
- k) What are the attributes of the results of SSA execution in real-time or study mode?

**Ref. Section 3: USER INTERFACE**

- 67. Please elaborate how you plan to structure the user login – single sign on – across the platform for all applications i.e., SCADA, Network, historian, ICCP, etc. Will it require a separate hardware for identity management?
- 68. Please elaborate how the MIS subsystem (Web and Historian) is placed

- with reference to main SCADA EMS and how SCADA users' identity will be managed for login to these across the firewall.
69. Can SCADA/EMS Operator access the historical data for making reports or seeing the logs of NMS System with Single Sign on?
  70. Describe the graphics user interface capabilities of proposed user interface and possibility of using drag/drop/encircling of nodes on world display/tabular display for calculation/ element identity.
  71. Describe the procedure for trending real-time data. Further please comment on possibility of default trending of all the SCADA data, say for past 24 hours or any other period.
  72. Describe how the proposed quality code of the data being trended can be displayed in Graphical trends and Tabular trends?
  73. Describe the approach used by the Alarm Management function to filter alarms and present only the most significant alarm information to the user.
  74. Describe the alarm message formats and modification capabilities to be included with the proposed SCADA/EMS.
  75. Describe the methods for report review and data modification.
  76. Describe the display building procedure for features such as Rotating of 'text' alignment at some angle/ horizontal/vertical, font in italics, bold, support for no. of Font sizes.
  77. Describe the printing functions and the options provided like orientation, background colour, page size, colour/black & white, print preview, printing complete display and printing a part of display selected by user.
  78. Describe how the user interface for Web users (Remote Consoles/External clients) is different that the user interface for the local Operator workstations.
  79. Describe how data will be made available to the Web Server users for downloading.
  80. Is there any standard display for limit override summary or it will have to be customized?
  81. Is it possible to integrate any Video Conferencing Utility to facilitate online meeting and discussion among operators of Control Centre/Sub Stations? Will it require a separate channel for communication? What will be the impact of the same on ICCP/RTU data if the same channel is used?



82. Is there any provision for Instant messaging among operators of same/different control centres in the supplied product?
83. Is it possible to integrate Video Surveillance feeds from Substation on to the operator screens? Will it affect RTU/ICCP Communication if same Communication Channel is used?
84. Can the supplied system display text in displays and report in Hindi and other Indian languages?
85. Describe the approach used for drag-and-drop of any object within an application as well as from one application to other applications (for example, dragging a value from a single line display into a trend view to see its history).
86. Describe the approach used for using standard editing tools of full graphics windows User Interface e.g. cut, paste, copy, drag, drop from the ICCP and SCADA database.
87. How Multi Factor Authentication for internal user can be achieved?
88. How all the details related to statistics related to communication channel (i.e., Uptime, downtime, identification of active channel etc.) shall be available in single browser for real time data and historical data?
89. How many data points can be trended simultaneously in proposed system on a single workstation and on a single window?

#### **Ref. Section 4: SYSTEM SOFTWARE REQUIREMENTS**

90. Provide descriptions of the proposed software design standards and the industry standards that are used. How the proposed product is Service Oriented Architecture (SOA) compliant?
91. Please describe the NMS offered for management and resource monitoring and proposed solution for security and patch management and update.
92. Describe the time synchronization process from GPS receiver and SCADA/EMS computers and Web Servers. What is the accuracy of time synchronization achieved for the Computers on local LAN?
93. Describe the Remote diagnostic capability provided between the SCADA/EMS system at control centres and the bidder's support offices or through the user's remote facility.
94. List all network software proposed and that which is available from the bidder and from the hardware manufacturer.
95. Describe the proposed network security software tools and environment for

- the owner network of users.
96. Please elaborate on the issues if any for Fire Wall configuration and redundancy of connection of Historian with SCADA/EMS.
  97. Provide those parts of the database user's manual that describe the Bidder's standard approach to building and maintaining the database, including the types of data structures used and the proposed scheme for the various system functions to access this database.
  98. Describe the support tools provided that allow data to be moved between Source database and real-time data sets, as applicable.
  99. Elaborate the editing of database (SCADA / RTU) in real time and the parameters allowed for editing.
  100. Describe the complete set of performance data collected, how data quantities are measured, and the calculations that are performed.
  101. Provide a software summary chart that includes all programs in the proposed system. The following entries shall be included for each program, called program, and subroutine –

Sub-system	Name/ Function	Language	Status
SCADA System			
EMS System			
User Interface			
Historian			
CFE			
Web System			
NMS			
ICCP			
Development System			
Security			
Load Forecasting			
..... others			

**Legend:**

- a) Name and function: Program name and statement of its function
- b) Language: Programming language in which program is written
- c) Status: The date of initial release and project name of first use in a control

system, the expected delivery date for new, altered, or custom-designed SCADA/EMS software.

102. Describe the features of the proposed on-line documentation access capability for all software products provided with computer system.
103. Is it possible to selectively integrate the databases files of various constituents in the region and automatically generate SCADA/EMS and ICCP databases for any desired Control Centre in the Region?
104. Explain, how the data/file from different versions of CIM in underlying control centers shall be integrated at NLDC?
105. Describe how a station modeled in two regions can be identified by CIM tool (e.g., HVDC Talcher at ER & SR say by node connectivity etc.).
106. Describe method available for mapping/identifying/generating ICCP data sets using the CIM tool.
107. Explain, how the different versions of CIM underlying control centers shall be integrated at NLDC?
108. Explain, if same sub-station (HVDC Talcher) is modeled in two regions (ER & SR) in two different ways i.e., by two different vendors (OSI & Alstom), what will be NLDC acceptance criterion on which model to be taken.
109. Please describe the solution proposed (hardware and software) for system image backup and file backup.
110. FEP and ICCP are virtualized machine in the single server, whether there will be impact on performance and troubleshooting?
111. Please provide information on operating system which will be supplied under the project for critical servers like FEP, ICCP, SCADA, historian etc.

#### **Ref. Section 5: HARDWARE REQUIREMENTS**

112. Provide a timing analysis for the normal and peak load conditions defined in **Appendix D of Part-B** for Performance Requirements. State all assumptions made and include all calculations used to produce the timing study.
113. Describe the capabilities and features of the proposed video projection system.
114. Describe how the SCADA/EMS configuration can change, grow, and be expanded to meet future system requirements.
115. Please submit a calculation sheet for individual and total heat as well as electrical load of the all-Control Centre equipment for calculation Air Conditioning and Power Supply Requirements.
116. Please elaborate the data base development applications hosting and hardware requirement. Also indicate the node on which it is proposed to be housed in offered configuration.

- 117. Remote Terminal Unit (RTU) and terminal server related queries:**
- a) Please provide the details of the solution offered for terminal server.
  - b) Please explain how the data integration done through Terminal Server between existing RTUs and Control Centre being supplied.
  - c) Explain how data configuration of terminal server will be done. Is there any limitation.
- 118.** Please elaborate the data base development applications hosting and hardware requirement. Also indicate the node on which it is proposed to be housed in offered configuration.
- 119.** Please list the data that will be exchanged across each LANs.
- 120.** What will be the loading of each LANs with the proposed system size? Please provide the detailed calculation.
- 121.** Please provide the minimum firewall throughput required to meet the data exchange requirement across the LANs with supporting calculations.
- 122.** Have you ever implemented FO LAN? Please share your experience.
- 123.** Is there any limitation in FO LAN Implementation in Control Centre?
- 124.** If wireless keyboard & Mouse is proposed, Is there any issue of frequency interference between different workstations?
- 125.** FEP and ICCP are virtualized machine in the single server, whether there will be impact on performance and troubleshooting?

### **Ref. Section 6: CONFIGURATION CHARACTERISTICS**

- 126.** Describe how the Backup databases are maintained in the SCADA/EMS system.
- 127.** Provide a schematic diagram of the proposed system configuration.
- 128.** Describe the Error detection and failure determination of the critical SCADA/EMS system functions and servers.
- 129.** Please describe how Systems of Main and Backup RLDC be synchronized for various application. What will be the failover mechanism?

### **Ref. Section 7: INSPECTION & TESTING**

- 130.** Provide an availability analysis for the proposed configurations to meet an availability goal of 99.9%. The analysis shall include the mean time between failures (MTBF) and mean time to repair (MTTR) of all components, and the historical, statistical basis for the analysis. Specific assumptions on availability of spare parts, maintenance responsibility etc. not in line with proposed contract shall be listed. The analysis shall also present the availability for

individual devices.

131. Provide a sample test plan and corresponding procedures for factory test of an application program.
132. Provide a sample test plan and corresponding procedures for Load testing & functional testing of Web Server application and it should also exhibit how the performance and scalability of applications would be tested.

### **Ref. Section 8: WEB SYSTEM APPLICATION**

133. Describe the Web services being supplied in the bidder's proposal. How will these web services import of data from offline applications into the SCADA or Historian server? Similarly, how real time/offline data in SCADA/Historian will be pushed to offline applications using web services.

### **Ref. Section 9: CYBER SECURITY REQUIREMENTS**

134. Describe the features and functioning of
  - (a) Application whitelisting tool
  - (b) End point security
  - (c) Intrusion detection and prevention system
  - (d) SIEM
  - (e) Patch management tool
  - (f) Asset management tool
  - (g) VAPT tool
  - (h) Firewall
  - (i) Router
135. Please describe the feature of DDS which will be used as test bench for cyber security requirement.
136. Please elaborate the cyber security policy.

### **Ref.: TRAINING, SUPPORT SERVICES, AND MAINTENANCE**

137. Describe any user groups that exist for the Bidders' equipment and software.
138. Describe how the maintenance responsibility requirements will be met.
139. Describe the Bidder/OEM upgrade and information services that are available for offered system.
140. Please elaborate arrangement with OEM for maintenance of the hardware such as Video Projection System, Servers, UPS, DG Set, etc.
141. Provide the complete itemized list of proposed consumables, including quantities.

**Ref. PART A: PROJECT MANAGEMENT, SCHEDULE AND DOCUMENTATION**

142. Provide a preliminary project schedule. This scheduled shall include the payment milestones defined in Volume I and be consistent with the implementation plan
143. Describe the difference in the proposed documentation and the documentation required as per specification.
144. Provide a sample Software Functional Requirements Document.
145. Provide a sample Software Design Document.
146. Provide a sample User Document for Dispatchers.
147. Provide a sample System Administration Document
148. Identify the formats (e.g., MS Word, .DXF drawing format) and media (e.g., CD, DVD, paper copy) to be used for final documentation of the following:
  - a) Standard documents produced by the bidder
  - b) Standard documents produced by third-party suppliers
  - c) Custom or modified standard documents
  - d) Other final documentation.

**Ref. Part B, Appendix B: PERFORMANCE REQUIREMENTS**

149. Please describe the feature of display design which will provide sample display attached at Appendix-B.
150. Please describe the report generation facility for creation by dispatcher which will provide sample reports attached at Appendix-B.
151. Please describe how these reports will be published for the web users.

**Ref. Part B, Appendix D: PERFORMANCE REQUIREMENTS**

152. Identify type of displays that will not meet the required display response times (local and remote consoles) and state the guaranteed response times of these displays.
153. Describe how the various load scenarios shall be simulated. List the tools which will be used for creating the load scenarios, measurement of performance and timing.
154. Describe how the performance of web server will be met as mentioned in the performance table for servers, when hundreds of virtual users would be accessing the application simultaneously, without effecting the load on



application performance, and how the scalability of all web applications are being managed.

155. How performance requirements are relaxed to make optimal use of system resources during conditions of excessive loading (beyond the specified requirement in this specification), which affects the operation of critical functions?

### **Miscellaneous Questionnaire**

156. How a Dashboard for performance monitoring of EMS applications as per the sample attached at Appendix B (B27)

157. How the User Interface will automatically re-initialize the various parameters (operator selected) associated with State Estimation process after running a specified number of times by the operator. A sample snapshot is attached as Appendix B(B26). Please submit the sample page/report of the proposed system.

158. Network equivalencing and Truncation shall be supported. It could be based on Station, voltage level and any class such as Area, region, etc. An example of truncation is given below –

*While truncating the network at 400kV and above level, all the switching devices at 220kV and below level are opened in Network database and Modeled Loads are connected at the secondary side of 400/220kV ICTs. These modeled loads take the Real-time data on associated ICTs as its load measurements. A sample illustration is attached in Appendix B (B34 -C), submit a copy of this feature with example of one such case.*

159. Please elaborate and attached a sample report/page that how On-line editing of ICCP database should be possible. Any changes made in SCADA database should be automatically reflected in ICCP database. Proper User Interface for online editing of the ICCP database and mapping with other CC can be provided.

160. Show with a sample print out that how Every Alarm should be accompanied by an Audible tone which should be configurable for some particular events also, like:

- Frequency drop.
- Overloading of some important 400kV lines.
- Generation tripping of important stations (individual and total).
- And as per the operator's requirement.

Also clarify and submit supporting printout that a dedicated display can be provided for selection of Audible Tone in separate category of Alarms and The

- automatic generation and sending of an E-mail & SMS containing operator selected Alarm or user-defined data should also be possible.
- What are the hardware and software requirements for sending Email and SMS? The required hardware and software would be connected to which server?
161. Submit a sample report & elaborate that how Geo-spatial display with contour map of Data within geographical boundary of India should be provided in which Zoom-in, Zoom-out, Pan, etc. option should be available in the map. Display Builder should be capable of importing point and placing a pre-defined picture/symbol as per the Latitude and Longitude specified by the user. The “Playback” option should be made available in the map so that the continuous pattern over the period of time should be visualized. The pattern should be exported in a video format so as to use it in offline mode. An illustration is attached in Appendix B(B40).
  162. Submit a sample report & elaborate that how Customization of axis in creating trends - In the “x” & “y” axis range of every interval should be displayed. On the x-axis the time format and displayed time should not be only displayed as a multiple of “GMT + 5:30” as in the existing system displaying round-off figures such as “5:00pm”, “6:00pm” etc. is not possible as it is not a multiple of “GMT+5:30”. In other words, the major and minor grid should be user configurable in such a way so as to avoid these limitations. An illustration is attached as Appendix B(B18).
  163. Submit a sample report & elaborate that how Display building features such as Auto-fit to Screen, user-defined font size for visualization, automatic pop-up display for calculations, shall be provided in the system.
  164. Submit a sample report & elaborate that how Visualization displays of SCADA/EMS system shall be able to take images from third-party software providers such as Google Earth, etc. as the background images. A sample display is attached in Appendix B(B41).
  165. Submit a sample report & elaborate that how Feature to “find/search” stations in the geographical display should be possible.
  166. Submit a sample report & elaborate that how in case of any pre-defined event the Geographical visualization should automatically focus on that point grabbing operator attention.
  167. Submit a sample report & elaborate that how the “playback” or “reconstruct” option which fetches the archived data and displays it in the required display should be able to export the corresponding playback of data in video format so that it could be visualized offline in some other system.
  168. Can “rate of Change” be added specifying that this should be automatically associated with every analog data field?

169. Please submit a detailed report telling that how all RLDC being upgraded on different CIM versions e.g. 10th version, 12th version etc. shall be finally merged into one CIM model at NLDC. As the SCADA/EMS system should be CIM compliant and import of SCADA and Network database should be possible from RLDCs with minimum efforts required in modeling of database.
170. Explain how provision to define multiple sites for each telemetered data shall be given. In case the data from one site is not available then the data should be fetched from other site in priority automatically (can it be taken from URTDSM system if the information isn't available in EMS/SCADA system).
171. Clarify & submit a report that how Statistical analysis for availability of telemetered data should be provided such as Period of availability/non-availability and its reporting based on various filters such as point-wise, station-wise, region-wise, etc.
172. Explain how an Integration tool with user interface can be provided for real-time SoE integration at NLDC, where the SOE is collected in different formats from all RLDCs.
173. Submit a solution that how “Monitoring and Compliance Manager of Critical Infrastructure Protection Standards (as per Sec 4.9.3 of Part B of Spec)” as described in spec shall be met.
174. Please elaborate how the Scheduling data available with RLDC can be sent to NLDC on ICCP and thru which block of ICCP?
175. Submit a sample format/report showing that how the proposed system is doing the merging of SoE from text and CSV files.
176. Please explain how the SCADA/EMS system shall integrated with PDC (Phasor Data Concentrator) for WAMS (Wide Area Measurements Systems)/URTDSM (Unified Real Time Dynamic State Measurements) systems.
177. Explain how the functionality of importing and adapting of historical data stored in existing Historian for integration in new system, shall be done.
178. How the historian of Main RLDC interact with that of Backup RLDC?
179. Features of user defined real-time calculation shall be available for Estimated Data along with SCADA data. Calculation shall support various mathematical functions. A sample snapshot is attached in Appendix B(B42), submit a copy of this feature with example of one such case.

# **Vol. II, Part-B Appendix - F System Sizing**

## Appendix F SYSTEM SIZING

Initial/present power system size and ultimate system size [Future Number/Quantity (Total expansion including present quantity)] are specified in Tables-1 to 6. The specified size shall be applicable for both Main and Backup Control Centre Computer Systems. All the status points defined in this appendix shall be configured as controllable and accordingly system shall be sized.

Table -1 shows the approximate number of power system components for each Control Centre Computer System sizing. These components need to be modelled for State Estimation and other SCADA/EMS functions, whether or not they have associated telemetry. All the points used for calculations are not telemetered. A more accurate count will be supplied during project implementation.

Table-2 shows the ICCP data to be exchanged with NLDC, RLDCs, State Load Dispatch Control Centres and other Control Centres. A more accurate count will be supplied during project implementation.

Table-3 shows the number of RTUs reporting on IEC 60870-5-101 & 104 protocols and Average number of I/O points per RTU. A more accurate count will be supplied during project implementation.

Table-4 shows the data to be exchanged with other/external computer systems such as off-line applications etc. A more accurate count will be supplied during project implementation.

Table-5 Sizing of the Data historian. A more accurate count will be supplied during project implementation.

Table – 6 Future Number/Quantity (Total expansion including present quantity). The table shows future expansion requirements for respective control centers (main and backup CC). The system shall be designed in accordance with system design parameter mentioned in Appendix-C, system performance requirement mentioned in Appendix-D and table-6 of Appendix-F for respective control centers. A more accurate count will be supplied during project implementation.

**SYSTEM SIZING**  
**Table – 1: POWER SYSTEM COMPONENTS SIZING**

POWER SYSTEM COMPONENT	Present Number/Quantity						
	BSPTCL	DVC	OPTCL	Sikkim	JUSNL	WBSETCL	ERLDC
<b>Substations</b>	175	51	251	33	150	154	1200
<b>Feeders /Overhead Line</b>	3100	450	1660	40	350	350	8000
<b>Transformers</b>	537	120	442	59	300	300	3000
<b>Generating Units</b>	6	25	47	3	4	5	750
<b>HVDC Converter stations</b>	10	10	10	10	12	10	20
<b>Power Flow Buses</b>	788	200	800	150	600	630	4000
<b>Static VAR Compensation</b>	10	10	10	10	10	10	40
<b>Series capacitor</b>	10	10	10	10	10	10	10
<b>Shunt capacitor</b>	39	10	10	10	10	10	1000
<b>Shunt reactor</b>	06	4	10	10	100	10	1000
<b>Series reactor</b>	10	10	10	10	100	10	20
<b>FSC, TCSC, STATCOM &amp; other FACTS devices</b>	10	10	10	10	8	10	30
<b>Wind Farms*</b>	10	10	10	10	5	10	200
<b>Biofuel Plants</b>	4	10	10	10	10	10	10
<b>Sugar Plants</b>	6	10	10	10	10	10	10
<b>Solar Farms/Parks*</b>	16	10	16	10	10	10	200
<b>CO-GEN PLANTS (Hydro plant)</b>	13	10	10	10	10	10	10



**Table – 2: ICCP Point Count**

Type of Data	Present Number/Quantity						
	BSPTCL	DVC	OPTCL	Sikkim	JUSNL	WBSETCL	ERLDC
<b>Analog Points</b>	78000	35000	15368	112	10000	Import-10458 Export- 5922	300000
<b>Status Points</b>	78000	40000	16724	135	20000	Import-15857 Export- 8381	450000

**Table – 3: System sizing (Initial) for RTUs and data received from RTUs**

Elements	Present Number/Quantity						
	BSPTCL	DVC	OPTCL	Sikkim	JUSNL	WBSETCL	ERLDC
<b>Number of RTUs on IEC 101</b>	11	0	97	0	50	42	100
<b>Number of RTUs on IEC 104</b>	226	51	129	34	30	112	200
<b>Average Number of analog points per RTU</b>	80	65	68	25	100	80	300
<b>Average Number of Status points per RTU</b>	170	200	74	40	225	200	450
<b>Average Number of SOE points per RTU</b>	170	20	18	6	200	50	100
<b>Average number of control signals per RTU</b>	25	5	--	--	--	--	20

**Table 4: Point Count for exchange with other/external Computer Systems**

POWER SYSTEM COMPONENT	Present Number/Quantity						
	BSPTCL	DVC	OPTCL	Sikkim	JUSNL	WBSETCL	ERLDC
Analog Points from and into SCADA	40000	16000	--	--	500	26318	150000
Status Points from and into SCADA	70000	27000	--	--	200	52042	150000

**Table-5: Sizing of the Data historian**

Data Source	No. of Points						
	BSPTCL	DVC	OPTCL	Sikkim	JUSNL	WBSETCL	ERLDC
Analog Points	23479	16000	32000	242	150000	26000	500000
Status points	45771	27000	40000	403	200000	52000	500000

**Table-6: Future Expansion (Main & Backup CC)**

S.n o.	Future Expansion						
	BSPTCL	DVC	OPTCL	Sikkim	JUSNL	WBSETCL	ERLDC
1	300% of present system	300% of present system	300% of present system	300% of present system	300% of present system	300% of present system	200% of present system

- The expansion requirement are 200% expansion i.e equal to 300% of present system size except for ERLDC where expansion requirement are 100% i.e. equal to 200% of present system size.

**Note:**

1. **Under the TS, multiple sources for data points have been envisaged. While defining the sizing of the system it is assumed that all the redundant sources to a data point has been considered as single point and telemetered point itself can be used for redundant data source configuration along with Inter-site (Main-Backup) data transfer. Sizing shall be done accordingly.**
2. Contractor shall consider hardware sizing considering 7 years of proposed system and 10 years old data, which shall be migrated to new historian. Old data for duration of 10 years needs to be migrated to new system. All this stored data shall be available online for trending and reporting.
3. The EMS/SCADA system shall not have any limitations including performance w.r.t. to increase in Database sizing. In case of any resizing or expansion of database is required due to constraint of system parameter in delivered system other than that listed in the table above, it shall be the responsibility of the vendor to re-size the delivered system without any cost of the customer during the entire course of the project including the AMC period.
4. System sizing shall include all system calculation like Max/Min/Avg/ROC/pf/MVA calculations and no financial implications to be imposed on owner.
5. Contractor shall consider expansion requirement mentioned at Table 6 above of present system for respective control center
6. The calculated points shall not be counted in the sizing specified herein above.
7. ICCP points to be exchanged to & for between multiple control centre simultaneously shall be considered as a single point for sizing point of view.

# **Vol. II, Part-B**

## **Appendix- G**

### **Bill of Quantity**

**Table 1a. Bill of Quantity for SCADA/EMS System of BSPTCL**

Sl. No.	Item Description	Unit	Quantity	
			Main CC	Backup CC
<b>A</b>	<b>Software</b>			
1.1	SCADA Software	Lot	1	1
1.2	Load Shed Support(LSS)/ADMS	Lot	1	1
1.3	SOFTWARE FOR ICCP COMMUNICATION	Lot	1	1
1.4	SOFTWARE FOR CFE COMMUNICATION	Lot	1	1
1.5	EMS Functions			
(a)	State Estimator	Lot	1	1
(b)	Contingency Analysis	Lot	1	1
(c)	Security Enhancement	Lot	1	1
(d)	Optimal Power Flow	Lot	1	1
(e)	Outage Scheduler	Lot	1	1
(f)	Transmission Line/Corridor Capability Monitor (TCM)	Lot	1	1
(g)	Short Circuit Analysis	Lot	1	1
(h)	Automatic Generation Control (AGC)	Lot	1	1
1.6	Dynamic Security Assessment (DSA) Software	Lot	0	0
1.7	Dispatcher Training Simulator Software	Lot	1	0
1.8	Database development system (PDS) cum test bench for SCADA and ICCP Integration			
(a)	Database development system (PDS)	Lot	1	1
(b)	Test bench FEP, SCADA & ICCP Intg	Lot	1	1
1.9	Web Server Application			
(a)	Data Replica system software	Lot	1	1
(b)	Web Server system software	Lot	1	1
(c)	Web Historian and Reporting System	Lot	1	1
1.10	OPC client licenses (SCADA & Historian 5 each) - To take data from outside.	Lot	1	0
1.11	SMS & Email Interface	Lot	1	1
1.12	Commercial Off-The-Shelf (COTS) Softwares			
(a)	SOFTWARE FOR DATA HISTORIAN	Lot	1	1
(b)	Document Management System	Lot	1	0
(c)	Identity Management Software	Lot	1	1
(d)	Network Access Control (NAC)	Lot	1	1
(e)	Patch Management Software	Lot	1	1
(f)	VAPT Tool	Lot	2	2

(g)	Virtualisation Software for all the virtual servers envisaged and required under the project along-with centralised management software	Lot	1	1
(h)	Operating System for all the servers envisaged and required under the project	Lot	1	1
(i)	Host based intrusion prevention system (HIPS) with centralised management	No.	16	16
(j)	End Point Security Solution with centralised management	No.	56	43
(k)	Centralised Management and Log Analyser of all FWs	Lot	1	1
(l)	Network Management System	Lot	1	1
(m)	SIEM (Security Information and Event management)	Lot	1	1
(n)	OPC client licenses to be installed outside OT network to exchange data from SCADA & Historian	No.	2	0
(o)	Load Forecasting	Lot	0	0
1.13	OPC server	No.	2	2
1.14	Report Development & Generation Software	Lot	1	1
1.15	Storage system			
(a)	SAN Software	Lot	1	1
(b)	NAS Software	Lot	1	1
<b>B</b>	<b>Hardware</b>			
2.1	SCADA/EMS Server	No.	2	2
2.2	Dynamic Security Assessment (DSA) Server	No.	0	0
2.3	ICCP, CFE, OPC Server			
(a)	ICCP, OPC communication Server	No.	2	2
(b)	Communication Front End (CFE) Server	No.	2	2
2.4	Data Historian Server/Data Storage Server	No.	2	2
2.5	DTS Server	No.	1	0
2.6	PDS (test & development) server	No.	1	1
2.7	Third Party Applications Servers as per technical specification	No	2	2
(a)	End Point Security Solution Server			
(b)	Patch management Server			
(c)	NMS server			
(d)	VAPT server			



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2.8	Management Applications Servers as per technical specification	No	2	2
(a)	Internal Centralised Mangement Server			
(b)	Network Access Control (NAC)			
(c)	Identity Management Server			
2.9	DRS DMZ Servers as per technical specification	No	2	2
(a)	External Centralised Mangement Server			
(b)	Data Replica Server			
(c)	SIEM			
(d)	Document Management System			
2.10	External DMZ Servers as per technical specification	No	2	2
(a)	Web Servers			
(b)	End Point Security Solution Server			
(c)	Patch management Server			
(d)	Web Historian and Reporting server			
(e)	OPC Server			
2.11	Server Mangement Console	No.	1	1
2.12	Backup Solution	No.	1	1
2.13	Storage system			
(a)	SAN management server along with SAN Box and mass storage (SAN)	No.	2	2
(b)	Nas Box	No.	1	1
2.14	WAN Routers with Firewall			
(a)	WAN Router cum Firewall for ICCP Communication	No.	2	2
(b)	WAN Router cum Firewall for External World Connectivity	No.	2	2
(c)	WAN Router cum firewall for RTU Communication	No.	2	2
(d)	Router cum firewall for Remote Consoles	No.	3	0
(e)	WAN Router cum firewall for PDS	No.	2	2
2.15	Switches			
(a)	48 Port L3- LAN switch for SCADA/EMS LAN	No.	2	2
(b)	24 Port L3- LAN switch for Historian & Reporting LAN	No.	2	2
(c)	16 port FC switch for SAN Switch	No.	2	2
(d)	24 Port L3- LAN switch for Internal & External DMZ LAN	No.	2	2
(e)	24 Port L3- LAN Switch for Server Management LAN	No.	2	2

(f)	24 Port L3- LAN Switch for ICCP & FEP LAN	No.	2	2
(g)	24 Port L3- LAN Switch for DCPC/Terminal Server LAN	No.	0	0
(h)	48 Port L3- LAN Switch for Terminal Server	No.	0	0
(i)	24 Port L3- LAN Switch for Terminal Server	No.	2	2
(j)	32 Port L3- LAN Switch for Terminal Server		0	0
2.16	Cyber Security Appliances			
(a)	External Firewall with NIPS and centralised mangement	No.	2	2
(b)	Internal Firewall with NIPS and centralised mangement	No.	2	2
(c)	External Firewall with NIPS for ICCP/RTU and centralised mangement	No.	2	2
(d)	Anti-APT	No.	1	1
2.17	Laptops			
(a)	Laptop for maintenance	No.	2	1
(b)	Laptop for DTS	No.	1	0
(c)	Laptop fot VAPT	No.	1	1
2.18	Data Concentrator PC (DCPC) as per technical specification	SET		
(a)	Industrial grade Computer with 4 LAN and 2 Serial Ports	No.	0	0
(b)	8 Port 10/100 Mbps Ethernet switch with RJ 45 Ports	No.	0	0
(c)	GPS based time synchronisation system	SET	0	0
(d)	16 Port Splitter	No.	0	0
(e)	32 Port Terminal Servers	No.	2	2
(f)	16 Port Terminal Servers	No.	0	0
(g)	Panel for Terminal Servers with accessories	No.	1	1
2.19	Workstations			
(a)	Workstation Console without Monitor	No.	0	0
(b)	Workstation Console integrated with dual Monitors			
(i)	Workstation	No.	6	4
(ii)	Dual monitors for workstation	No.	6	4
(c)	DTS Workstation with dual Monitors (Training Console)			
(i)	DTS Workstation console	No.	4	0
(ii)	Dual monitors for DTS	No.	4	0

(d)	Workstation Console integrated with dual Monitors for DSA (at RLDC only)			
(i)	Workstation Console for DSA	No.	0	0
(ii)	dual Monitors for DSA	No.	0	0
(e)	PDS Workstations with dual Monitor			
(i)	workstation for PDS	No.	6	2
(ii)	Dual monitor for PDS	No.	6	2
(f)	Workstation Console integrated with single Monitors			
(i)	Workstation	No.	0	0
(ii)	Single monitors for workstation	No.	0	0
2.20	Remote Consoles			
(a)	Remote Console with Dual monitor			
(i)	Remote Consoles with CPU (Dual monitor)	No.	3	0
(ii)	Dual monitor for remote console	No.	3	0
(b)	All-in-One workstations with CPU (remote console)	No.	0	0
(c)	Remote Consoles with 55" Monitor with CPU			
(i)	Remote Consoles with CPU (55" monitor)	No.	0	0
(ii)	55" monitor for remote console	No.	0	0
2.21	Video Projection System			
(i)	Laser VPS (Modules)	No.	24	8
(ii)	LED VPS (Modules)	No.	0	0
2.22	Video wall			
(a)	55" Tower Type Video Wall with CPU (with proper stand)	No.	2	1
(b)	55" Wall mounted Video Wall with CPU (with proper mounting)	No.	2	1
(c)	55" (3*3) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
(d)	55" (3*2) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
(e)	55" (2*2) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
2.23	Printers			
(a)	Color Laser Printer	No.	2	1
(b)	Multi Functional Printer	No.	2	1
(c)	A4 Size Multi Functional Display Printers	No.	0	0
2.24	Time & Frequency System and External displays			

(a)	Time & Frequency System NavIC(with failback to GPS)Based	Lot	2	1
(b)	Digital Display for Date	No.	1	1
(c)	Digital Display for Day	No.	1	1
(d)	Digital Display for Time	No.	1	1
(e)	Digital Display for Frequency	No.	1	1
(f)	Digital Display for Time Block	No.	1	1
(g)	Digital Display for Temperature	No.	0	0
(h)	Digital Display for Humidity	No.	0	0
2.25	Furniture			
(a)	U-Type Operator Workstations desk (per cubicle 9-10 feet)	No.	0	0
(b)	Operator Workstations desk			
(i)	Operator Workstations desk-Motorized	No.	16	6
(ii)	Operator Workstations desk-Normal	No.	0	0
(c)	Chairs	No.	32	12
(d)	printer Table	No.	1	1
2.26	Weather Sensors for Server Room	No.	4	4
2.27	Link Load Balancer	No.	2	2
2.28	Smart server rack	No.	3	3
2.29	IP based KVM system	No.	1	1
2.30	Centralized keyboard & mouse control solution (CKMC)	Set	1	1
2.31	External HDD	No.	2	2
<b>C</b>	<b>Auxiliary power Supply</b>			
3.2	80 kVA UPS System			
(a)	80 kVA (64 kW at 0.8 pf) UPS running in parallel	No.	2	0
(b)	VRLA type Battery banks for UPS (each bank of atleast 153.6 kVAH)	No.	2	0
(c)	Input ACDB (350KVA rating)	No.	1	0
(d)	Output ACDB (300 kVA rating)	No.	1	0
3.3	60 kVA UPS System			
(a)	60 kVA (48 kW at 0.8 pf) UPS running in parallel	No.	0	2
(b)	VRLA type Battery banks for UPS (each bank of atleast 115.2 kVAH)	No.	0	2
(c)	Input ACDB (250 kVA rating)	No.	0	1
(d)	Output ACDB (200 kVA rating)	No.	0	1
3.4	40 kVA UPS System			
(a)	40 kVA (32 kW at 0.8 pf) UPS running in parallel	No.	0	0
(b)	VRLA type Battery banks for UPS (each bank of atleast 76.8 kVAH)	No.	0	0
(c)	Input ACDB (150 kVA rating)	No.	0	0

(d)	Output ACDB (100 kVA rating)	No.	0	0
3.5	20 kVA UPS System			
(a)	20 kVA (16 kW at 0.8 pf) UPS running in parallel	No.	0	0
(b)	VRLA type Battery banks for UPS (each bank of atleast 38.4 kVAH)	No.	0	0
(c)	Input ACDB (150 kVA rating)	No.	0	0
(d)	Output ACDB (100 kVA rating)	No.	0	0
3.6	Accessories for maintenance of VRLA type batteries	Lot	1	1
3.7	Power Distribution and cabling work required to establish UPS	Lot	1	1
<b>D</b>	<b>DG System</b>			
(a)	50 KVA DG Set	No.	0	0
(b)	100 KVA DG Set	No.	0	0
(c)	125 KVA DG Set	No.	0	0
(d)	160 KVA DG Set	No.	0	1
(e)	200 KVA DG Set	No.	0	0
(f)	250 KVA DG Set	No.	1	0
(g)	320 kVA DG Set	No.	0	0
<b>E</b>	<b>48V DC Power Supply (DCPS) for Substations</b>			
(a)	SMPS based 48V DC Power Supply (DCPS) system of 35 Amp rating	No.	0	
(b)	VRLA type Battery bank for above DCPS system of 450AH Rating	No.	0	
(c)	SMPS based 48V DC Power Supply (DCPS) system of 25 Amp rating	No.	0	0
(d)	VRLA type Battery bank for above DCPS system of 600AH Rating	No.	0	0
(e)	VRLA type Battery bank for above DCPS system of 400AH Rating	No.	0	0
<b>F</b>	<b>Test Equipment for RTU</b>			
(a)	Master Station cum RTU simulator & ProtocolAnalyser Software tool.	Lot	1	0
(b)	Laptop PC for above software tools along with interfacing hardware	Lot	1	0
<b>G</b>	<b>Video Conferencing System</b>			
(a)	Multi-Point Conferencing Unit	Lot	2	2
(b)	Configuration Laptop with associate Accessories	No.	1	1
(c)	Video End Points	Lot	1	1
(d)	HD camera	No.	2	2
(e)	Micophone basestation	Set	1	1
(f)	Wireless Microphone	No.	2	2

(g)	Collar Microphones	No.	2	2
(h)	LCD Video walls	No.	4	4
(i)	Wall Mounted Line array speakers	No.	2	2
(j)	Dual Channel Power Amplifiers	No.	1	1
<b>H</b>	<b>Mandatory Spares (As per Technical Specification)</b>			
(a)	Mandatory Spares for SCADA/EMS system	Lot	1	1
(b)	Mandatory Spares for VPS	Lot	1	1
(c)	Mandatory Spares for Auxiliary Power Supply system for the control centres	Lot	1	1
(d)	Mandatory Spares for DG Set & AMF Panel for control centres	Lot	1	1
(e)	Mandatory Spares for RTU	Lot	0	0
(f)	Mandatory Spares for DCPS	Lot	0	0
<b>I</b>	<b>Services</b>			
9.1	Integration with Control Centres/other system on ICCP on ICCP	No.	6	6
9.2	Integration with other Applications/Systems			
(a)	Market and Metering Applications	No.	0	0
(b)	Scheduling software	No.	0	0
(c)	Integration of SCADA/EMS system on OPC/Modbus/web services	No.	10	10
9.3	Existing RTU Integration	No.	258	258
9.4	Integration Existing RTU with Data Concentrator Cum Protocol Convertor	Lot	0	0
9.5	Cyber Security Audit by CERT -IN certified Auditors during FAT	No.	1	1
9.6	Cyber Security Audit by CERT -IN certified Auditors during SAT	No.	1	1
9.7	Integration with existing VPS with all required software	Lot	0	0
9.8	Dismantling and Buyback of existing SCADA/EMS system	Lot	1	1
9.9	SMS integration with service provider Email integration with owner email system	Lot	1	1
<b>J</b>	<b>Training</b>			
(a)	Training on Computer System Hardware & Software	Lot	1	0
(b)	Training on Database & Display	Lot	1	0
(c)	Training on Application Software	Lot	1	0
(d)	Training on Dispatcher/Operator	Lot	1	0
(e)	Training on NMS	Lot	1	0



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(f)	Training on Cyber Security and VAPT	Lot	1	0
(g)	Training on Dispatcher Training Simulator	Lot	1	0
(h)	Training on Terminal/DCPC/ICCP Server Course	Lot	1	0
(i)	Training on Auxiliary Power Supply	Lot	1	0
(j)	Training on VC	Lot	1	0
(k)	Training on RTU	Lot	0	0
<b>K</b>	<b>AMC</b>			
11.1	Annual maintenance contract of SCADA/EMS System and all the equipment supplied in the project during Warranty Period	Year	1	1
11.2	Annual maintenance contract of SCADA/EMS System and all the equipment supplied in the project after expiry of Warranty Period	Year	6	6
11.3	ICCP Integration for 7 years (Per ICCP Integration)	No.	15	15
11.4	Six Monthly Cyber Security Audit by Cert-IN certified Auditors	No.	14	14
11.5	Patch Management including Signature updates for all Cyber security equipments for 7 years	Lot	1	1
11.6	Integration of RTU with SCADA during AMC	No.	242	242
11.7	OPC client function (per user) in SCADA Server	No.	5	5
11.8	Integration of SCADA/EMS system on OPC/Modbus/Web services/SAMAST during AMC including DLP	No.	5	5
11.9	Yearly Training on SCADA/EMS for 5 Days for 20 people	Year	7	0
11.10	Catridges			
(a)	Catridges- Cyan/Magenta/Yellow (Set of All)	No.	0	0
(b)	Catridges- Black	No.	0	0
11.11	Drum			
(a)	Drum- Cyan/Magenta/Yellow (Set of All)	No.	0	0
(b)	Drum- Black	No.	0	0
<b>11.12</b>	<b>Relocation and Commissioning at New Location</b>			
(a)	Relocation and Commissioning at New Location- All the systems supplied under this project except VPS and APS	Lot	0	0

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(b)	Relocation and Commissioning at New Location- video Projection System	Lot	0	0
(c)	Relocation and Commissioning at New Location- Auxilliary power supply	Lot	0	0
11.13	SMS Service of 1 Lakh messages annually	Year	7	0

**Table 1b. SPARES OF BSPTCL**

Sl.no	Item description	Unit	Quantity	
			Main CC	Backup-CC
<b>A</b>	<b>SCADA/EMS system</b>			
1	Servers (one of each type)	Lot	1	1
2	Workstation with Dual monitors	No.	1	1
3	LAN switch (one of each type)	Lot	1	1
4	Routers (one of each type)	Lot	1	1
5	Firewall with NIPS(External)	No.	1	1
6	Firewall with NIPS(Internal)	No.	1	1
7	Terminal Servers	No.	1	1
8	DCPC	No.	0	0
9	IP based KVM System	No.	1	1
10	Time & Frequency system	Lot	1	1
<b>B</b>	<b>VPS Spares</b>			
1	One complete VPS Module without screen / frame structure	Lot	1	1
2	VPS Controller with all interface cards	Lot	1	1
3	Laser Lamp - one set per VPS	LOT	1	1
4	Dust filters	No.	48	16
<b>C</b>	<b>Mandatory Spares for APS</b>			
1	MCCB/MCB/Isolator/Switch/ Contactor of each type & rating (as applicable & used inside UPS panel / Input ACDB / Output ACDB)	Lot	1	1
2	Fuse of each type & rating (if applicable, UPS panel / Input ACDB / Output ACDB)	Lot	5	5
3	DC Filter assembly	Lot	1	1
4	Input AC Filter assembly	Lot	1	1
5	Output AC Filter assembly	Lot	1	1
6	Electronic Printed Circuit Board /Card of each type (including all cards/modules for rectifier/charger, inverter, system card, display module, interface cards etc.)	Lot	1	1
7	Power Semiconductor devices of each type & rating such as SCRs, IGBTs etc. for rectifier/ charger module, Inverter module, Static Switch module for all the three phases (exclude those items which are covered under item-6 above)	Lot	1	1
<b>B</b>	<b>Mandatory Spares for DG Set</b>			

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1	Filter, Spring, Gaskets, Air cleaner (one no. of each type)	Lot	1	1
2	Complete Rotating Rectifier Assembly for Alternator	Lot	1	1
3	Voltage Regulator Complete	Lot	1	1
4	Switches/ Isolator / Contactor/Auxiliary relay / Timers (one no. of each type & rating)	Lot	1	1
5	DG Fuel Pump, V Belt for DG set & Solenoid coil for Fuel Oil system (one no. each type)	Lot	1	1
6	Indicating Lamps & Fuses (5 nos of each type & rating)	Lot	1	1

**Table 2a. Bill of Quantity for SCADA/EMS System of DVC**

Sl. No.	Item Description	Unit	Quantity	
			Main CC	Backup CC
<b>A</b>	<b>Software</b>			
1.1	SCADA Software	Lot	1	1
1.2	Load Shed Support(LSS)/ADMS	Lot	1	1
1.3	SOFTWARE FOR ICCP COMMUNICATION	Lot	1	1
1.4	SOFTWARE FOR CFE COMMUNICATION	Lot	1	1
1.5	EMS Functions			
(a)	State Estimator	Lot	1	1
(b)	Contingency Analysis	Lot	1	1
(c)	Security Enhancement	Lot	1	1
(d)	Optimal Power Flow	Lot	1	1
(e)	Outage Scheduler	Lot	1	1
(f)	Transmission Line/Corridor Capability Monitor (TCM)	Lot	1	1
(g)	Short Circuit Analysis	Lot	1	1
(h)	Automatic Generation Control (AGC)	Lot	1	1
1.6	Dynamic Security Assessment (DSA) Software	Lot	0	0
1.7	Dispatcher Training Simulator Software	Lot	1	0
1.8	Database development system (PDS) cum test bench for SCADA and ICCP Integration			
(a)	Database development system (PDS)	Lot	1	0
(b)	Test bench FEP, SCADA & ICCP Intg	Lot	1	0
1.9	Web Server Application			
(a)	Data Replica system software	Lot	1	1
(b)	Web Server system software	Lot	1	1
(c)	Web Historian and Reporting System	Lot	1	1
1.10	OPC client licenses (SCADA & Historian 5 each) - To take data from outside.	Lot	1	1
1.11	SMS & Email Interface	Lot	1	1
1.12	Commercial Off-The-Shelf (COTS) Softwares			
(a)	SOFTWARE FOR DATA HISTORIAN	Lot	1	1
(b)	Document Management System	Lot	1	0
(c)	Identity Management Software	Lot	1	1
(d)	Network Access Control (NAC)	Lot	1	1
(e)	Patch Management Software	Lot	1	1
(f)	VAPT Tool	Lot	2	2

(g)	Virtualisation Software for all the virtual servers envisaged and required under the project along-with centralised management software	Lot	1	1
(h)	Operating System for all the servers envisaged and required under the project	Lot	1	1
(i)	Host based intrusion prevention system (HIPS) with centralised management	No.	16	16
(j)	End Point Security Solution with centralised management	No.	50	43
(k)	Centralised Management and Log Analyser of all FWs	Lot	1	1
(l)	Network Management System	Lot	1	1
(m)	SIEM (Security Information and Event management)	Lot	1	1
(n)	OPC client licenses to be installed outside OT network to exchange data from SCADA & Historian	No.	2	1
(o)	Load Forecasting	Lot	1	1
1.13	OPC server	No.	2	2
1.14	Report Development & Generation Software	Lot	1	1
1.15	Storage system			
(a)	SAN Software	Lot	1	1
(b)	NAS Software	Lot	1	1
<b>B</b>	<b>Hardware</b>			
2.1	SCADA/EMS Server	No.	2	2
2.2	Dynamic Security Assessment (DSA) Server	No.	0	0
2.3	ICCP, CFE, OPC Server			
(a)	ICCP, OPC communication Server	No.	2	2
(b)	Communication Front End (CFE) Server	No.	2	2
2.4	Data Historian Server/Data Storage Server	No.	2	2
2.5	DTS Server	No.	1	0
2.6	PDS (test & development) server	No.	1	0
2.7	Third Party Applications Servers as per technical specification	No	2	2
(a)	End Point Security Solution Server			
(b)	Patch management Server			
(c)	NMS server			
(d)	VAPT server			



2.8	Management Applications Servers as per technical specification	No	2	2
(a)	Internal Centralised Mangement Server			
(b)	Network Access Control (NAC)			
(c)	Identity Management Server			
2.9	DRS DMZ Servers as per technical specification	No	2	2
(a)	External Centralised Mangement Server			
(b)	Data Replica Server			
(c)	SIEM			
(d)	Document Management System			
2.10	External DMZ Servers as per technical specification	No	2	2
(a)	Web Servers			
(b)	End Point Security Solution Server			
(c)	Patch management Server			
(d)	Web Historian and Reporting server			
(e)	OPC Server			
2.11	Server Mangement Console	No.	1	1
2.12	Backup Solution	No.	1	1
2.13	Storage system			
(a)	SAN management server along with SAN Box and mass storage (SAN)	No.	2	2
(b)	Nas Box	No.	1	1
2.14	WAN Routers with Firewall			
(a)	WAN Router cum Firewall for ICCP Communication	No.	2	2
(b)	WAN Router cum Firewall for External World Connectivity	No.	2	2
(c)	WAN Router cum firewall for RTU Communication	No.	2	2
(d)	Router cum firewall for Remote Consoles	No.	16	6
(e)	WAN Router cum firewall for PDS	No.	2	0
2.15	Switches			
(a)	48 Port L3- LAN switch for SCADA/EMS LAN	No.	2	2
(b)	24 Port L3- LAN switch for Historian & Reporting LAN	No.	2	2
(c)	16 port FC switch for SAN Switch	No.	2	2
(d)	24 Port L3- LAN switch for Internal & External DMZ LAN	No.	2	2
(e)	24 Port L3- LAN Switch for Server Management LAN	No.	2	2

(f)	24 Port L3- LAN Switch for ICCP & FEP LAN	No.	2	2
(g)	24 Port L3- LAN Switch for DCPC/Terminal Server LAN	No.	0	0
(h)	48 Port L3- LAN Switch for Terminal Server	No.	0	0
(i)	24 Port L3- LAN Switch for Terminal Server	No.	0	0
(j)	32 Port L3- LAN Switch for Terminal Server	No.	0	0
(k)	24 Port L3- LAN Switch for Remote Console	No.	1	1
2.16	Cyber Security Appliances			
(a)	External Firewall with NIPS and centralised mangement	No.	2	2
(b)	Internal Firewall with NIPS and centralised mangement	No.	2	2
(c)	External Firewall with NIPS for ICCP/RTU and centralised mangement	No.	2	2
(d)	Anti-APT	No.	1	1
2.17	Laptops			
(a)	Laptop for maintenance	No.	2	2
(b)	Laptop for DTS	No.	1	0
(c)	Laptop fot VAPT	No.	1	1
2.18	Data Concentrator PC (DCPC) as per technical specification	SET		
(a)	Industrial grade Computer with 4 LAN and 2 Serial Ports	No.	0	0
(b)	8 Port 10/100 Mbps Ethernet switch with RJ 45 Ports	No.	0	0
(c)	GPS based time synchronisation system	SET	0	0
(d)	16 Port Splitter	No.	0	0
(e)	32 Port Terminal Servers	No.	0	0
(f)	16 Port Terminal Servers	No.	0	0
(g)	Panel for Terminal Servers with accessories	No.	0	0
2.19	Workstations			
(a)	Workstation Console without Monitor	No.	0	0
(b)	Workstation Console integrated with dual Monitors			
(i)	Workstation	No.	4	3
(ii)	Dual monitors for workstation	No.	4	3
(c)	DTS Workstation with dual Monitors (Training Console)			

**Technical Specifications of “Replacement/Upgradation of SCADA/EMS systems of RLDC and SLDCs of Eastern Region under ER ULDC Phase-III”**



(i)	DTS Workstation console	No.	2	0
(ii)	Dual monitors for DTS	No.	2	0
(d)	Workstation Console integrated with dual Monitors for DSA (at RLDC only)			
(i)	Workstation Console for DSA	No.	0	0
(ii)	dual Monitors for DSA	No.	0	0
(e)	PDS Workstations with dual Monitor			
(i)	workstation for PDS	No.	1	0
(ii)	Dual monitor for PDS	No.	1	0
(f)	Workstation Console integrated with single Monitors			
(i)	Workstation	No.	2	2
(ii)	Single monitors for workstation	No.	2	2
2.20	Remote Consoles			
(a)	Remote Console with Dual monitor			
(i)	Remote Consoles with CPU (Dual monitor)	No.	16	6
(ii)	Dual monitor for remote console	No.	16	6
(b)	All-in-One workstations with CPU (remote console)	No.	0	0
(c)	Remote Consoles with 55" Monitor with CPU			
(i)	Remote Consoles with CPU (55" monitor)	No.	0	0
(ii)	55" monitor for remote console	No.	0	0
2.21	Video Projection System			
(i)	Laser VPS (Modules)	No.	8	6
(ii)	LED VPS (Modules)	No.	0	0
2.22	Video wall			
(a)	55" Tower Type Video Wall with CPU (with proper stand)	No.	0	1
(b)	55" Wall mounted Video Wall with CPU (with proper mounting)	No.	2	0
(c)	55" (3*3) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
(d)	55" (3*2) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
(e)	55" (2*2) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
2.23	Printers			
(a)	Color Laser Printer	No.	2	2
(b)	Multi Functional Printer	No.	2	2
(c)	A4 Size Multi Functional Display Printers	No.	0	0

2.24	Time & Frequency System and External displays			
(a)	Time & Frequency System NavIC(with failback to GPS)Based	Lot	2	1
(b)	Digital Display for Date	No.	1	1
(c)	Digital Display for Day	No.	1	1
(d)	Digital Display for Time	No.	1	1
(e)	Digital Display for Frequency	No.	1	1
(f)	Digital Display for Time Block	No.	1	1
(g)	Digital Display for Temperature	No.	0	0
(h)	Digital Display for Humidity	No.	0	0
2.25	Furniture			
(a)	U-Type Operator Workstations desk (per cubicle 9-10 feet)	No.	0	0
(b)	Operator Workstations desk			
(i)	Operator Workstations desk-Motorized	No.	9	5
(ii)	Operator Workstations desk-Normal	No.	0	0
(c)	Chairs	No.	18	10
(d)	printer Table	No.	1	1
2.26	Weather Sensors for Server Room	No.	1	1
2.27	Link Load Balancer	No.	2	2
2.28	Smart server rack	No.	3	3
2.29	IP based KVM system	No.	1	1
2.30	Centralized keyboard & mouse control solution (CKMC)	Set	1	1
2.31	External HDD	No.	2	2
<b>C</b>	<b>Auxiliary power Supply</b>			
3.2	80 kVA UPS System			
(a)	80 kVA (64 kW at 0.8 pf) UPS running in parallel	No.	0	0
(b)	VRLA type Battery banks for UPS (each bank of atleast 153.6 kVAH)	No.	0	0
(c)	Input ACDB (350KVA rating)	No.	0	0
(d)	Output ACDB (300 kVA rating)	No.	0	0
3.3	60 kVA UPS System			
(a)	60 kVA (48 kW at 0.8 pf) UPS running in parallel	No.	0	0
(b)	VRLA type Battery banks for UPS (each bank of atleast 115.2 kVAH)	No.	0	0
(c)	Input ACDB (250 kVA rating)	No.	0	0
(d)	Output ACDB (200 kVA rating)	No.	0	0
3.4	40 kVA UPS System			
(a)	40 kVA (32 kW at 0.8 pf) UPS running in parallel	No.	2	2

(b)	VRLA type Battery banks for UPS (each bank of atleast 76.8 kVAH)	No.	2	2
(c)	Input ACDB (150 kVA rating)	No.	1	1
(d)	Output ACDB (100 kVA rating)	No.	1	1
3.5	20 kVA UPS System			
(a)	20 kVA (16 kW at 0.8 pf) UPS running in parallel	No.	0	0
(b)	VRLA type Battery banks for UPS (each bank of atleast 38.4 kVAH)	No.	0	0
(c)	Input ACDB (150 kVA rating)	No.	0	0
(d)	Output ACDB (100 kVA rating)	No.	0	0
3.6	Accessories for maintenance of VRLA type batteries	Lot	1	1
3.7	Power Distribution and cabling work required to establish UPS	Lot	1	1
<b>D</b>	<b>DG System</b>			
(a)	50 KVA DG Set	No.	0	0
(b)	100 KVA DG Set	No.	0	0
(c)	125 KVA DG Set	No.	0	1
(d)	160 KVA DG Set	No.	0	0
(e)	200 KVA DG Set	No.	0	0
(f)	250 KVA DG Set	No.	0	0
(g)	320 KVA DG Set	No.	0	0
<b>E</b>	<b>48V DC Power Supply (DCPS) for Substations</b>			
(a)	SMPS based 48V DC Power Supply (DCPS) system of 35 Amp rating	No.	0	
(b)	VRLA type Battery bank for above DCPS system of 450AH Rating	No.	0	
(c)	SMPS based 48V DC Power Supply (DCPS) system of 25 Amp rating	No.	0	0
(d)	VRLA type Battery bank for above DCPS system of 600AH Rating	No.	0	0
(e)	VRLA type Battery bank for above DCPS system of 400AH Rating	No.	0	0
<b>F</b>	<b>Test Equipment for RTU</b>			
(a)	Master Station cum RTU simulator & ProtocolAnalyser Software tool.	Lot	1	0
(b)	Laptop PC for above software tools along with interfacing hardware	Lot	1	0
<b>G</b>	<b>Video Conferencing System</b>			
(a)	Multi-Point Conferencing Unit	Lot	2	2
(b)	Configuration Laptop with associate Accessories	No.	1	1
(c)	Video End Points	Lot	1	1

**Technical Specifications of “Replacement/Upgradation of SCADA/EMS systems of RLDC and SLDCs of Eastern Region under ER ULDC Phase-III”**



(d)	HD camera	No.	2	2
(e)	Micophone basestation	Set	1	1
(f)	Wireless Microphone	No.	2	2
(g)	Collar Microphones	No.	2	2
(h)	LCD Video walls	No.	2	2
(i)	Wall Mounted Line array speakers	No.	2	2
(j)	Dual Channel Power Amplifiers	No.	1	1
<b>H</b>	<b>Mandatory Spares (As per Technical Specification)</b>			
(a)	Mandatory Spares for SCADA/EMS system	Lot	1	1
(b)	Mandatory Spares for VPS	Lot	1	1
(c)	Mandatory Spares for Auxiliary Power Supply system for the control centres	Lot	1	1
(d)	Mandatory Spares for DG Set & AMF Panel for control centres	Lot	0	1
(e)	Mandatory Spares for RTU	Lot	0	0
(f)	Mandatory Spares for DCPS	Lot	0	0
<b>I</b>	<b>Services</b>			
9.1	Integration with Control Centres/other system on ICCP on ICCP	No.	6	6
9.2	Integration with other Applications/Systems			
(a)	Market and Metering Applications	No.	1	1
(b)	Scheduling software	No.	1	1
(c)	Integration of SCADA/EMS system on OPC/Modbus/web services	No.	10	10
9.3	Existing RTU Integration	No.	50	50
9.4	Integration Existing RTU with Data Concentrator Cum Protocol Convertor	Lot	0	0
9.5	Cyber Security Audit by CERT -IN certified Auditors during FAT	No.	1	1
9.6	Cyber Security Audit by CERT -IN certified Auditors during SAT	No.	1	1
9.7	Integration with existing VPS with all required software	Lot	0	0
9.8	Dismantling and Buyback of existing SCADA/EMS system	Lot	1	1
9.9	SMS integration with service provider Email integration with owner email system	Lot	1	1
<b>J</b>	<b>Training</b>			
(a)	Training on Computer System Hardware & Software	Lot	1	0
(b)	Training on Database & Display	Lot	1	0



(c)	Training on Application Software	Lot	1	0
(d)	Training on Dispatcher/Operator	Lot	1	0
(e)	Training on NMS	Lot	1	0
(f)	Training on Cyber Security and VAPT	Lot	1	0
(g)	Training on Dispatcher Training Simulator	Lot	1	0
(h)	Training on Terminal/DCPC/ICCP Server Course	Lot	0	0
(i)	Training on Auxiliary Power Supply	Lot	1	0
(j)	Training on VC	Lot	1	0
(k)	Training on RTU	Lot	0	0
<b>K</b>	<b>AMC</b>			
11.1	Annual maintenance contract of SCADA/EMS System and all the equipment supplied in the project during Warranty Period	Year	1	1
11.2	Annual maintenance contract of SCADA/EMS System and all the equipment supplied in the project after expiry of Warranty Period	Year	6	6
11.3	ICCP Integration for 7 years (Per ICCP Integration)	No.	15	15
11.4	Six Monthly Cyber Security Audit by Cert-IN certified Auditors	No.	14	14
11.5	Patch Management including Signature updates for all Cyber security equipments for 7 years	Lot	1	1
11.6	Integration of RTU with SCADA during AMC	No.	50	50
11.7	OPC client function (per user) in SCADA Server	No.	5	5
11.8	Integration of SCADA/EMS system on OPC/Modbus/Web services/SAMAST during AMC including DLP	No.	5	5
11.9	Yearly Training on SCADA/EMS for 5 Days for 20 people	Year	7	0
11.10	Catridges			
(a)	Catridges- Cyan/Magenta/Yellow (Set of All)	No.	0	0
(b)	Catridges- Black	No.	0	0
11.11	Drum			
(a)	Drum- Cyan/Magenta/Yellow (Set of All)	No.	0	0
(b)	Drum- Black	No.	0	0
<b>11.12</b>	<b>Relocation and Commissioning at New Location</b>			

**Technical Specifications of “Replacement/Upgradation of SCADA/EMS systems of RLDC and SLDCs of Eastern Region under ER ULDC Phase-III”**



(a)	Relocation and Commissioning at New Location- All the systems supplied under this project except VPS and APS	Lot	0	0
(b)	Relocation and Commissioning at New Location- video Projection System	Lot	0	0
(c)	Relocation and Commissioning at New Location- Auxilliary power supply	Lot	0	0
11.13	SMS Service of 1 Lakh messages annually	Year	7	0

**Table 2b. SPARES OF DVC**

Sl.no	Item description	Unit	Quantity	
			Main CC	Backup-CC
<b>A</b>	<b>SCADA/EMS system</b>			
1	Servers (one of each type)	Lot	1	1
2	Workstation with Dual monitors	No.	1	1
3	LAN switch (one of each type)	Lot	1	1
4	Routers (one of each type)	Lot	1	1
5	Firewall with NIPS(External)	No.	1	1
6	Firewall with NIPS(Internal)	No.	1	1
7	Terminal Servers (MCC & BCC)	No.	0	0
8	DCPC	No.	0	0
9	IP based KVM System	No.	1	1
10	Time & Frequency system	Lot	1	1
<b>B</b>	<b>VPS Spares</b>			
1	One complete VPS Module without screen / frame structure	Lot	1	1
2	VPS Controller with all interface cards	Lot	1	1
3	VPS LED PACK of three colors (red, green & Blue) one set per VPS	Lot	0	0
4	Laser Lamp - one set per VPS	LOT	1	1
5	Dust filters	No.	16	12
<b>C</b>	<b>Mandatory Spares for APS</b>			
1	MCCB/MCB/Isolator/Switch/ Contactor of each type & rating (as applicable & used inside UPS panel / Input ACDB / Output ACDB)	Lot	1	1
2	Fuse of each type & rating (if applicable, UPS panel / Input ACDB / Output ACDB)	Lot	5	5
3	DC Filter assembly	Lot	1	1
4	Input AC Filter assembly	Lot	1	1
5	Output AC Filter assembly	Lot	1	1
6	Electronic Printed Circuit Board /Card of each type (including all cards/modules for rectifier/charger, inverter, system card, display module, interface cards etc.)	Lot	1	1
7	Power Semiconductor devices of each type & rating such as SCRs, IGBTs etc. for rectifier/ charger module, Inverter module, Static Switch module for all the three phases (exclude those items which are covered under item-6 above)	Lot	1	1

B	Mandatory Spares for DG Set			
1	Filter, Spring, Gaskets, Air cleaner (one no. of each type)	Lot	0	1
2	Complete Rotating Rectifier Assembly for Alternator	Lot	0	1
3	Voltage Regulator Complete	Lot	0	1
4	Switches/ Isolator / Contactor/Auxiliary relay / Timers (one no. of each type & rating)	Lot	0	1
5	DG Fuel Pump, V Belt for DG set & Solenoid coil for Fuel Oil system (one no. each type)	Lot	0	1
6	Indicating Lamps & Fuses (5 nos of each type & rating)	Lot	0	1

**Table 3a. Bill of Quantity for SCADA/EMS System of ERLDC**

Sl. No.	Item Description	Unit	Quantity	
			Main CC	Backup CC
<b>A</b>	<b>Software</b>			
1.1	SCADA Software	Lot	1	1
1.2	Load Shed Support(LSS)/ADMS	Lot	0	0
1.3	SOFTWARE FOR ICCP COMMUNICATION	Lot	1	1
1.4	SOFTWARE FOR CFE COMMUNICATION	Lot	1	1
1.5	EMS Functions			
(a)	State Estimator	Lot	1	1
(b)	Contingency Analysis	Lot	1	1
(c)	Security Enhancement	Lot	1	1
(d)	Optimal Power Flow	Lot	1	1
(e)	Outage Scheduler	Lot	1	1
(f)	Transmission Line/Corridor Capability Monitor (TCM)	Lot	1	1
(g)	Short Circuit Analysis	Lot	1	1
(h)	Automatic Generation Control (AGC)	Lot	1	1
1.6	Dynamic Security Assessment (DSA) Software	Lot	1	1
1.7	Dispatcher Training Simulator Software	Lot	1	0
1.8	Database development system (PDS) cum test bench for SCADA and ICCP Integration			
(a)	Database development system (PDS)	Lot	1	1
(b)	Test bench FEP, SCADA & ICCP Intg	Lot	1	1
1.9	Web Server Application			
(a)	Data Replica system software	Lot	1	1
(b)	Web Server system software	Lot	1	1
(c)	Web Historian and Reporting System	Lot	1	1
1.10	OPC client licenses (SCADA & Historian 5 each) - To take data from outside.	Lot	1	1
1.11	SMS & Email Interface	Lot	1	0
1.12	Commercial Off-The-Shelf (COTS) Softwares			
(a)	SOFTWARE FOR DATA HISTORIAN	Lot	1	1
(b)	Document Management System	Lot	1	1
(c)	Identity Management Software	Lot	1	1
(d)	Network Access Control (NAC)	Lot	1	1
(e)	Patch Management Software	Lot	1	1
(f)	VAPT Tool	Lot	2	2
(g)	Virtualisation Software for all the virtual servers envisaged and required under the project along-with centralised management software	Lot	1	1

(h)	Operating System for all the servers envisaged and required under the project	Lot	1	1
(i)	Host based intrusion prevention system (HIPS) with centralised management	No.	16	16
(j)	End Point Security Solution with centralised management	No.	75	46
(k)	Centralised Management and Log Analyser of all FWs	Lot	1	1
(l)	Network Management System	Lot	1	1
(m)	SIEM (Security Information and Event management)	Lot	1	1
(n)	OPC client licenses to be installed outside OT network to exchange data from SCADA & Historian	No.	2	0
(o)	Load Forecasting	Lot	1	1
1.13	OPC server	No.	1	1
1.14	Report Development & Generation Software	Lot	1	1
1.15	Storage system			
(a)	SAN Software	Lot	1	1
(b)	NAS Software	Lot	1	1
<b>B</b>	<b>Hardware</b>			
2.1	SCADA/EMS Server	No.	2	2
2.2	Dynamic Security Assessment (DSA) Server	No.	2	2
2.3	ICCP, CFE, OPC Server			
(a)	ICCP, OPC communication Server	No.	2	2
(b)	Communication Front End (CFE) Server	No.	2	2
2.4	Data Historian Server/Data Storage Server	No.	2	2
2.5	DTS Server	No.	2	0
2.6	PDS (test & development) server	No.	2	2
2.7	Third Party Applications Servers as per technical specification	No	2	2
(a)	End Point Security Solution Server			
(b)	Patch management Server			
(c)	NMS server			
(d)	VAPT server			
2.8	Management Applications Servers as per technical specification	No	2	2
(a)	Internal Centralised Mangement Server			
(b)	Network Access Control (NAC)			
(c)	Identity Management Server			
2.9	DRS DMZ Servers as per technical specification	No	2	2
(a)	External Centralised Mangement Server			
(b)	Data Replica Server			



(c)	SIEM			
(d)	Document Management System			
2.10	External DMZ Servers as per technical specification	No	2	2
(a)	Web Servers			
(b)	End Point Security Solution Server			
(c)	Patch management Server			
(d)	Web Historian and Reporting server			
(e)	OPC Server			
2.11	Server Mangement Console	No.	1	1
2.12	Backup Solution	No.	1	1
2.13	Storage system			
(a)	SAN management server along with SAN Box and mass storage (SAN)	No.	2	2
(b)	Nas Box	No.	1	1
(c)	SAN management server along with SAN Box and mass storage (SAN) for IT side	No.	1	0
2.14	WAN Routers with Firewall			
(a)	WAN Router cum Firewall for ICCP Communication	No.	2	2
(b)	WAN Router cum Firewall for External World Connectivity	No.	2	2
(c)	WAN Router cum firewall for RTU Communication	No.	2	2
(d)	Router cum firewall for Remote Consoles	No.	3	0
(e)	WAN Router cum firewall for PDS	No.	2	2
2.15	Switches			
(a)	48 Port L3- LAN switch for SCADA/EMS LAN	No.	2	2
(b)	24 Port L3- LAN switch for Historian & Reporting LAN	No.	2	2
(c)	16 port FC switch for SAN Switch	No.	2	2
(d)	24 Port L3- LAN switch for Internal & External DMZ LAN	No.	2	2
(e)	24 Port L3- LAN Switch for Server Management LAN	No.	2	2
(f)	24 Port L3- LAN Switch for ICCP & FEP LAN	No.	2	2
(g)	24 Port L3- LAN Switch for DCPC/Terminal Server LAN	No.	4	4
(h)	48 Port L3- LAN Switch for Terminal Server	No.	0	0
2.16	Cyber Security Appliances			
(a)	External Firewall with NIPS and centralised mangement	No.	2	2
(b)	Internal Firewall with NIPS and centralised mangement	No.	2	2

(c)	External Firewall with NIPS for ICCP/RTU and centralised mangement	No.	2	2
(d)	Anti-APT	No.	1	1
2.17	Laptops			
(a)	Laptop for maintenance	No.	2	1
(b)	Laptop for DTS	No.	2	0
(c)	Laptop fot VAPT	No.	1	1
2.18	Data Concentrator PC (DCPC) as per technical specification	SET		
(a)	Industrial grade Computer with 4 LAN and 2 Serial Ports	No.	0	0
(b)	8 Port 10/100 Mbps Ethernet switch with RJ 45 Ports	No.	2	2
(c)	GPS based time synchronisation system	SET	0	0
(d)	16 Port Splitter	No.	8	8
(e)	32 Port Terminal Servers	No.	4	4
(f)	16 Port Terminal Servers	No.	0	0
(g)	Panel for Terminal Servers with accessories	No.	1	1
2.19	Workstations			
(a)	Workstation Console without Monitor	No.	4	0
(b)	Workstation Console integrated with dual Monitors			
(i)	Workstation	No.	10	5
(ii)	Dual monitors for workstation	No.	10	5
(c)	DTS Workstation with dual Monitors (Training Console)			
(i)	DTS Workstation console	No.	6	0
(ii)	Dual monitors for DTS	No.	6	0
(d)	Workstation Console integrated with dual Monitors for DSA (at RLDC only)			
(i)	Workstation Console for DSA	No.	2	1
(ii)	dual Monitors for DSA	No.	2	1
(e)	PDS Workstations with dual Monitor			
(i)	workstation for PDS	No.	3	1
(ii)	Dual monitor for PDS	No.	3	1
2.20	Remote Consoles			
(a)	Remote Console with Dual monitor			
(i)	Remote Consoles with CPU (Dual monitor)	No.	0	0
(ii)	Dual monitor for remote console	No.	0	0
(b)	All-in-One workstations with CPU (remote console)	No.	6	0
(c)	Remote Consoles with 55" Monitor with CPU			
(i)	Remote Consoles with CPU (55" monitor)	No.	0	0

(ii)	55" monitor for remote console	No.	0	0
2.21	Video Projection System			
(i)	Laser VPS	No.	40	6
(ii)	LED VPS	No.	0	0
2.22	Video wall			
(a)	55" Tower Type Video Wall with CPU (with proper stand)	No.	8	0
(b)	55" Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
(c)	55" (3*3) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
(d)	55" (3*2) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
(e)	55" (2*2) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
(f)	55" (4*3) Wall mounted Video Wall with CPU (with proper mounting)	No.	1	0
2.23	Printers			
(a)	Color Laser Printer	No.	0	0
(b)	Multi Functional Printer	No.	0	0
(c)	A4 Size Multi Functional Display Printers	No.	0	0
2.24	Time & Frequency System and External displays			
(a)	Time & Frequency System NavIC(with failback to GPS)Based	Lot	2	2
(b)	Digital Display for Date	No.	1	1
(c)	Digital Display for Day	No.	1	1
(d)	Digital Display for Time	No.	1	1
(e)	Digital Display for Frequency	No.	1	1
(f)	Digital Display for Time Block	No.	1	1
(g)	Digital Display for Temperature	No.	2	1
(h)	Digital Display for Humidity	No.	2	1
2.25	Furniture			
(a)	U-Type Operator Workstations desk (per cubicle 9-10 feet)	No.	5	2
(b)	Operator Workstations desk			
(i)	Operator Workstations desk-Motorized	No.	0	0
(ii)	Operator Workstations desk-Normal	No.	8	2
(c)	Chairs	No.	11	5
(d)	printer Table	No.	0	0
2.26	Weather Sensors for Server Room	No.	4	1
2.27	Link Load Balancer	No.	2	2
2.28	Smart server rack	No.	4	4
2.29	IP based KVM system	No.	2	2
2.3	Centralized keyboard & mouse control solution (CKMC)	Set	3	1
2.31	External HDD	No.	3	2

<b>C</b>	<b>Auxiliary power Supply</b>			
3.1	120 kVA UPS System			
(a)	120 kVA (96 kW at 0.8 pf) UPS running in parallel	No.	2	0
(b)	VRLA type Battery banks for UPS (each bank of atleast 230.4 kVAH)	No.	2	0
(c)	Input ACDB (600 KVA rating)	No.	1	0
(d)	Output ACDB (400 kVA rating)	No.	1	0
(e)	Workstation Console for UPS monitoring			0
(i)	Workstation	No.	1	0
(ii)	Single monitors for workstation	No.	1	0
3.2	80 kVA UPS System			
(a)	80 kVA (64 kW at 0.8 pf) UPS running in parallel	No.	0	2
(b)	VRLA type Battery banks for UPS (each bank of atleast 153.6 kVAH)	No.	0	2
(c)	Input ACDB (350KVA rating)	No.	0	1
(d)	Output ACDB (300 kVA rating)	No.	0	1
(e)	Workstation Console for UPS monitoring			
(i)	Workstation	No.	0	1
(ii)	Single monitors for workstation	No.	0	1
3.3	60 kVA UPS System			
(a)	60 kVA (48 kW at 0.8 pf) UPS running in parallel	No.	0	0
(b)	VRLA type Battery banks for UPS (each bank of atleast 115.2 kVAH)	No.	0	0
(c)	Input ACDB (250 kVA rating)	No.	0	0
(d)	Output ACDB (200 kVA rating)	No.	0	0
3.4	40 kVA UPS System			
(a)	40 kVA (32 kW at 0.8 pf) UPS running in parallel	No.	0	0
(b)	VRLA type Battery banks for UPS (each bank of atleast 76.8 kVAH)	No.	0	0
(c)	Input ACDB (150 kVA rating)	No.	0	0
(d)	Output ACDB (100 kVA rating)	No.	0	0
3.5	20 kVA UPS System			
(a)	20 kVA (16 kW at 0.8 pf) UPS running in parallel	No.	0	0
(b)	VRLA type Battery banks for UPS (each bank of atleast 38.4 kVAH)	No.	0	0
(c)	Input ACDB (150 kVA rating)	No.	0	0
(d)	Output ACDB (100 kVA rating)	No.	0	0
3.6	Accessories for maintenance of VRLA type batteries	Lot	1	1
3.7	Power Distribution and cabling work required to establish UPS	Lot	1	1
<b>D</b>	<b>DG System</b>			

(a)	50 KVA DG Set	No.	0	0
(b)	100 KVA DG Set	No.	0	0
(c)	125 KVA DG Set	No.	0	0
(d)	160 KVA DG Set	No.	0	0
(e)	200 KVA DG Set	No.	0	0
(f)	320 kVA DG Set	No.	0	0
<b>E</b>	<b>48V DC Power Supply (DCPS) for Substations</b>			
(a)	SMPS based 48V DC Power Supply (DCPS) system of 35 Amp rating	No.	0	0
(b)	VRLA type Battery bank for above DCPS system of 450AH Rating	No.	0	0
(c)	SMPS based 48V DC Power Supply (DCPS) system of 25 Amp rating	No.	0	0
(d)	VRLA type Battery bank for above DCPS system of 600AH Rating	No.	0	0
(e)	VRLA type Battery bank for above DCPS system of 400AH Rating	No.	0	0
<b>F</b>	<b>Test Equipment for RTU</b>			
(a)	Master Station cum RTU simulator & ProtocolAnalyser Software tool.	Lot	1	0
(b)	Laptop PC for above software tools along with interfacing hardware	Lot	1	0
<b>G</b>	<b>Video Conferencing System (VCS)</b>			
<b>1</b>	<b>VCS for Location 1</b>			
(a)	Multi-Point Conferencing Unit	Lot	1	0
(b)	Configuration Laptop with associate Accessories	No.	1	0
(c)	Video End Points	Lot	1	0
(d)	HD camera	No.	2	0
(e)	Micophone basestation	Set	1	0
(f)	Wireless Microphone	No.	2	0
(g)	Collar Microphones	No.	2	0
	LCD Video walls	No.	2	0
(i)	Wall Mounted Line array speakers	No.	2	0
(j)	Dual Channel Power Amplifiers	No.	1	0
<b>2</b>	<b>VCS for Location 2</b>			
(a)	Multi-Point Conferencing Unit	Lot	0	0
(b)	Configuration Laptop with associate Accessories	No.	1	0
(c)	Video End Points	Lot	1	0
(d)	HD camera	No.	2	0
(e)	Micophone basestation	Set	1	0
(f)	Wireless Microphone	No.	2	0
(g)	Collar Microphones	No.	2	0
	LCD Video walls	No.	2	0

(i)	Wall Mounted Line array speakers	No.	2	0
(j)	Dual Channel Power Amplifiers	No.	1	0
<b>3</b>	<b>VCS for ERPC</b>			
(a)	Multi-Point Conferencing Unit	Lot	1	0
(b)	Configuration Laptop with associate Accessories	No.	1	0
(c)	Video End Points	Lot	1	0
(d)	HD camera	No.	2	0
(e)	Micophone basestation	Set	1	0
(f)	Wireless Microphone	No.	2	0
(g)	Collar Microphones	No.	2	0
(h)	LCD Video walls	No.	2	0
(i)	Wall Mounted Line array speakers	No.	2	0
(j)	Dual Channel Power Amplifiers	No.	1	0
<b>H</b>	<b>Mandatory Spares (As per Technical Specification)</b>			
(a)	Mandatory Spares for SCADA/EMS system	Lot	1	1
(b)	Mandatory Spares for VPS	Lot	1	1
(c)	Mandatory Spares for Auxiliary Power Supply system for the control centres	Lot	1	1
(d)	Mandatory Spares for DG Set & AMF Panel for control centres	Lot	0	0
(e)	Mandatory Spares for RTU	Lot	0	0
(f)	Mandatory Spares for DCPS	Lot	0	0
<b>I</b>	<b>Services</b>			
9.1	Integration with Control Centres/other system on ICCP on ICCP	No.	20	20
9.2	Integration with other Applications/Systems			
(a)	Market and Metering Applications	No.	1	1
(b)	Scheduling software	No.	1	1
(c)	Integration of SCADA/EMS system on OPC/Modbus/web services	No.	10	10
9.3	Existing RTU Integration	No.	150	150
9.4	Integration Existing RTU with Data Concentrator Cum Protocol Converter	Lot	0	0
9.5	Cyber Security Audit by CERT -IN certified Auditors during FAT	No.	1	1
9.6	Cyber Security Audit by CERT -IN certified Auditors during SAT	No.	1	1
9.7	Integration with existing VPS with all required software	Lot	0	0
9.8	Dismantling and Buyback of existing SCADA/EMS system	Lot	1	1



9.9	SMS integration with service provider Email integration with owner email system	Lot	1	1
10	Warehouse storage of all supplied system under the Project (as per actual)	Monthly	1	0
<b>J</b>	<b>Training</b>			
(a)	Training on Computer System Hardware & Software	Lot	1	0
(b)	Training on Database & Display	Lot	1	0
(c)	Training on Application Software	Lot	1	0
(d)	Training on Dispatcher/Operator	Lot	1	0
(e)	Training on NMS	Lot	1	0
(f)	Training on Cyber Security and VAPT	Lot	1	0
(g)	Training on Dispatcher Training Simulator	Lot	1	0
(h)	Training on Terminal/DCPC/ICCP Server Course	Lot	1	0
(i)	Training on Auxiliary Power Supply	Lot	1	0
(j)	Training on VC	Lot	0	0
(k)	Training on RTU	Lot	0	0
<b>K</b>	<b>AMC</b>			
11.1	Annual maintenance contract of SCADA/EMS System and all the equipment supplied in the project during Warranty Period	Year	1	1
11.2	Annual maintenance contract of SCADA/EMS System and all the equipment supplied in the project after expiry of Warranty Period	Year	6	6
11.3	ICCP Integration for 7 years (Per ICCP Integration)	No.	10	10
11.4	Six Monthly Cyber Security Audit by Cert-IN certified Auditors	No.	14	14
11.5	Patch Management including Signature updates for all Cyber security equipments for 7 years	Lot	1	1
11.6	Integration of RTU with SCADA during AMC	No.	150	150
11.7	OPC client function (per user) in SCADA Server	No.	5	5
11.8	Integration of SCADA/EMS system on OPC/Modbus/Web services/SAMAST during AMC including DLP	No.	5	5
11.9	Yearly Training on SCADA/EMS for 5 Days for 20 people	Year	7	0
11.10	Catridges			
(a)	Catridges- Cyan/Magenta/Yellow (Set of All)	No.	0	0
(b)	Catridges- Black	No.	0	0

11.11	Drum			
(a)	Drum- Cyan/Magenta/Yellow (Set of All)	No.	0	0
(b)	Drum- Black	No.	0	0
<b>11.12</b>	<b>Relocation and Commissioning at New Location</b>			
(a)	Relocation and Commissioning at New Location- All the systems supplied under this project except VPS and APS	Lot	1	1
(b)	Relocation and Commissioning at New Location- video Projection System	Lot	1	1
(c)	Relocation and Commissioning at New Location- Auxilliary power supply	Lot	1	1
11.13	SMS Service of 1 Lakh messages annually	Year	7	0

**Table 3b. SPARES OF ERLDC**

Sl.no	Item description	Unit	ERLDC	
			Main CC	Backup-CC
<b>A</b>	<b>SCADA/EMS system</b>			
1	Servers (one of each type)	Lot	1	1
2	Workstation with Dual monitors	No.	1	1
3	LAN switch (one of each type)	Lot	1	1
4	Routers (one of each type)	Lot	1	1
5	Firewall with NIPS(External)	No.	1	1
6	Firewall with NIPS(Internal)	No.	1	1
7	Terminal Servers	No.	1	1
8	DCPC	No.	0	0
9	IP based KVM System	No.	1	1
10	Time & Frequency system	Lot	1	1
<b>B</b>	<b>VPS Spares</b>			
1	One complete VPS Module without screen / frame structure	Lot	1	1
2	VPS Controller with all interface cards	Lot	1	1
3	VPS LED PACK of three colors (red, green & Blue) one set per VPS	Lot	0	0
4	Laser Lamp - one set per VPS	LOT	1	1
5	Dust filters	No.	54	12
<b>C</b>	<b>Mandatory Spares for APS</b>			
1	MCCB/MCB/Isolator/Switch/ Contactor of each type & rating (as applicable & used inside UPS panel / Input ACDB / Output ACDB)	Lot	1	1
2	Fuse of each type & rating (if applicable, UPS panel / Input ACDB / Output ACDB)	Lot	5	5
3	DC Filter assembly	Lot	1	1
4	Input AC Filter assembly	Lot	1	1
5	Output AC Filter assembly	Lot	1	1
6	Electronic Printed Circuit Board /Card of each type (including all cards/modules for rectifier/charger, inverter, system card, display module, interface cards etc.)	Lot	1	1
7	Power Semiconductor devices of each type & rating such as SCRs, IGBTs etc. for rectifier/ charger module, Inverter module, Static Switch module for all the three phases (exclude those items which are covered under item-6 above)	Lot	1	1

**Technical Specifications of “Replacement/Upgradation of SCADA/EMS systems of RLDC and SLDCs of Eastern Region under ER ULDC Phase-III”**

<b>Table 4a. Bill of Quantity for SCADA/EMS System of JUSNL</b>				
<b>Sl. No.</b>	<b>Item Description</b>	<b>Unit</b>	<b>Quantity</b>	
			<b>Main CC</b>	<b>Backup CC</b>
<b>A</b>	<b>Software</b>			
1.1	SCADA Software	Lot	1	1
1.2	Load Shed Support(LSS)/ADMS	Lot	1	1
1.3	SOFTWARE FOR ICCP COMMUNICATION	Lot	1	1
1.4	SOFTWARE FOR CFE COMMUNICATION	Lot	1	1
1.5	EMS Functions			
(a)	State Estimator	Lot	1	1
(b)	Contingency Analysis	Lot	1	1
(c)	Security Enhancement	Lot	1	1
(d)	Optimal Power Flow	Lot	1	1
(e)	Outage Scheduler	Lot	1	1
(f)	Transmission Line/Corridor Capability Monitor (TCM)	Lot	1	1
(g)	Short Circuit Analysis	Lot	1	1
(h)	Automatic Generation Control (AGC)	Lot	1	1
1.6	Dynamic Security Assessment (DSA) Software	Lot	0	0
1.7	Dispatcher Training Simulator Software	Lot	1	0
1.8	Database development system (PDS) cum test bench for SCADA and ICCP Integration			
(a)	Database development system (PDS)	Lot	1	1
(b)	Test bench FEP, SCADA & ICCP Intg	Lot	1	1
1.9	Web Server Application			
(a)	Data Replica system software	Lot	1	1
(b)	Web Server system software	Lot	1	1
(c)	Web Historian and Reporting System	Lot	1	1
1.10	OPC client licenses (SCADA & Historian 5 each) - To take data from outside.	Lot	1	1
1.11	SMS & Email Interface	Lot	1	1
1.12	Commercial Off-The-Shelf (COTS) Softwares			
(a)	SOFTWARE FOR DATA HISTORIAN	Lot	1	1
(b)	Document Management System	Lot	1	1

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(c)	Identity Management Software	Lot	1	1
(d)	Network Access Control (NAC)	Lot	1	1
(e)	Patch Management Software	Lot	1	1
(f)	VAPT Tool	Lot	2	2
(g)	Virtualisation Software for all the virtual servers envisaged and required under the project along-with centralised management software	Lot	1	1
(h)	Operating System for all the servers envisaged and required under the project	Lot	1	1
(i)	Host based intrusion prevention system (HIPS) with centralised management	No.	16	16
(j)	End Point Security Solution with centralised management	No.	60	52
(k)	Centralised Management and Log Analyser of all FWs	Lot	1	1
(l)	Network Management System	Lot	1	1
(m)	SIEM (Security Information and Event management)	Lot	1	1
(n)	OPC client licenses to be installed outside OT network to exchange data from SCADA & Historian	No.	2	2
(o)	Load Forecasting	Lot	1	1
1.13	OPC server	No.	2	2
1.14	Report Development & Generation Software	Lot	1	1
1.15	Storage system			
(a)	SAN Software	Lot	1	1
(b)	NAS Software	Lot	1	1
<b>B</b>	<b>Hardware</b>			
2.1	SCADA/EMS Server	No.	2	2
2.2	Dynamic Security Assessment (DSA) Server	No.	0	0
2.3	ICCP, CFE, OPC Server			
(a)	<b>ICCP, OPC communication Server</b>	No.	2	2
(b)	Communication Front End (CFE) Server	No.	2	2
2.4	Data Historian Server/Data Storage Server	No.	2	2

**Technical Specifications of “Replacement/Upgradation of SCADA/EMS systems of RLDC and SLDCs of Eastern Region under ER ULDC Phase-III”**

2.5	DTS Server	No.	2	0
2.6	PDS (test & development) server	No.	2	1
2.7	Third Party Applications Servers as per technical specification	No	2	2
(a)	End Point Security Solution Server			
(b)	Patch management Server			
(c)	NMS server			
(d)	VAPT server			
2.8	Management Applications Servers as per technical specification	No	2	2
(a)	Internal Centralised Mangement Server			
(b)	Network Access Control (NAC)			
(c)	Identity Management Server			
2.9	DRS DMZ Servers as per technical specification	No	2	2
(a)	External Centralised Mangement Server			
(b)	Data Replica Server			
(c)	SIEM			
(d)	Document Management System			
2.10	External DMZ Servers as per technical specification	No	2	2
(a)	Web Servers			
(b)	End Point Security Solution Server			
(c)	Patch management Server			
(d)	Web Historian and Reporting server			
(e)	OPC Server			
2.11	Server Mangement Console	No.	1	1
2.12	Backup Solution	No.	1	1
2.13	Storage system			
(a)	SAN management server along with SAN Box and mass storage (SAN)	No.	2	2
(b)	Nas Box	No.	1	1
2.14	WAN Routers with Firewall			
(a)	WAN Router cum Firewall for ICCP Communication	No.	2	2
(b)	WAN Router cum Firewall for External World Connectivity	No.	2	2
(c)	WAN Router cum firewall for RTU Communication	No.	2	2
(d)	Router cum firewall for Remote Consoles	No.	4	4



**Technical Specifications of “Replacement/Upgradation of SCADA/EMS systems of RLDC and SLDCs of Eastern Region under ER ULDC Phase-III”**

(e)	WAN Router cum firewall for PDS	No.	2	2
2.15	Switches			
(a)	48 Port L3- LAN switch for SCADA/EMS LAN	No.	2	2
(b)	24 Port L3- LAN switch for Historian & Reporting LAN	No.	2	2
(c)	16 port FC switch for SAN Switch	No.	2	2
(d)	24 Port L3- LAN switch for Internal & External DMZ LAN	No.	2	2
(e)	24 Port L3- LAN Switch for Server Management LAN	No.	2	2
(f)	24 Port L3- LAN Switch for ICCP & FEP LAN	No.	2	2
(g)	24 Port L3- LAN Switch for DCPC/Terminal Server LAN	No.	2	2
2.16	Cyber Security Appliances			
(a)	External Firewall with NIPS and centralised mangement	No.	2	2
(b)	Internal Firewall with NIPS and centralised mangement	No.	2	2
(c)	External Firewall with NIPS for ICCP/RTU and centralised mangement	No.	2	2
(d)	Anti-APT	No.	1	1
2.17	Laptops			
(a)	Laptop for maintenance	No.	1	1
(b)	Laptop for DTS	No.	2	0
(c)	Laptop fot VAPT	No.	1	1
2.18	Data Concentrator PC (DCPC) as per technical specification			
(a)	Industrial grade Computer with 4 LAN and 2 Serial Ports	No.	2	0
(b)	8 Port 10/100 Mbps Ethernet switch with RJ 45 Ports	No.	2	0
(c)	GPS based time synchronisation system	SET	2	0
(d)	16 Port Splitter	No.	2	0
(e)	32 Port Terminal Servers	No.	2	0
(g)	Panel for Terminal Servers with accessories	No.	1	0
2.19	Workstations			
(a)	Workstation Console without Monitor	No.	2	2

**Technical Specifications of “Replacement/Upgradation of SCADA/EMS systems of RLDC and SLDCs of Eastern Region under ER ULDC Phase-III”**

(b)	Workstation Console integrated with dual Monitors			
(i)	Workstation	No.	4	2
(ii)	Dual monitors for workstation	No.	4	2
(c)	DTS Workstation with dual Monitors (Training Console)			
(i)	DTS Workstation console	No.	4	0
(ii)	Dual monitors for DTS	No.	4	0
(d)	Workstation Console integrated with dual Monitors for DSA (at RLDC only)			
(i)	Workstation Console for DSA	No.	0	0
(ii)	dual Monitors for DSA	No.	0	0
(e)	PDS Workstations with dual Monitor			
(i)	workstation for PDS	No.	2	2
(ii)	Dual monitor for PDS	No.	2	2
(f)	Workstation Console integrated with Single Monitors			
(i)	Workstation	No.	2	2
(ii)	Dual monitors for workstation	No.	2	2
2.20	Remote Consoles			
(a)	Remote Console with Dual monitor			
(i)	Remote Consoles with CPU (Dual monitor)	No.	0	0
(ii)	Dual monitor for remote console	No.	0	0
(b)	All-in-One workstations with CPU (remote console)	No.	2	2
(c)	Remote Consoles with 55" Monitor with CPU			
(i)	Remote Consoles with CPU (55" monitor)	No.	2	2
(ii)	55" monitor for remote console	No.	2	2
2.21	Video Projection System			
(a)	Laser VPS	No.	18	12
(b)	LED VPS	No.	0	0
2.22	Video wall			
(a)	55" Tower Type Video Wall with CPU (with proper stand)	No.	2	0

**Technical Specifications of “Replacement/Upgradation of SCADA/EMS systems of RLDC and SLDCs of Eastern Region under ER ULDC Phase-III”**

(b)	55" Wall mounted Video Wall with CPU (with proper mounting)	No.	2	0
(c)	55" (3*3) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
(d)	55" (3*2) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
(e)	55" (2*2) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
2.23	Printers			
(a)	Color Laser Printer	No.	2	1
(b)	Multi Functional Printer	No.	4	1
(c)	A4 Size Multi Functional Display Printers	No.	0	0
2.24	Time & Frequency System and External displays			
(a)	Time & Frequency System NavIC(with failback to GPS)Based	Lot	2	2
(b)	Digital Display for Date	No.	1	1
(c)	Digital Display for Day	No.	1	1
(d)	Digital Display for Time	No.	1	1
(e)	Digital Display for Frequency	No.	1	1
(f)	Digital Display for Time Block	No.	1	1
(g)	Digital Display for Temperature	No.	1	1
2.25	Furniture			
(a)	U-Type Operator Workstations desk (per cubicle 9-10 feet)	No.	3	2
(b)	Operator Workstations desk			
(i)	Operator Workstations desk-Motorized	No.	2	2
(ii)	Operator Workstations desk-Normal	No.	10	6
(c)	Chairs	No.	16	10
(d)	printer Table	No.	0	0
2.26	Weather Sensors for Server Room	No.	1	1
2.27	Link Load Balancer	No.	2	2
2.28	Smart server rack	No.	3	3
2.29	IP based KVM system	No.	1	1
2.30	Centralized keyboard & mouse control solution (CKMC)	Set	3	3
2.31	External HDD	No.	4	4
<b>C</b>	<b>Auxiliary power Supply</b>			
3.2	<b>80 kVA UPS System</b>	No.		
(a)	80 kVA (64 kW at 0.8 pf) UPS running in	No.	0	0
(b)	VRLA type Battery banks for UPS (each	No.	0	0

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(c)	Input ACDB (350KVA rating)	No.	0	0
(d)	Output ACDB (300 kVA rating)	No.	0	0
3.3	<b>60 kVA UPS System</b>			
(a)	60 kVA (48 kW at 0.8 pf) UPS running in parallel	No.	2	0
(b)	VRLA type Battery banks for UPS (each	No.	2	0
(c)	Input ACDB (250 kVA rating)	No.	1	0
(d)	Output ACDB (200 kVA rating)	No.	1	0
3.4	<b>40 kVA UPS System</b>			
(a)	40 kVA (32 kW at 0.8 pf) UPS running in parallel	No.	0	2
(b)	VRLA type Battery banks for UPS (each bank of atleast 76.8 kVAH)	No.	0	2
(c)	Input ACDB (150 kVA rating)	No.	0	1
(d)	Output ACDB (100 kVA rating)	No.	0	1
3.6	Accessories for maintenance of VRLA type batteries	Lot	1	1
3.7	Power Distribution and cabling work required to establish UPS	Lot	1	1
<b>D</b>	<b>DG set</b>			
(a)	50 KVA DG Set	No.	0	0
(b)	100 KVA DG Set	No.	0	0
(c)	125 KVA DG Set	No.	0	0
(d)	160 KVA DG Set	No.	1	0
(e)	200 KVA DG Set	No.	0	0
(f)	320 kVA DG Set	No.	0	0
<b>E</b>	<b>48V DC Power Supply (DCPS) in Substations</b>			
(a)	SMPS based 48V DC Power Supply (DCPS) system of 35 Amp rating	No.	10	
(b)	VRLA type Battery bank for above DCPS system of 450AH Rating	No.	10	
(c)	SMPS based 48V DC Power Supply (DCPS) system of 25 Amp rating	No.	0	0
(d)	VRLA type Battery bank for above DCPS system of 600AH Rating	No.	0	0
(e)	VRLA type Battery bank for above DCPS system of 400AH Rating	No.	0	0
<b>F</b>	<b>Test Equipment for RTU</b>			
(a)	Master Station cum RTU simulator & ProtocolAnalyser Software tool.	Lot	1	1
(b)	Laptop PC for above software tools along with interfacing hardware	Lot	1	1

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<b>H</b>	<b>Mandatory Spares (As per Technical Specification)</b>			
(a)	Mandatory Spares for SCADA/EMS system	Lot	1	1
(b)	Mandatory Spares for VPS	Lot	1	1
(c)	Mandatory Spares for Auxiliary Power Supply system for the control centres	Lot	1	1
(d)	Mandatory Spares for DG Set & AMF Panel for control centres	Lot	1	0
<b>I</b>	<b>Services</b>			
9.1	Integration with Control Centres/other system on ICCP on ICCP	No.	16	16
9.2	Integration with other Applications/Systems			
(a)	Integration with Market and Metering Applications	No.	1	1
(b)	Integration with Scheduling software	No.	1	1
(c)	Integration of SCADA/EMS system on OPC/Modbus/web services	No.	10	10
9.3	Existing RTU Integration	No.	150	150
9.4	Integration Existing RTU with Data Concentrator Cum Protocol Convertor	Lot	1	1
9.5	Cyber Security Audit by CERT -IN certified Auditors during FAT	No.	1	1
9.6	Cyber Security Audit by CERT -IN certified Auditors during SAT	No.	1	1
9.8	Dismantling and Buyback of existing SCADA/EMS system	Lot	1	1
9.9	SMS integration with service provider Email integration with owner email system	Lot	1	1
<b>J</b>	<b>Training</b>			
(a)	Training on Computer System Hardware & Software	Lot	1	0
(b)	Training on Database & Display	Lot	1	0
(c)	Training on Application Software	Lot	1	0
(d)	Training on Dispatcher/Operator	Lot	1	0
(e)	Training on NMS	Lot	1	0
(f)	Training on Cyber Security and VAPT	Lot	1	0

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(g)	Training on Dispatcher Training Simulator	Lot	1	0
(h)	Training on Terminal/DCPC/ICCP Server Course	Lot	1	0
(i)	Training on Auxiliary Power Supply	Lot	1	0
<b>K</b>	<b>AMC</b>			
11.1	Annual maintenance contract of SCADA/EMS System and all the equipment supplied in the project during Warranty Period	Year	1	1
11.2	Annual maintenance contract of SCADA/EMS System and all the equipment supplied in the project after expiry of Warranty Period	Year	6	6
11.3	ICCP Integration for 7 years (Per ICCP Integration)	No.	20	20
11.4	Six Monthly Cyber Security Audit by Cert-IN certified Auditors	No.	14	14
11.5	Patch Management including Signature updates for all Cyber security equipments for 7 years	Lot	1	1
11.6	Integration of RTU with SCADA during AMC	No.	200	200
11.7	OPC client function (per user) in SCADA Server	No.	5	5
11.8	Integration of SCADA/EMS system on OPC/Modbus/Web services/SAMAST during AMC including DLP	No.	5	5
11.9	Yearly Training on SCADA/EMS for 5 Days for 20 people	Year	7	0
11.10	Catridges			
(a)	Catridges- Cyan/Magenta/Yellow (Set of All)	No.	6	6
(b)	Catridges- Black	No.	10	10
11.11	Drum			
(a)	Drum- Cyan/Magenta/Yellow (Set of All)	No.	6	6
(b)	Drum- Black	No.	10	10
11.14	SMS Service of 1 Lakh messages annually	Year	7	0



**Table 4b. SPARES OF JUSNL**

Sl.no	Item description	Unit	Quantity	
			Main CC	Backup-CC
<b>A</b>	<b>SCADA/EMS system</b>			
1	Servers (one of each type)	Lot	1	1
2	Workstation with Dual monitors	No.	1	1
3	LAN switch (one of each type)	Lot	1	1
4	Routers (one of each type)	Lot	1	1
5	Firewall with NIPS(External)	No.	1	1
6	Firewall with NIPS(Internal)	No.	1	1
7	Terminal Servers	No.	1	1
8	DCPC	No.	1	1
9	IP based KVM System	No.	1	1
10	Time & Frequency system	Lot	1	1
<b>B</b>	<b>VPS Spares</b>			
1	One complete VPS Module without screen / frame structure	Lot	1	1
2	VPS Controller with all interface cards	Lot	1	1
3	VPS LED PACK of three colors (red, green & Blue) one set per VPS	Lot	0	0
4	Laser Lamp - one set per VPS	LOT	1	1
5	Dust filters	No.	36	24
<b>C</b>	<b>Mandatory Spares for APS</b>			
1	MCCB/MCB/Isolator/Switch/ Contactor of each type & rating (as applicable & used inside UPS panel / Input ACDB / Output ACDB)	Lot	1	1
2	Fuse of each type & rating (if applicable, UPS panel / Input ACDB / Output ACDB)	Lot	5	5
3	DC Filter assembly	Lot	1	1
4	Input AC Filter assembly	Lot	1	1
5	Output AC Filter assembly	Lot	1	1
6	Electronic Printed Circuit Board /Card of each type (including all cards/modules for rectifier/charger, inverter, system card, display module, interface cards etc.)	Lot	1	1
7	Power Semiconductor devices of each type & rating such as SCRs, IGBTs etc. for rectifier/ charger module, Inverter module, Static Switch module for all the three phases (exclude those items which are covered under item-6 above)	Lot	1	1

<b>D Mandatory Spares for DG Set</b>				
1	Filter, Spring, Gaskets, Air cleaner (one no. of each type)	Lot	1	0
2	Complete Rotating Rectifier Assembly for Alternator	Lot	1	0
3	Voltage Regulator Complete	Lot	1	0
4	Switches/ Isolator / Contactor/Auxiliary relay / Timers (one no. of each type & rating)	Lot	1	0
5	DG Fuel Pump, V Belt for DG set & Solenoid coil for Fuel Oil system (one no. each type)	Lot	1	0
6	Indicating Lamps & Fuses (5 nos of each type & rating)	Lot	1	0
<b>E Mandatory Spares for DCPS Spare</b>		Lot		
1	MCCB/MCB/CONTACTOR/TIMER/RELAY FOR DCPS	Set	1	0
2	SINGLE POLE MCBS FOR DCPS FEP	Set	3	0
3	ELECTRONIC PRINTED CIRCUIT BOARD	Set	1	0
<b>F RTU Spares</b>				
1	CPU Cards	No.	4	0
2	Digital Input Module	No.	31	0
3	Digital Output Module	No.	13	0
4	Analog Input Module	No.	2	0
5	Multi Function Transducers	No.	45	0
6	OLTC Transducer	No.	7	0
7	Contact Multiplying Relays (CMRs)	No.	469	0
8	Heavy Duty Relay	No.	90	0

**Table 4c. RTU-BOQ OF JUSNL**

Sl. No.	Item Description	Unit	Quantity
<b>A</b>	<b>Hardware</b>		
1	RTU & associated items		
(a)	RTU base equipment as per technical specification	Set	18
(b)	CPU Cards	Nos	36
(c)	Digital Input Module (16 channel)	Nos	303
(d)	Digital Output Module (8 channel)	Nos	126
(e)	Analog Input Module (8 channel)	Nos	18
(f)	Multi Function Transducers	Nos	447
(g)	Weather Sensor	Nos	18
(h)	OLTC Transducer	Nos	61
(i)	Contact Multiplying Relays (CMRs)	Nos	4682
(j)	Time Synchronization Equipment	Set	18
(k)	Heavy Duty Relay	Nos	894
(l)	Supervisory Interface Cubicles(SIC) panel for mounting MFTs, CMR etc if required	Set	18
(m)	LDMS System Along with software	Set	18
(n)	Furniture for LDMS system (1 Table &1 Chair)	Set	18
(o)	Inverter for LDMS	Nos	18
(p)	Cables for RTU	Lot	18
(q)	Laptop for PCMT	Nos	2
<b>B</b>	<b>Services</b>		
1	Integration with Control Centres (SLDC/RLDC) on IEC104 at substation & control centre	Lot	18
<b>C</b>	<b>Annual Maintenance Contract</b>		
1	Integration of new bay(Including supply & commis	Lot	150
2	RTU maintenance (1 Years)	Lot	18
3	RTU maintenance (6 Years)	Lot	18

**Table 5a. Bill of Quantity for SCADA/EMS System of OPTCL**

Sl. No.	Item Description	Unit	Quantity	
			Main CC	Backup CC
<b>A</b>	<b>Software</b>			
1.1	SCADA Software	Lot	1	1
1.2	Load Shed Support(LSS)/ADMS	Lot	1	1
1.3	SOFTWARE FOR ICCP COMMUNICATION	Lot	1	1
1.4	SOFTWARE FOR CFE COMMUNICATION	Lot	1	1
1.5	EMS Functions			
(a)	State Estimator	Lot	1	1
(b)	Contingency Analysis	Lot	1	1
(c)	Security Enhancement	Lot	1	1
(d)	Optimal Power Flow	Lot	1	1
(e)	Outage Scheduler	Lot	1	1
(f)	Transmission Line/Corridor Capability Monitor (TCM)	Lot	1	1
(g)	Short Circuit Analysis	Lot	1	1
(h)	Automatic Generation Control (AGC)	Lot	1	1
1.6	Dynamic Security Assessment (DSA) Software	Lot	0	0
1.7	Dispatcher Training Simulator Software	Lot	1	0
1.8	Database development system (PDS) cum test bench for SCADA and ICCP Integration			
(a)	Database development system (PDS)	Lot	1	1
(b)	Test bench FEP, SCADA & ICCP Intg	Lot	1	1
1.9	Web Server Application			
(a)	Data Replica system software	Lot	1	1
(b)	Web Server system software	Lot	1	1
(c)	Web Historian and Reporting System	Lot	1	1
1.10	OPC client licenses (SCADA & Historian 5 each) - To take data from outside.	Lot	1	0
1.11	SMS & Email Interface	Lot	1	1
1.12	Commercial Off-The-Shelf (COTS) Softwares			
(a)	SOFTWARE FOR DATA HISTORIAN	Lot	1	1
(b)	Document Management System	Lot	1	0
(c)	Identity Management Software	Lot	1	1
(d)	Network Access Control (NAC)	Lot	1	1
(e)	Patch Management Software	Lot	1	1

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(f)	VAPT Tool	Lot	2	2
(g)	Virtualisation Software for all the virtual servers envisaged and required under the project along-with centralised management software	Lot	1	1
(h)	Operating System for all the servers envisaged and required under the project	Lot	1	1
(i)	Host based intrusion prevention system (HIPS) with centralised management	No.	16	16
(j)	End Point Security Solution with centralised management	No.	50	41
(k)	Centralised Management and Log Analyser of all FWs	Lot	1	1
(l)	Network Management System	Lot	1	1
(m)	SIEM (Security Information and Event management)	Lot	1	1
(n)	OPC client licenses to be installed outside OT network to exchange data from SCADA & Historian	No.	2	0
(o)	Load Forecasting	Lot	1	1
1.13	OPC server	No.	2	2
1.14	Report Development & Generation Software	Lot	1	1
1.15	Storage system			
(a)	SAN Software	Lot	1	1
(b)	NAS Software	Lot	1	1
<b>B</b>	<b>Hardware</b>			
2.1	SCADA/EMS Server	No.	2	2
2.2	Dynamic Security Assessment (DSA) Server	No.	0	0
2.3	ICCP, CFE, OPC Server			
(a)	ICCP, OPC communication Server	No.	2	2
(b)	Communication Front End (CFE) Server	No.	2	2
2.4	Data Historian Server/Data Storage Server	No.	2	2
2.5	DTS Server	No.	1	0
2.6	PDS (test & development) server	No.	1	0
2.7	Third Party Applications Servers as per technical specification	No	2	2
(a)	End Point Security Solution Server			
(b)	Patch management Server			
(c)	NMS server			

(d)	VAPT server			
2.8	Management Applications Servers as per technical specification	No	2	2
(a)	Internal Centralised Mangement Server			
(b)	Network Access Control (NAC)			
(c)	Identity Management Server			
2.9	DRS DMZ Servers as per technical specification	No	2	2
(a)	External Centralised Mangement Server			
(b)	Data Replica Server			
(c)	SIEM			
(d)	Document Management System			
2.10	External DMZ Servers as per technical specification	No	2	2
(a)	Web Servers			
(b)	End Point Security Solution Server			
(c)	Patch management Server			
(d)	Web Historian and Reporting server			
(e)	OPC Server			
2.11	Server Mangement Console	No.	1	1
2.12	Backup Solution	No.	1	1
2.13	Storage system			
(a)	SAN management server along with SAN Box and mass storage (SAN)	No.	2	2
(b)	Nas Box	No.	1	1
2.14	WAN Routers with Firewall			
(a)	WAN Router cum Firewall for ICCP Communication	No.	2	2
(b)	WAN Router cum Firewall for External World Connectivity	No.	2	2
(c)	WAN Router cum firewall for RTU Communication	No.	2	2
(d)	Router cum firewall for Remote Consoles	No.	10	0
(e)	WAN Router cum firewall for PDS	No.	2	2
2.15	Switches			
(a)	48 Port L3- LAN switch for SCADA/EMS LAN	No.	2	2
(b)	24 Port L3- LAN switch for Historian & Reporting LAN	No.	2	2
(c)	16 port FC switch for SAN Switch	No.	2	2
(d)	24 Port L3- LAN switch for Internal & External DMZ LAN	No.	2	2



(e)	24 Port L3- LAN Switch for Server Management LAN	No.	2	2
(f)	24 Port L3- LAN Switch for ICCP & FEP LAN	No.	2	2
(g)	24 Port L3- LAN Switch for DCPC/Terminal Server LAN	No.	0	0
(h)	48 Port L3- LAN Switch for Terminal Server	No.	0	0
(i)	24 Port L3- LAN Switch for Terminal Server	No.	0	0
(j)	32 Port L3- LAN Switch for Terminal Server	No.	0	0
(k)	24 Port L3- LAN Switch for Remote Console	No.	0	0
2.16	Cyber Security Appliances			
(a)	External Firewall with NIPS and centralised mangement	No.	2	2
(b)	Internal Firewall with NIPS and centralised mangement	No.	2	2
(c)	External Firewall with NIPS for ICCP/RTU and centralised mangement	No.	2	2
(d)	Anti-APT	No.	1	1
2.17	Laptops			
(a)	Laptop for maintenance	No.	2	2
(b)	Laptop for DTS	No.	1	0
(c)	Laptop fot VAPT	No.	1	1
2.18	Data Concentrator PC (DCPC) as per technical specification	SET		
(a)	Industrial grade Computer with 4 LAN and 2 Serial Ports	No.	0	0
(b)	8 Port 10/100 Mbps Ethernet switch with RJ 45 Ports	No.	0	0
(c)	GPS based time synchronisation system	SET	0	0
(d)	16 Port Splitter	No.	0	0
(e)	32 Port Terminal Servers	No.	0	0
(f)	16 Port Terminal Servers	No.	0	0
(g)	Panel for Terminal Servers with accessories	No.	0	0
2.19	Workstations			
(a)	Workstation Console without Monitor	No.	0	0
(b)	Workstation Console integrated with dual Monitors			
(i)	Workstation	No.	4	2
(ii)	Dual monitors for workstation	No.	4	2

(c)	DTS Workstation with dual Monitors (Training Console)			
(i)	DTS Workstation console	No.	3	0
(ii)	Dual monitors for DTS	No.	3	0
(d)	Workstation Console integrated with dual Monitors for DSA (at RLDC only)			
(i)	Workstation Console for DSA	No.	0	0
(ii)	dual Monitors for DSA	No.	0	0
(e)	PDS Workstations with dual Monitor			
(i)	workstation for PDS	No.	2	2
(ii)	Dual monitor for PDS	No.	2	2
(f)	Workstation Console integrated with single Monitors			
(i)	Workstation	No.	0	0
(ii)	Single monitors for workstation	No.	0	0
2.20	Remote Consoles			
(a)	Remote Console with Dual monitor			
(i)	Remote Consoles with CPU (Dual monitor)	No.	10	0
(ii)	Dual monitor for remote console	No.	10	0
(b)	All-in-One workstations with CPU (remote console)	No.	0	0
(c)	Remote Consoles with 55" Monitor with CPU			
(i)	Remote Consoles with CPU (55" monitor)	No.	0	0
(ii)	55" monitor for remote console	No.	0	0
2.21	Video Projection System			
(i)	Laser VPS (Modules)	No.	0	4
(ii)	LED VPS (Modules)	No.	0	0
2.22	Video wall			
(a)	55" Tower Type Video Wall with CPU (with proper stand)	No.	1	1
(b)	55" Wall mounted Video Wall with CPU (with proper mounting)	No.	1	0
(c)	55" (3*3) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
(d)	55" (3*2) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
(e)	55" (2*2) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
2.23	Printers			
(a)	Color Laser Printer	No.	2	2
(b)	Multi Functional Printer	No.	2	2

(c)	A4 Size Multi Functional Display Printers	No.	0	0
2.24	Time & Frequency System and External displays			
(a)	Time & Frequency System NavIC(with failback to GPS)Based	Lot	2	1
(b)	Digital Display for Date	No.	1	1
(c)	Digital Display for Day	No.	1	1
(d)	Digital Display for Time	No.	1	1
(e)	Digital Display for Frequency	No.	1	1
(f)	Digital Display for Time Block	No.	1	1
(g)	Digital Display for Temperature	No.	0	0
(h)	Digital Display for Humidity	No.	0	0
2.25	Furniture			
(a)	U-Type Operator Workstations desk (per cubicle 9-10 feet)	No.	0	0
(b)	Operator Workstations desk			
(i)	Operator Workstations desk-Motorized	No.	9	4
(ii)	Operator Workstations desk-Normal	No.	0	0
(c)	Chairs	No.	18	8
(d)	printer Table	No.	1	1
2.26	Weather Sensors for Server Room	No.	1	1
2.27	Link Load Balancer	No.	2	2
2.28	Smart server rack	No.	3	3
2.29	IP based KVM system	No.	1	1
2.30	Centralized keyboard & mouse control solution (CKMC)	Set	1	1
2.31	External HDD	No.	2	2
<b>C</b>	<b>Auxiliary power Supply</b>			
3.2	80 kVA UPS System			
(a)	80 kVA (64 kW at 0.8 pf) UPS running in parallel	No.	0	0
(b)	VRLA type Battery banks for UPS (each bank of atleast 153.6 kVAH)	No.	0	0
(c)	Input ACDB (350KVA rating)	No.	0	0
(d)	Output ACDB (300 kVA rating)	No.	0	0
3.3	60 kVA UPS System			
(a)	60 kVA (48 kW at 0.8 pf) UPS running in parallel	No.	0	0
(b)	VRLA type Battery banks for UPS (each bank of atleast 115.2 kVAH)	No.	0	0
(c)	Input ACDB (250 kVA rating)	No.	0	0
(d)	Output ACDB (200 kVA rating)	No.	0	0
3.4	40 kVA UPS System			

(a)	40 kVA (32 kW at 0.8 pf) UPS running in parallel	No.	2	2
(b)	VRLA type Battery banks for UPS (each bank of atleast 76.8 kVAH)	No.	2	2
(c)	Input ACDB (150 kVA rating)	No.	1	1
(d)	Output ACDB (100 kVA rating)	No.	1	1
3.5	20 kVA UPS System			
(a)	20 kVA (16 kW at 0.8 pf) UPS running in parallel	No.	0	0
(b)	VRLA type Battery banks for UPS (each bank of atleast 38.4 kVAH)	No.	0	0
(c)	Input ACDB (150 kVA rating)	No.	0	0
(d)	Output ACDB (100 kVA rating)	No.	0	0
3.6	Accessories for maintenance of VRLA type batteries	Lot	1	1
3.7	Power Distribution and cabling work required to establish UPS	Lot	1	1
<b>D</b>	<b>DG System</b>			
(a)	50 KVA DG Set	No.	0	0
(b)	100 KVA DG Set	No.	0	0
(c)	125 KVA DG Set	No.	1	1
(d)	160 KVA DG Set	No.	0	0
(e)	200 KVA DG Set	No.	0	0
(f)	250 KVA DG Set	No.	0	0
(g)	320 kVA DG Set	No.	0	0
<b>E</b>	<b>48V DC Power Supply (DCPS) for Substations</b>			
(a)	SMPS based 48V DC Power Supply (DCPS) system of 35 Amp rating	No.	2	2
(b)	VRLA type Battery bank for above DCPS system of 450AH Rating	No.	2	2
(c)	SMPS based 48V DC Power Supply (DCPS) system of 25 Amp rating	No.	0	0
(d)	VRLA type Battery bank for above DCPS system of 600AH Rating	No.	0	0
(e)	VRLA type Battery bank for above DCPS system of 400AH Rating	No.	0	0
<b>F</b>	<b>Test Equipment for RTU</b>			
(a)	Master Station cum RTU simulator & ProtocolAnalyser Software tool.	Lot	1	0
(b)	Laptop PC for above software tools along with interfacing hardware	Lot	1	0
<b>G</b>	<b>Video Conferencing System</b>			
(a)	Multi-Point Conferencing Unit	Lot	2	0

(b)	Configuration Laptop with associate Accessories	No.	1	0
(c)	Video End Points	Lot	1	0
(d)	HD camera	No.	2	0
(e)	Micophone basestation	Set	1	0
(f)	Wireless Microphone	No.	2	0
(g)	Collar Microphones	No.	2	0
(h)	LCD Video walls	No.	2	0
(i)	Wall Mounted Line array speakers	No.	2	0
(j)	Dual Channel Power Amplifiers	No.	1	0
<b>H</b>	<b>Mandatory Spares (As per Technical Specification)</b>			
(a)	Mandatory Spares for SCADA/EMS system	Lot	1	1
(b)	Mandatory Spares for VPS	Lot	0	1
(c)	Mandatory Spares for Auxiliary Power Supply system for the control centres	Lot	1	1
(d)	Mandatory Spares for DG Set & AMF Panel for control centres	Lot	1	1
(e)	Mandatory Spares for RTU	Lot	0	0
(f)	Mandatory Spares for DCPS	Lot	1	1
<b>I</b>	<b>Services</b>			
9.1	Integration with Control Centres/other system on ICCP on ICCP	No.	6	6
9.2	Integration with other Applications/Systems			
(a)	Market and Metering Applications	No.	1	1
(b)	Scheduling software	No.	1	1
(c)	Integration of SCADA/EMS system on OPC/Modbus/web services	No.	10	0
9.3	Existing RTU Integration	No.	280	280
9.4	Integration Existing RTU with Data Concentrator Cum Protocol Convertor	Lot	0	0
9.5	Cyber Security Audit by CERT -IN certified Auditors during FAT	No.	1	1
9.6	Cyber Security Audit by CERT -IN certified Auditors during SAT	No.	1	1
9.7	Integration with existing VPS with all required software	Lot	1	0
9.8	Dismantling and Buyback of existing SCADA/EMS system	Lot	1	1
9.9	SMS integration with service provider Email integration with owner email system	Lot	1	1
<b>J</b>	<b>Training</b>			

(a)	Training on Computer System Hardware & Software	Lot	1	0
(b)	Training on Database & Display	Lot	1	0
(c)	Training on Application Software	Lot	1	0
(d)	Training on Dispatcher/Operator	Lot	1	0
(e)	Training on NMS	Lot	1	0
(f)	Training on Cyber Security and VAPT	Lot	1	0
(g)	Training on Dispatcher Training Simulator	Lot	1	0
(h)	Training on Terminal/DCPC/ICCP Server Course	Lot	0	0
(i)	Training on Auxiliary Power Supply	Lot	1	0
(j)	Training on VC	Lot	1	0
(k)	Training on RTU	Lot	0	0
<b>K</b>	<b>AMC</b>			
11.1	Annual maintenance contract of SCADA/EMS System and all the equipment supplied in the project during Warranty Period	Year	1	1
11.2	Annual maintenance contract of SCADA/EMS System and all the equipment supplied in the project after expiry of Warranty Period	Year	6	6
11.3	ICCP Integration for 7 years (Per ICCP Integration)	No.	15	15
11.4	Six Monthly Cyber Security Audit by Cert-IN certified Auditors	No.	14	14
11.5	Patch Management including Signature updates for all Cyber security equipments for 7 years	Lot	1	1
11.6	Integration of RTU with SCADA during AMC	No.	350	350
11.7	OPC client function (per user) in SCADA Server	No.	5	5
11.8	Integration of SCADA/EMS system on OPC/Modbus/Web services/SAMAST during AMC including DLP	No.	5	5
11.9	Yearly Training on SCADA/EMS for 5 Days for 20 people	Year	7	0
11.10	Catridges			
(a)	Catridges- Cyan/Magenta/Yellow (Set of All)	No.	0	0
(b)	Catridges- Black	No.	0	0
11.11	Drum			
(a)	Drum- Cyan/Magenta/Yellow (Set of All)	No.	0	0



(b)	Drum- Black	No.	0	0
<b>11.12</b>	<b>Relocation and Commissioning at New Location</b>			
(a)	Relocation and Commissioning at New Location- All the systems supplied under this project except VPS and APS	Lot	0	0
(b)	Relocation and Commissioning at New Location- video Projection System	Lot	0	0
(c)	Relocation and Commissioning at New Location- Auxilliary power supply	Lot	0	0
11.13	SMS Service of 1 Lakh messages annually	Year	7	0
11.14	Maintanance of existing VPS with all required software	Lot	1	0

**Table 5b. SPARES OF OPTCL**

Sl.no	Item description	Unit	Quantity	
			Main CC	Backup-CC
<b>A</b>	<b>SCADA/EMS system</b>			
1	Servers (one of each type)	Lot	1	1
2	Workstation with Dual monitors	No.	1	1
3	LAN switch (one of each type)	Lot	1	1
4	Routers (one of each type)	Lot	1	1
5	Firewall with NIPS(External)	No.	1	1
6	Firewall with NIPS(Internal)	No.	1	1
7	Terminal Servers (MCC & BCC)	No.	0	0
8	DCPC	No.	0	0
8	IP based KVM System	No.	1	1
9	Time & Frequency system	Lot	1	1
<b>B</b>	<b>VPS Spares</b>			
1	One complete VPS Module without screen / frame structure	Lot	0	1
2	VPS Controller with all interface cards	Lot	0	1
3	VPS LED PACK of three colors (red, green & Blue) one set per VPS	Lot	0	0
4	Laser Lamp - one set per VPS	LOT	0	1
5	Dust filters	No.	0	8
<b>C</b>	<b>Mandatory Spares for APS</b>			
1	MCCB/MCB/Isolator/Switch/ Contactor of each type & rating (as applicable & used inside UPS panel / Input ACDB / Output ACDB)	Lot	1	1
2	Fuse of each type & rating (if applicable, UPS panel / Input ACDB / Output ACDB)	Lot	5	5
3	DC Filter assembly	Lot	1	1
4	Input AC Filter assembly	Lot	1	1
5	Output AC Filter assembly	Lot	1	1
6	Electronic Printed Circuit Board /Card of each type (including all cards/modules for rectifier/charger, inverter, system card, display module, interface cards etc.)	Lot	1	1
7	Power Semiconductor devices of each type & rating such as SCRs, IGBTs etc. for rectifier/ charger module, Inverter module, Static Switch module for all the three phases (exclude those items which are covered under item-6 above)	Lot	1	1

<b>B</b>	<b>Mandatory Spares for DG Set</b>			
1	Filter, Spring, Gaskets, Air cleaner (one no. of each type)	Lot	1	1
2	Complete Rotating Rectifier Assembly for Alternator	Lot	1	1
3	Voltage Regulator Complete	Lot	1	1
4	Switches/ Isolator / Contactor/Auxiliary relay / Timers (one no. of each type & rating)	Lot	1	1
5	DG Fuel Pump, V Belt for DG set & Solenoid coil for Fuel Oil system (one no. each type)	Lot	1	1
6	Indicating Lamps & Fuses (5 nos of each type & rating)	Lot	1	1
<b>C</b>	<b>Mandatory Spares for DCPS Spare</b>	Lot		
1	MCCB/MCB/CONTACTOR/TIMER/RELAY FOR DCPS	Set	1	1
2	SINGLE POLE MCBS FOR DCPS FEP	Set	3	3
3	ELECTRONIC PRINTED CIRCUIT BOARD	Set	1	1

Table 6a. Bill of Quantity for SCADA/EMS System of Sikkim SLDC				
Sl. No.	Item Description	Unit	Quantity	
			Main CC	Backup CC
<b>A</b>	<b>Software</b>			
1.1	SCADA Software	Lot	1	1
1.2	Load Shed Support(LSS)/ADMS	Lot	1	1
1.3	SOFTWARE FOR ICCP COMMUNICATION	Lot	1	1
1.4	SOFTWARE FOR CFE COMMUNICATION	Lot	1	1
1.5	EMS Functions			
(a)	State Estimator	Lot	1	1
(b)	Contingency Analysis	Lot	1	1
(c)	Security Enhancement	Lot	1	1
(d)	Optimal Power Flow	Lot	1	1
(e)	Outage Scheduler	Lot	1	1
(f)	Transmission Line/Corridor Capability Monitor (TCM)	Lot	1	1
(g)	Short Circuit Analysis	Lot	1	1
(h)	Automatic Generation Control (AGC)	Lot	1	1
1.6	Dynamic Security Assessment (DSA) Software	Lot	0	0
1.7	Dispatcher Training Simulator Software	Lot	1	0
1.8	Database development system (PDS) cum test bench for SCADA and ICCP Integration			
(a)	Database development system (PDS)	Lot	1	1
(b)	Test bench FEP, SCADA & ICCP Intg	Lot	1	1
1.9	Web Server Application			
(a)	Data Replica system software	Lot	1	1
(b)	Web Server system software	Lot	1	1
(c)	Web Historian and Reporting System	Lot	1	1
1.10	OPC client licenses (SCADA & Historian 5 each) - To take data from outside.	Lot	1	0
1.11	SMS & Email Interface	Lot	1	1
1.12	Commercial Off-The-Shelf (COTS) Softwares			
(a)	SOFTWARE FOR DATA HISTORIAN	Lot	1	1
(b)	Document Management System	Lot	1	0
(c)	Identity Management Software	Lot	1	1
(d)	Network Access Control (NAC)	Lot	1	1
(e)	Patch Management Software	Lot	1	1
(f)	VAPT Tool	Lot	2	2

(g)	Virtualisation Software for all the virtual servers envisaged and required under the project along-with centralised management software	Lot	1	1
(h)	Operating System for all the servers envisaged and required under the project	Lot	1	1
(i)	Host based intrusion prevention system (HIPS) with centralised management	No.	16	16
(j)	End Point Security Solution with centralised management	No.	50	43
(k)	Centralised Management and Log Analyser of all FWs	Lot	1	1
(l)	Network Management System	Lot	1	1
(m)	SIEM (Security Information and Event management)	Lot	1	1
(n)	OPC client licenses to be installed outside OT network to exchange data from SCADA & Historian	No.	2	0
(o)	Load Forecasting	Lot	1	1
1.13	OPC server	No.	2	2
1.14	Report Development & Generation Software	Lot	1	1
1.15	Storage system			
(a)	SAN Software	Lot	1	1
(b)	NAS Software	Lot	1	1
<b>B</b>	<b>Hardware</b>			
2.1	SCADA/EMS Server	No.	2	2
2.2	Dynamic Security Assessment (DSA) Server	No.	0	0
2.3	ICCP, CFE, OPC Server			
(a)	ICCP, OPC communication Server	No.	2	2
(b)	Communication Front End (CFE) Server	No.	2	2
2.4	Data Historian Server/Data Storage Server	No.	2	2
2.5	DTS Server	No.	1	0
2.6	PDS (test & development) server	No.	1	1
2.7	Third Party Applications Servers as per technical specification	No	2	2
(a)	End Point Security Solution Server			
(b)	Patch management Server			
(c)	NMS server			
(d)	VAPT server			

2.8	Management Applications Servers as per technical specification	No	2	2
(a)	Internal Centralised Mangement Server			
(b)	Network Access Control (NAC)			
(c)	Identity Management Server			
2.9	DRS DMZ Servers as per technical specification	No	2	2
(a)	External Centralised Mangement Server			
(b)	Data Replica Server			
(c)	SIEM			
(d)	Document Management System			
2.10	External DMZ Servers as per technical specification	No	2	2
(a)	Web Servers			
(b)	End Point Security Solution Server			
(c)	Patch management Server			
(d)	Web Historian and Reporting server			
(e)	OPC Server			
2.11	Server Mangement Console	No.	1	1
2.12	Backup Solution	No.	1	1
2.13	Storage system			
(a)	SAN management server along with SAN Box and mass storage (SAN)	No.	2	2
(b)	Nas Box	No.	1	1
2.14	WAN Routers with Firewall			
(a)	WAN Router cum Firewall for ICCP Communication	No.	2	2
(b)	WAN Router cum Firewall for External World Connectivity	No.	2	2
(c)	WAN Router cum firewall for RTU Communication	No.	2	2
(d)	Router cum firewall for Remote Consoles	No.	3	0
(e)	WAN Router cum firewall for PDS	No.	2	2
2.15	Switches			
(a)	48 Port L3- LAN switch for SCADA/EMS LAN	No.	2	2
(b)	24 Port L3- LAN switch for Historian & Reporting LAN	No.	2	2
(c)	16 port FC switch for SAN Switch	No.	2	2
(d)	24 Port L3- LAN switch for Internal & External DMZ LAN	No.	2	2
(e)	24 Port L3- LAN Switch for Server Management LAN	No.	2	2



(f)	24 Port L3- LAN Switch for ICCP & FEP LAN	No.	2	2
(g)	24 Port L3- LAN Switch for DCPC/Terminal Server LAN	No.	0	0
(h)	48 Port L3- LAN Switch for Terminal Server	No.	0	0
2.16	Cyber Security Appliances			
(a)	External Firewall with NIPS and centralised mangement	No.	2	2
(b)	Internal Firewall with NIPS and centralised mangement	No.	2	2
(c)	External Firewall with NIPS for ICCP/RTU and centralised mangement	No.	2	2
(d)	Anti-APT	No.	1	1
2.17	Laptops			
(a)	Laptop for maintenance	No.	2	2
(b)	Laptop for DTS	No.	1	0
(c)	Laptop fot VAPT	No.	1	1
2.18	Data Concentrator PC (DCPC) as per technical specification	SET		
(a)	Industrial grade Computer with 4 LAN and 2 Serial Ports	No.	0	0
(b)	8 Port 10/100 Mbps Ethernet switch with RJ 45 Ports	No.	0	0
(c)	GPS based time synchronisation system	SET	0	0
(d)	16 Port Splitter	No.	0	0
(e)	32 Port Terminal Servers	No.	0	0
(f)	16 Port Terminal Servers	No.	0	0
(g)	Panel for Terminal Servers with accessories	No.	0	0
2.19	Workstations			
(a)	Workstation Console without Monitor	No.	0	0
(b)	Workstation Console integrated with dual Monitors			
(i)	Workstation	No.	4	2
(ii)	Dual monitors for workstation	No.	4	2
(c)	DTS Workstation with dual Monitors (Training Console)			
(i)	DTS Workstation console	No.	3	0
(ii)	Dual monitors for DTS	No.	3	0
(d)	Workstation Console integrated with dual Monitors for DSA (at RLDC only)			
(i)	Workstation Console for DSA	No.	0	0
(ii)	dual Monitors for DSA	No.	0	0

(e)	PDS Workstations with dual Monitor			
(i)	workstation for PDS	No.	2	2
(ii)	Dual monitor for PDS	No.	2	2
2.20	Remote Consoles			
(a)	Remote Console with Dual monitor			
(i)	Remote Consoles with CPU (Dual monitor)	No.	2	0
(ii)	Dual monitor for remote console	No.	2	0
(b)	All-in-One workstations with CPU (remote console)	No.	0	0
(c)	Remote Consoles with 55" Monitor with CPU			
(i)	Remote Consoles with CPU (55" monitor)	No.	0	0
(ii)	55" monitor for remote console	No.	0	0
2.21	Video Projection System			
(i)	Laser VPS (Modules)	No.	8	8
(ii)	LED VPS (Modules)	No.	0	0
2.22	Video wall			
(a)	55" Tower Type Video Wall with CPU (with proper stand)	No.	2	1
(b)	55" Wall mounted Video Wall with CPU (with proper mounting)	No.	2	1
(c)	55" (3*3) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
(d)	55" (3*2) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
(e)	55" (2*2) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
2.23	Printers			
(a)	Color Laser Printer	No.	2	2
(b)	Multi Functional Printer	No.	2	2
(c)	A4 Size Multi Functional Display Printers	No.	0	0
2.24	Time & Frequency System and External displays			
(a)	Time & Frequency System NavIC(with failback to GPS)Based	Lot	2	1
(b)	Digital Display for Date	No.	1	1
(c)	Digital Display for Day	No.	1	1
(d)	Digital Display for Time	No.	1	1
(e)	Digital Display for Frequency	No.	1	1
(f)	Digital Display for Time Block	No.	1	1
(g)	Digital Display for Temprature	No.	0	0
(h)	Digital Display for Humidity	No.	0	0

2.25	Furniture			
(a)	U-Type Operator Workstations desk (per cubicle 9-10 feet)	No.	0	0
(b)	Operator Workstations desk			
(i)	Operator Workstations desk-Motorized	No.	9	4
(ii)	Operator Workstations desk-Normal	No.	0	0
(c)	Chairs	No.	18	8
(d)	printer Table	No.	1	1
2.26	Weather Sensors for Server Room	No.	1	1
2.27	Link Load Balancer	No.	2	2
2.28	Smart server rack	No.	3	3
2.29	IP based KVM system	No.	1	1
2.30	Centralized keyboard & mouse control solution (CKMC)	Set	1	1
2.31	External HDD	No.	2	2
<b>C</b>	<b>Auxiliary power Supply</b>			
3.2	80 kVA UPS System			
(a)	80 kVA (64 kW at 0.8 pf) UPS running in parallel	No.	0	0
(b)	VRLA type Battery banks for UPS (each bank of atleast 153.6 kVAH)	No.	0	0
(c)	Input ACDB (350KVA rating)	No.	0	0
(d)	Output ACDB (300 kVA rating)	No.	0	0
3.3	60 kVA UPS System			
(a)	60 kVA (48 kW at 0.8 pf) UPS running in parallel	No.	0	0
(b)	VRLA type Battery banks for UPS (each bank of atleast 115.2 kVAH)	No.	0	0
(c)	Input ACDB (250 kVA rating)	No.	0	0
(d)	Output ACDB (200 kVA rating)	No.	0	0
3.4	40 kVA UPS System			
(a)	40 kVA (32 kW at 0.8 pf) UPS running in parallel	No.	2	2
(b)	VRLA type Battery banks for UPS (each bank of atleast 76.8 kVAH)	No.	2	2
(c)	Input ACDB (150 kVA rating)	No.	1	1
(d)	Output ACDB (100 kVA rating)	No.	1	1
3.5	20 kVA UPS System			
(a)	20 kVA (16 kW at 0.8 pf) UPS running in parallel	No.	0	0
(b)	VRLA type Battery banks for UPS (each bank of atleast 38.4 kVAH)	No.	0	0
(c)	Input ACDB (150 kVA rating)	No.	0	0
(d)	Output ACDB (100 kVA rating)	No.	0	0

3.6	Accessories for maintenance of VRLA type batteries	Lot	1	1
3.7	Power Distribution and cabling work required to establish UPS	Lot	1	1
<b>D</b>	<b>DG System</b>			
(a)	50 KVA DG Set	No.	1	1
(b)	100 KVA DG Set	No.	0	0
(c)	125 KVA DG Set	No.	0	0
(d)	160 KVA DG Set	No.	0	0
(e)	200 KVA DG Set	No.	0	0
(f)	320 kVA DG Set	No.	0	0
<b>E</b>	<b>48V DC Power Supply (DCPS) for Substations</b>			
(a)	SMPS based 48V DC Power Supply (DCPS) system of 35 Amp rating	No.	8	0
(b)	VRLA type Battery bank for above DCPS system of 450AH Rating	No.	8	0
(c)	SMPS based 48V DC Power Supply (DCPS) system of 25 Amp rating	No.	0	0
(d)	VRLA type Battery bank for above DCPS system of 600AH Rating	No.	0	0
(e)	VRLA type Battery bank for above DCPS system of 400AH Rating	No.	0	0
<b>F</b>	<b>Test Equipment for RTU</b>			
(a)	Master Station cum RTU simulator & ProtocolAnalyser Software tool.	Lot	1	0
(b)	Laptop PC for above software tools along with interfacing hardware	Lot	1	0
<b>G</b>	<b>Video Conferencing System</b>			
(a)	Multi-Point Conferencing Unit	Lot	2	2
(b)	Configuration Laptop with associate Accessories	No.	1	1
(c)	Video End Points	Lot	1	1
(d)	HD camera	No.	2	2
(e)	Micophone basestation	Set	1	1
(f)	Wireless Microphone	No.	2	2
(g)	Collar Microphones	No.	2	2
(h)	LCD Video walls	No.	2	2
(i)	Wall Mounted Line array speakers	No.	2	2
(j)	Dual Channel Power Amplifiers	No.	1	1
<b>H</b>	<b>Mandatory Spares (As per Technical Specification)</b>			
(a)	Mandatory Spares for SCADA/EMS system	Lot	1	1
(b)	Mandatory Spares for VPS	Lot	1	1

**Technical Specifications of “Replacement/Upgradation of SCADA/EMS systems of RLDC and SLDCs of Eastern Region under ER ULDC Phase-III”**



(c)	Mandatory Spares for Auxiliary Power Supply system for the control centres	Lot	1	1
(d)	Mandatory Spares for DG Set & AMF Panel for control centres	Lot	1	1
(e)	Mandatory Spares for RTU	Lot	1	0
(f)	Mandatory Spares for DCPS	Lot	1	0
<b>I</b>	<b>Services</b>			
9.1	Integration with Control Centres/other system on ICCP on ICCP	No.	6	6
9.2	Integration with other Applications/Systems			
(a)	Market and Metering Applications	No.	1	1
(b)	Scheduling software	No.	1	1
(c)	Integration of SCADA/EMS system on OPC/Modbus/web services	No.	10	10
9.3	Existing RTU Integration	No.	9	9
9.4	Integration Existing RTU with Data Concentrator Cum Protocol Convertor	Lot	0	0
9.5	Cyber Security Audit by CERT -IN certified Auditors during FAT	No.	1	1
9.6	Cyber Security Audit by CERT -IN certified Auditors during SAT	No.	1	1
9.7	Integration with existing VPS with all required software	Lot	0	0
9.8	Dismantling and Buyback of existing SCADA/EMS system	Lot	1	1
9.9	SMS integration with service provider Email integration with owner email system	Lot	1	1
<b>J</b>	<b>Training</b>			
(a)	Training on Computer System Hardware & Software	Lot	1	0
(b)	Training on Database & Display	Lot	1	0
(c)	Training on Application Software	Lot	1	0
(d)	Training on Dispatcher/Operator	Lot	1	0
(e)	Training on NMS	Lot	1	0
(f)	Training on Cyber Security and VAPT	Lot	1	0
(g)	Training on Dispatcher Training Simulator	Lot	1	0
(h)	Training on Terminal/DCPC/ICCP Server Course	Lot	0	0
(i)	Training on Auxiliary Power Supply	Lot	1	0
(j)	Training on VC	Lot	1	0
(k)	Training on RTU	Lot	1	0
<b>K</b>	<b>AMC</b>			

11.1	Annual maintenance contract of SCADA/EMS System and all the equipment supplied in the project during Warranty Period	Year	1	1
11.2	Annual maintenance contract of SCADA/EMS System and all the equipment supplied in the project after expiry of Warranty Period	Year	6	6
11.3	ICCP Integration for 7 years (Per ICCP Integration)	No.	15	15
11.4	Six Monthly Cyber Security Audit by Cert-IN certified Auditors	No.	14	14
11.5	Patch Management including Signature updates for all Cyber security equipments for 7 years	Lot	1	1
11.6	Integration of RTU with SCADA during AMC	No.	23	23
11.7	OPC client function (per user) in SCADA Server	No.	5	5
11.8	Integration of SCADA/EMS system on OPC/Modbus/Web services/SAMAST during AMC including DLP	No.	5	5
11.9	Yearly Training on SCADA/EMS for 5 Days for 20 people	Year	7	0
11.10	Catridges			
(a)	Catridges- Cyan/Magenta/Yellow (Set of All)	No.	0	0
(b)	Catridges- Black	No.	0	0
11.11	Drum			
(a)	Drum- Cyan/Magenta/Yellow (Set of All)	No.	0	0
(b)	Drum- Black	No.	0	0
<b>11.12</b>	<b>Relocation and Commissioning at New Location</b>			
(a)	Relocation and Commissioning at New Location- All the systems supplied under this project except VPS and APS	Lot	0	0
(b)	Relocation and Commissioning at New Location- video Projection System	Lot	0	0
(c)	Relocation and Commissioning at New Location- Auxilliary power supply	Lot	0	0
11.13	SMS Service of 1 Lakh messages annually	Year	7	0

**Table 6b. SPARES OF Sikkim**

Sl.no	Item description	Unit	Quantity	
			Main CC	Backup-CC
<b>A</b>	<b>SCADA/EMS system</b>			
1	Servers (one of each type)	Lot	1	1
2	Workstation with Dual monitors	No.	1	1
3	LAN switch (one of each type)	Lot	1	1
4	Routers (one of each type)	Lot	1	1
5	Firewall with NIPS(External)	No.	1	1
6	Firewall with NIPS(Internal)	No.	1	1
7	Terminal Servers (MCC & BCC)	No.	0	0
8	DCPC	No.	0	0
9	IP based KVM System	No.	1	1
10	Time & Frequency system	Lot	1	1
<b>B</b>	<b>VPS Spares</b>			
1	One complete VPS Module without screen / frame structure	Lot	1	1
2	VPS Controller with all interface cards	Lot	1	1
3	VPS LED PACK of three colors (red, green & Blue) one set per VPS	Lot	0	0
4	Laser Lamp - one set per VPS	LOT	1	1
5	Dust filters	No.	16	16
<b>C</b>	<b>APS/DG Spares</b>			
<b>A</b>	<b>Mandatory Spares for APS</b>			
1	MCCB/MCB/Isolator/Switch/ Contactor of each type & rating (as applicable & used inside UPS panel / Input ACDB / Output ACDB)	Lot	1	1
2	Fuse of each type & rating (if applicable, UPS panel / Input ACDB / Output ACDB)	Lot	5	5
3	DC Filter assembly	Lot	1	1
4	Input AC Filter assembly	Lot	1	1
5	Output AC Filter assembly	Lot	1	1
6	Electronic Printed Circuit Board /Card of each type (including all cards/modules for rectifier/charger, inverter, system card, display module, interface cards etc.)	Lot	1	1



7	Power Semiconductor devices of each type & rating such as SCRs, IGBTs etc. for rectifier/ charger module, Inverter module, Static Switch module for all the three phases (exclude those items which are covered under item-6 above)	Lot	1	1
<b>B Mandatory Spares for DG Set</b>				
1	Filter, Spring, Gaskets, Air cleaner (one no. of each type)	Lot	1	1
2	Complete Rotating Rectifier Assembly for Alternator	Lot	1	1
3	Voltage Regulator Complete	Lot	1	1
4	Switches/ Isolator / Contactor/Auxiliary relay / Timers (one no. of each type & rating)	Lot	1	1
5	DG Fuel Pump, V Belt for DG set & Solenoid coil for Fuel Oil system (one no. each type)	Lot	1	1
6	Indicating Lamps & Fuses (5 nos of each type & rating)	Lot	1	1
<b>C Mandatory Spares for DCPS Spare</b>				
1	MCCB/MCB/CONTACTOR/TIMER/RELAY FOR DCPS	Set	1	0
2	SINGLE POLE MCBS FOR DCPS FEP	Set	2	0
3	ELECTRONIC PRINTED CIRCUIT BOARD	Set	3	0
<b>D RTU Spares</b>				
1	CPU Cards	No.	2	0
2	Digital Input Module	No.	4	0
3	Digital Output Module	No.	2	0
4	Analog Input Module	No.	1	0
5	Multi Function Transducers	No.	6	0
6	OLTC Transducer	No.	3	0
7	Contact Multiplying Relays (CMRs)	No.	43	0
8	Heavy Duty Relay	No.	11	0

**Table 6c. RTU-BOQ OF Sikkim**

Sl. No.	Item Description	Unit	Quantity
<b>A</b>	<b>Hardware</b>		
1	RTU & associated items		
(a)	RTU base equipment as per technical specification	Set	8
(b)	CPU Cards	Nos	16
(c)	Digital Input Module (16 channel)	Nos	34
(d)	Digital Output Module (8 channel)	Nos	16
(e)	Analog Input Module (8 channel)	Nos	8
(f)	Multi Function Transducers	Nos	53
(g)	Weather Sensor	Nos	8
(h)	OLTC Transducer	Nos	21
(i)	Contact Multiplying Relays (CMRs)	Nos	426
(j)	Time Synchronization Equipment	Set	8
(k)	Heavy Duty Relay	Nos	106
(l)	Supervisory Interface Cubicles(SIC) panel for mounting MFTs, CMR etc if required	Set	8
(m)	LDMS System Along with software	Set	8
(n)	Furniture for LDMS system (1 Table &1 Chair)	Set	8
(o)	Inverter for LDMS	Nos	8
(p)	Cables for RTU	Lot	8
(q)	Laptop for PCMT	Nos	1
<b>B</b>	<b>Services</b>		
1	Integration with Control Centres (SLDC/RLDC) on IEC104 at substation & control centre	Lot	8
<b>C</b>	<b>Annual Maintenance Contract</b>		
1	Integration of new bay(Including supply & commis	Lot	80
2	RTU maintenance (1 Years)	Lot	8
3	RTU maintenance (6 Years)	Lot	8

Table 7a. Bill of Quantity for SCADA/EMS System of WBSETCL				
Sl. No.	Item Description	Unit	Quantity	
			Main CC	Backup CC
<b>A</b>	<b>Software</b>			
1.1	SCADA Software	Lot	1	1
1.2	Load Shed Support(LSS)/ADMS	Lot	1	1
1.3	SOFTWARE FOR ICCP COMMUNICATION	Lot	1	1
1.4	SOFTWARE FOR CFE COMMUNICATION	Lot	1	1
1.5	EMS Functions			
(a)	State Estimator	Lot	1	1
(b)	Contingency Analysis	Lot	1	1
(c)	Security Enhancement	Lot	1	1
(d)	Optimal Power Flow	Lot	1	1
(e)	Outage Scheduler	Lot	1	1
(f)	Transmission Line/Corridor Capability Monitor (TCM)	Lot	1	1
(g)	Short Circuit Analysis	Lot	1	1
(h)	Automatic Generation Control (AGC)	Lot	1	1
1.6	Dynamic Security Assessment (DSA) Software	Lot	0	0
1.7	Dispatcher Training Simulator Software	Lot	1	0
1.8	Database development system (PDS) cum test bench for SCADA and ICCP Integration			
(a)	Database development system (PDS)	Lot	1	1
(b)	Test bench FEP, SCADA & ICCP Intg	Lot	1	1
1.9	Web Server Application			
(a)	Data Replica system software	Lot	1	1
(b)	Web Server system software	Lot	1	1
(c)	Web Historian and Reporting System	Lot	1	1
1.10	OPC client licenses (SCADA & Historian 5 each) - To take data from outside.	Lot	1	0
1.11	SMS & Email Interface	Lot	1	1
1.12	Commercial Off-The-Shelf (COTS) Softwares			
(a)	SOFTWARE FOR DATA HISTORIAN	Lot	1	1
(b)	Document Management System	Lot	1	0
(c)	Identity Management Software	Lot	1	1
(d)	Network Access Control (NAC)	Lot	1	1
(e)	Patch Management Software	Lot	1	1
(f)	VAPT Tool	Lot	2	2

(g)	Virtualisation Software for all the virtual servers envisaged and required under the project along-with centralised management software	Lot	1	1
(h)	Operating System for all the servers envisaged and required under the project	Lot	1	1
(i)	Host based intrusion prevention system (HIPS) with centralised management	No.	16	16
(j)	End Point Security Solution with centralised management	No.	55	45
(k)	Centralised Management and Log Analyser of all FWs	Lot	1	1
(l)	Network Management System	Lot	1	1
(m)	SIEM (Security Information and Event management)	Lot	1	1
(n)	OPC client licenses to be installed outside OT network to exchange data from SCADA & Historian	No.	2	0
(o)	Load Forecasting	Lot	1	1
1.13	OPC server	No.	2	2
1.14	Report Development & Generation Software	Lot	1	1
1.15	Storage system			
(a)	SAN Software	Lot	1	1
(b)	NAS Software	Lot	1	1
<b>B</b>	<b>Hardware</b>			
2.1	SCADA/EMS Server	No.	2	2
2.2	Dynamic Security Assessment (DSA) Server	No.	0	0
2.3	ICCP, CFE, OPC Server			
(a)	ICCP, OPC communication Server	No.	2	2
(b)	Communication Front End (CFE) Server	No.	2	2
2.4	Data Historian Server/Data Storage Server	No.	2	2
2.5	DTS Server	No.	1	0
2.6	PDS (test & development) server	No.	1	1
2.7	Third Party Applications Servers as per technical specification	No	2	2
(a)	End Point Security Solution Server			
(b)	Patch management Server			
(c)	NMS server			
(d)	VAPT server			

2.8	Management Applications Servers as per technical specification	No	2	2
(a)	Internal Centralised Mangement Server			
(b)	Network Access Control (NAC)			
(c)	Identity Management Server			
2.9	DRS DMZ Servers as per technical specification	No	2	2
(a)	External Centralised Mangement Server			
(b)	Data Replica Server			
(c)	SIEM			
(d)	Document Management System			
2.10	External DMZ Servers as per technical specification	No	2	2
(a)	Web Servers			
(b)	End Point Security Solution Server			
(c)	Patch management Server			
(d)	Web Historian and Reporting server			
(e)	OPC Server			
2.11	Server Mangement Console	No.	1	1
2.12	Backup Solution	No.	1	1
2.13	Storage system			
(a)	SAN management server along with SAN Box and mass storage (SAN)	No.	2	2
(b)	Nas Box	No.	1	1
2.14	WAN Routers with Firewall			
(a)	WAN Router cum Firewall for ICCP Communication	No.	2	2
(b)	WAN Router cum Firewall for External World Connectivity	No.	2	2
(c)	WAN Router cum firewall for RTU Communication	No.	2	2
(d)	Router cum firewall for Remote Consoles	No.	0	0
(e)	WAN Router cum firewall for PDS	No.	2	2
2.15	Switches			
(a)	48 Port L3- LAN switch for SCADA/EMS LAN	No.	2	2
(b)	24 Port L3- LAN switch for Historian & Reporting LAN	No.	2	2
(c)	16 port FC switch for SAN Switch	No.	2	2
(d)	24 Port L3- LAN switch for Internal & External DMZ LAN	No.	2	2
(e)	24 Port L3- LAN Switch for Server Management LAN	No.	2	2

(f)	24 Port L3- LAN Switch for ICCP & FEP LAN	No.	2	2
(g)	24 Port L3- LAN Switch for DCPC/Terminal Server LAN	No.	0	0
(h)	48 Port L3- LAN Switch for Terminal Server	No.	0	0
(i)	24 Port L3- LAN Switch for Terminal Server	No.	2	2
2.16	Cyber Security Appliances			
(a)	External Firewall with NIPS and centralised mangement	No.	2	2
(b)	Internal Firewall with NIPS and centralised mangement	No.	2	2
(c)	External Firewall with NIPS for ICCP/RTU and centralised mangement	No.	2	2
(d)	Anti-APT	No.	1	1
2.17	Laptops			
(a)	Laptop for maintenance	No.	2	2
(b)	Laptop for DTS	No.	1	0
(c)	Laptop fot VAPT	No.	1	1
2.18	Data Concentrator PC (DCPC) as per technical specification	SET		
(a)	Industrial grade Computer with 4 LAN and 2 Serial Ports	No.	0	0
(b)	8 Port 10/100 Mbps Ethernet switch with RJ 45 Ports	No.	0	0
(c)	GPS based time synchronisation system	SET	1	1
(d)	16 Port Splitter	No.	0	0
(e)	32 Port Terminal Servers	No.	0	0
(f)	16 Port Terminal Servers	No.	1	1
(g)	Panel for Terminal Servers with accessories	No.	1	1
2.19	Workstations			
(a)	Workstation Console without Monitor	No.	0	0
(b)	Workstation Console integrated with dual Monitors			
(i)	Workstation	No.	8	4
(ii)	Dual monitors for workstation	No.	8	4
(c)	DTS Workstation with dual Monitors (Training Console)			
(i)	DTS Workstation console	No.	3	0
(ii)	Dual monitors for DTS	No.	3	0
(d)	Workstation Console integrated with dual Monitors for DSA (at RLDC only)			

**Technical Specifications of “Replacement/Upgradation of SCADA/EMS systems of RLDC and SLDCs of Eastern Region under ER ULDC Phase-III”**



(i)	Workstation Console for DSA	No.	0	0
(ii)	dual Monitors for DSA	No.	0	0
(e)	PDS Workstations with dual Monitor			
(i)	workstation for PDS	No.	2	2
(ii)	Dual monitor for PDS	No.	2	2
(f)	Workstation Console integrated with single Monitors			
(i)	Workstation	No.	4	0
(ii)	Single monitors for workstation	No.	4	0
2.20	Remote Consoles			
(a)	Remote Console with Dual monitor			
(i)	Remote Consoles with CPU (Dual monitor)	No.	0	0
(ii)	Dual monitor for remote console	No.	0	0
(b)	All-in-One workstations with CPU (remote console)	No.	0	0
(c)	Remote Consoles with 55" Monitor with CPU			
(i)	Remote Consoles with CPU (55" monitor)	No.	0	0
(ii)	55" monitor for remote console	No.	0	0
2.21	Video Projection System			
(i)	Laser VPS (Modules)	No.	12	8
(ii)	LED VPS (Modules)	No.	0	0
2.22	Video wall			
(a)	55" Tower Type Video Wall with CPU (with proper stand)	No.	2	1
(b)	55" Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
(c)	55" (3*3) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
(d)	55" (3*2) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
(e)	55" (2*2) Wall mounted Video Wall with CPU (with proper mounting)	No.	0	0
2.23	Printers			
(a)	Color Laser Printer	No.	2	2
(b)	Multi Functional Printer	No.	2	2
(c)	A4 Size Multi Functional Display Printers	No.	0	0
2.24	Time & Frequency System and External displays			
(a)	Time & Frequency System NavIC(with failback to GPS)Based	Lot	2	1
(b)	Digital Display for Date	No.	1	1



**Technical Specifications of “Replacement/Upgradation of SCADA/EMS systems of RLDC and SLDCs of Eastern Region under ER ULDC Phase-III”**



(c)	Digital Display for Day	No.	1	1
(d)	Digital Display for Time	No.	1	1
(e)	Digital Display for Frequency	No.	1	1
(f)	Digital Display for Time Block	No.	1	1
(g)	Digital Display for Temperature	No.	1	1
(h)	Digital Display for Humidity	No.	1	1
2.25	Furniture			
(a)	U-Type Operator Workstations desk (per cubicle 9-10 feet)	No.	0	0
(b)	Operator Workstations desk			
(i)	Operator Workstations desk-Motorized	No.	15	6
(ii)	Operator Workstations desk-Normal	No.	0	0
(c)	Chairs	No.	25	12
(d)	printer Table	No.	1	1
2.26	Weather Sensors for Server Room	No.	1	1
2.27	Link Load Balancer	No.	2	2
2.28	Smart server rack	No.	3	3
2.29	IP based KVM system	No.	1	1
2.30	Centralized keyboard & mouse control solution (CKMC)	Set	1	1
2.31	External HDD	No.	2	2
<b>C</b>	<b>Auxiliary power Supply</b>			
3.2	80 kVA UPS System			
(a)	80 kVA (64 kW at 0.8 pf) UPS running in parallel	No.	0	0
(b)	VRLA type Battery banks for UPS (each bank of atleast 153.6 kVAH)	No.	0	0
(c)	Input ACDB (350KVA rating)	No.	0	0
(d)	Output ACDB (300 kVA rating)	No.	0	0
3.3	60 kVA UPS System			
(a)	60 kVA (48 kW at 0.8 pf) UPS running in parallel	No.	2	2
(b)	VRLA type Battery banks for UPS (each bank of atleast 115.2 kVAH)	No.	2	2
(c)	Input ACDB (250 kVA rating)	No.	1	1
(d)	Output ACDB (200 kVA rating)	No.	1	1
3.4	40 kVA UPS System			
(a)	40 kVA (32 kW at 0.8 pf) UPS running in parallel	No.	0	0
(b)	VRLA type Battery banks for UPS (each bank of atleast 76.8 kVAH)	No.	0	0
(c)	Input ACDB (150 kVA rating)	No.	0	0
(d)	Output ACDB (100 kVA rating)	No.	0	0
3.5	20 kVA UPS System			

(a)	20 kVA (16 kW at 0.8 pf) UPS running in parallel	No.	0	0
(b)	VRLA type Battery banks for UPS (each bank of atleast 38.4 kVAH)	No.	0	0
(c)	Input ACDB (150 kVA rating)	No.	0	0
(d)	Output ACDB (100 kVA rating)	No.	0	0
3.6	Accessories for maintenance of VRLA type batteries	Lot	1	1
3.7	Power Distribution and cabling work required to establish UPS	Lot	1	1
<b>D</b>	<b>DG System</b>			
(a)	50 KVA DG Set	No.	0	0
(b)	100 KVA DG Set	No.	0	0
(c)	125 KVA DG Set	No.	0	0
(d)	160 KVA DG Set	No.	1	0
(e)	200 KVA DG Set	No.	0	0
(f)	320 kVA DG Set	No.	0	0
<b>E</b>	<b>48V DC Power Supply (DCPS) for Substations</b>			
(a)	SMPS based 48V DC Power Supply (DCPS) system of 35 Amp rating	No.	1	1
(b)	VRLA type Battery bank for above DCPS system of 450AH Rating	No.	1	1
(c)	SMPS based 48V DC Power Supply (DCPS) system of 25 Amp rating	No.	0	0
(d)	VRLA type Battery bank for above DCPS system of 600AH Rating	No.	0	0
(e)	VRLA type Battery bank for above DCPS system of 400AH Rating	No.	0	0
<b>F</b>	<b>Test Equipment for RTU</b>			
(a)	Master Station cum RTU simulator & ProtocolAnalyser Software tool.	Lot	1	0
(b)	Laptop PC for above software tools along with interfacing hardware	Lot	1	0
<b>G</b>	<b>Video Conferencing System</b>			
(a)	Multi-Point Conferencing Unit	Lot	2	2
(b)	Configuration Laptop with associate Accessories	No.	1	1
(c)	Video End Points	Lot	1	1
(d)	HD camera	No.	2	2
(e)	Micophone basestation	Set	1	1
(f)	Wireless Microphone	No.	2	2
(g)	Collar Microphones	No.	2	2
(h)	LCD Video walls	No.	4	4
(i)	Wall Mounted Line array speakers	No.	2	2

(j)	Dual Channel Power Amplifiers	No.	1	1
<b>H</b>	<b>Mandatory Spares (As per Technical Specification)</b>			
(a)	Mandatory Spares for SCADA/EMS system	Lot	1	1
(b)	Mandatory Spares for VPS	Lot	1	1
(c)	Mandatory Spares for Auxiliary Power Supply system for the control centres	Lot	1	1
(d)	Mandatory Spares for DG Set & AMF Panel for control centres	Lot	1	0
(e)	Mandatory Spares for RTU	Lot	0	0
(f)	Mandatory Spares for DCPS	Lot	0	0
<b>I</b>	<b>Services</b>			
9.1	Integration with Control Centres/other system on ICCP on ICCP	No.	6	6
9.2	Integration with other Applications/Systems			
(a)	Market and Metering Applications	No.	1	1
(b)	Scheduling software	No.	1	1
(c)	Integration of SCADA/EMS system on OPC/Modbus/web services	No.	10	10
9.3	Existing RTU Integration	No.	165	165
9.4	Integration Existing RTU with Data Concentrator Cum Protocol Convertor	Lot	0	0
9.5	Cyber Security Audit by CERT -IN certified Auditors during FAT	No.	1	1
9.6	Cyber Security Audit by CERT -IN certified Auditors during SAT	No.	1	1
9.7	Integration with existing VPS with all required software	Lot	0	0
9.8	Dismantling and Buyback of existing SCADA/EMS system	Lot	1	1
9.9	SMS integration with service provider Email integration with owner email system	Lot	1	1
<b>J</b>	<b>Training</b>			
(a)	Training on Computer System Hardware & Software	Lot	1	0
(b)	Training on Database & Display	Lot	1	0
(c)	Training on Application Software	Lot	1	0
(d)	Training on Dispatcher/Operator	Lot	1	0
(e)	Training on NMS	Lot	1	0
(f)	Training on Cyber Security and VAPT	Lot	1	0
(g)	Training on Dispatcher Training Simulator	Lot	1	0

(h)	Training on Terminal/DCPC/ICCP Server Course	Lot	1	0
(i)	Training on Auxiliary Power Supply	Lot	1	0
(j)	Training on VC	Lot	1	0
(k)	Training on RTU	Lot	0	0
<b>K</b>	<b>AMC</b>			
11.1	Annual maintenance contract of SCADA/EMS System and all the equipment supplied in the project during Warranty Period	Year	1	1
11.2	Annual maintenance contract of SCADA/EMS System and all the equipment supplied in the project after expiry of Warranty Period	Year	6	6
11.3	ICCP Integration for 7 years (Per ICCP Integration)	No.	15	15
11.4	Six Monthly Cyber Security Audit by Cert-IN certified Auditors	No.	14	14
11.5	Patch Management including Signature updates for all Cyber security equipments for 7 years	Lot	1	1
11.6	Integration of RTU with SCADA during AMC	No.	100	100
11.7	OPC client function (per user) in SCADA Server	No.	5	5
11.8	Integration of SCADA/EMS system on OPC/Modbus/Web services/SAMAST during AMC including DLP	No.	5	5
11.9	Yearly Training on SCADA/EMS for 5 Days for 20 people	Year	7	0
11.10	Catridges			
(a)	Catridges- Cyan/Magenta/Yellow (Set of All)	No.	0	0
(b)	Catridges- Black	No.	0	0
11.11	Drum			
(a)	Drum- Cyan/Magenta/Yellow (Set of All)	No.	0	0
(b)	Drum- Black	No.	0	0
<b>11.12</b>	<b>Relocation and Commissioning at New Location</b>			
(a)	Relocation and Commissioning at New Location- All the systems supplied under this project except VPS and APS	Lot	0	0
(b)	Relocation and Commissioning at New Location- video Projection System	Lot	0	0

(c)	Relocation and Commissioning at New Location- Auxilliary power supply	Lot	0	0
11.13	SMS Service of 1 Lakh messages annually	Year	7	0

**Table 7b. SPARES OF WBSETCL**

Sl.no	Item description	Unit	Quantity			
			Main CC	Backup-CC	KASBA	ALDC
<b>A</b>	<b>SCADA/EMS system</b>					
1	Servers (one of each type)	Lot	1	1	0	0
2	Workstation with Dual monitors	No.	1	1	0	0
3	LAN switch (one of each type)	Lot	1	1	0	0
4	Routers (one of each type)	Lot	1	1	0	0
5	Firewall with NIPS(External)	No.	1	1	0	0
6	Firewall with NIPS(Internal)	No.	1	1	0	0
7	Terminal Servers	No.	1	1	0	0
8	DCPC	No.	0	0	0	0
9	IP based KVM System	No.	1	1	0	0
10	Time & Frequency system	Lot	1	1	0	0
<b>B</b>	<b>VPS Spares</b>					
1	One complete VPS Module without screen / frame structure	Lot	1	1	1	1
2	VPS Controller with all interface cards	Lot	1	1	1	1
3	VPS LED PACK of three colors (red, green & Blue) one set per VPS	Lot	0	0	0	0
4	Laser Lamp - one set per VPS	LOT	1	1	1	1
5	Dust filters	No.	24	16	16	12
<b>C</b>	<b>Mandatory Spares for APS</b>					
1	MCCB/MCB/Isolator/Switch/ Contactor of each type & rating (as applicable & used inside UPS panel / Input ACDB / Output ACDB)	Lot	1	1	0	1
2	Fuse of each type & rating (if applicable, UPS panel / Input ACDB / Output ACDB)	Lot	5	5	0	5
3	DC Filter assembly	Lot	1	1	0	1
4	Input AC Filter assembly	Lot	1	1	0	1
5	Output AC Filter assembly	Lot	1	1	0	1
6	Electronic Printed Circuit Board /Card of each type (including all cards/modules for rectifier/charger, inverter, system card, display module, interface cards etc.)	Lot	1	1	0	1

7	Power Semiconductor devices of each type & rating such as SCRs, IGBTs etc. for rectifier/ charger module, Inverter module, Static Switch module for all the three phases (exclude those items which are covered under item-6 above)	Lot	1	1	0	1
<b>D</b>	<b>Mandatory Spares for DG Set</b>					
1	Filter, Spring, Gaskets, Air cleaner (one no. of each type)	Lot	1	0	0	0
2	Complete Rotating Rectifier Assembly for Alternator	Lot	1	0	0	0
3	Voltage Regulator Complete	Lot	1	0	0	0
4	Switches/ Isolator / Contactor/Auxiliary relay / Timers (one no. of each type & rating)	Lot	1	0	0	0
5	DG Fuel Pump, V Belt for DG set & Solenoid coil for Fuel Oil system (one no. each type)	Lot	1	0	0	0
6	Indicating Lamps & Fuses (5 nos of each type & rating)	Lot	1	0	0	0
<b>E</b>	<b>Mandatory Spares for DCPS Spare</b>	Lot				
1	MCCB/MCB/CONTACTOR/TIMER/RELAY FOR DCPS	Set	1	1	0	0
2	SINGLE POLE MCBS FOR DCPS FEP	Set	3	3	0	0
3	ELECTRONIC PRINTED CIRCUIT BOARD	Set	1	1	0	0



Table 7c. Bill of Quantity for SCADA/EMS System of WBSETCL Remote Location				
Sl. No.	Item Description	Unit	Quantity	
			KASBA	ALDC
<b>A</b>	<b>Hardware</b>			
1	Firewall with NIPS and centralised mangement	No.	2	2
2	Remote Consoles			
(a)	Remote Console with Dual monitor			
(i)	Remote Consoles with CPU (Dual monitor)	No.	6	0
(ii)	Dual monitor for remote console	No.	6	0
(b)	Remote Consoles with 55" Monitor with CPU			
(i)	Remote Consoles with CPU (55" monitor)	No.	1	4
(ii)	55" monitor for remote console	No.	1	4
(c)	Router cum firewall for Remote Consoles	No.	2	2
(d)	24 Port L3- LAN Switch for Remote Console	No.	4	4
3	Video Projection System			
(i)	Laser VPS (Modules)	No.	8	6
4	Printers			
(a)	A4 Size Multi Functional Display Printers	No.	1	1
<b>B</b>	<b>Auxiliary power Supply</b>			
1	40 kVA UPS System			
(a)	40 kVA (32 kW at 0.8 pf) UPS running in parallel	No.	0	2
(b)	VRLA type Battery banks for UPS (each bank of atleast 76.8 kVAH)	No.	0	2
(c)	Input ACDB (150 kVA rating)	No.	0	1
(d)	Output ACDB (100 kVA rating)	No.	0	1
2	Accessories for maintenance of VRLA type batteries	Lot	0	1
3	Power Distribution and cabling work required to establish UPS	Lot	0	1
<b>C</b>	<b>Mandatory Spares (As per Techincal Specification)</b>			
(a)	Mandatory Spares for VPS	Lot	1	1
(b)	Mandatory Spares for Auxiliary Power Supply system for the control centres	Lot	0	1

	<b>Note:- The following mentioned requirements are applicable to BoQ of all constituents specified under Appendix-G.</b>
(a)	Above mentioned requirements are minimum, however, if bidder feels that some additional hardware/software is also required to meet the technical specification requirements. Same may be considered by the bidder without any additional cost to the Owner
(b)	All the supplied system shall be under OEM (Hardware and Software) warranty & support till the completion of entire contract period.
(c)	During entire contract period, if OEM discontinues/ ends support to any item supplied (software/hardware/security solution) under the contract, contractor has to replace such hardware, software (or both, depending on software or hardware dependency) without any additional cost to Owner. Replacement shall be of either same or higher configuration keeping required performance specified under the contract and from same OEMs.
(d)	Bidder has to submit annually documentary evidence for the availability of OEM supports for the supplied items including continuity of security patches.
(e)	<b>Commercial Off-The-Shelf (COTS) product means bidder has to quote product which is independently commercially available in the market.</b> <b>For all such products bidder has to provide at least three references in Govt/Public Listed companies at the time of bid submission and same shall have been sold as an independent product and solution shall be in successful operation for at least three years at the time of bid submission.</b> <b>For that Bidder has to submit copy of PO/LOA and installation/completion/operational certificate issued by Customer for the relevant reference.</b>
(f)	Prices mentioned during AMC period shall be released on actual basis as-and-when services will be availed.
(g)	Bidder shall mention country of origin for each of the items proposed under the contract.
(h)	Price of all the client licenses shall be included in end-point equipments (laptops, Workstation etc) for which unit prices has not been asked in BoQ separately.
(i)	Configuration of Servers and Applications shall be configured as per the proposed architecture (as an critical and non-critical) and non-critical applications shall be distributed between redundant physical servers for proper utilisation of both the servers.

(j)	List of Mandatory Spares to be supplied under the project has been mentioned in <b>Maintenance and Support Spares</b> . If quantity for any line item is considered as zero then spares shall not be considered for that line item and price shall be quoted accordingly.
(k)	Virtualisation Software shall be considered for all the servers on which virtualisation is required as per design and architecture to meet the technical specification requirements stated in various sections.
(l)	Operating System (OS) shall be considered for all the servers (Physical as well as virtual) as per design and architecture to meet the technical specification requirements stated in various sections.
(m)	Host Based Intrusion Prevention System (HIPS) shall be provided for all machines on DMZ LANs and machines interacting from outside the network (ICCP & FEP server) and for rest of the systems End Point Security Solution shall be provided.

**Table 8. VPS Configuration for RLDCs/SLDCs**

S.No.	RLDC/SLDCs	Main CC		Backup CC	
		Modules as per BoQ	Configuration (Column*Row)	Modules as per BoQ	Configuration (Column*Row)
1.	BSPTCL	24	8*3	8	4*2
2.	DVC	8	4*2	6	3*2
3.	ERLDC	40	10*4	6	3*2
4.	JUSNL	18	6*3	12	4*3
5.	OPTCL	0	0	4	2*2
6.	Sikkim	8	4*2	8	4*2
7.	WBSETCL	12	6*2	8	4*2

**VOL. II, PART-B  
APPENDIX – H  
DRS- HARDWARE & SOFTWARE  
SPECIFICATION**

## APPENDIX- H

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(Please fill for each server as per BOQ)

1. Servers:

- a. SCADA, EMS, AGC Applications
- b. ICCP Application
- c. CFE and OPC Applications
- d. Historian System along-with GUI, Reporting Application

Sl. No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
1.	Application		
2.	Manufacturer		
3.	Model No.		
4.	Specint & Specfp	As per the base runtime requirements of SPEC CPU 2017 Benchmarking Standards.	
5.	Processor	Min 2x16 core, x86 64-bit third generation or latest processor (with compatible chipset) with 3.0 GHz or more base frequency  <b>The OEM software should be tested on the offered processor &amp; chipset</b>	
6.	RAM	128 GB delivered, expandable up to 256 GB or Above DDR4 RDIMMs/LRDIMMs.  The operating system delivered should support expansion up to 256 GB of RAM.	
7.	Internal Auxiliary memory	More than 900 GB SSD, delivered after RAID 1 disk configuration, expandable up to 2 TB, Hot-pluggable	
8.	Spare Disk	one hot spare shall be provided	
9.	Interfaces	1. 2 x 10 Gbps Ethernet/FO ports 2. Dedicated 1 Gbps Management port 3. 2 x 16 Gbps FC port for SAN connectivity	
10.	User interface	Through KVM switch & console	
11.	Configuration & management	<ul style="list-style-type: none"> <li>• Real-time out-of-band hardware performance monitoring &amp; alerting</li> <li>• Agent-free monitoring, driver updates &amp; configuration, power monitoring &amp; capping, RAID management, monitoring of I/O card &amp; system health.</li> <li>• Out-of-band hardware &amp; firmware inventory</li> </ul>	

Sl. No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
		<ul style="list-style-type: none"> <li>• Auto configuration to auto deploy a baseline server configuration profile.</li> <li>• Automated hardware configuration and deployment to multiple servers</li> </ul>	
12.	Server Security	<p>Should provide effective protection, reliable detection &amp; rapid recovery using:</p> <ul style="list-style-type: none"> <li>- Silicon-based Hardware Root of Trust</li> <li>- Signed firmware updates</li> <li>- Secure default passwords</li> <li>- Configuration and firmware drift detection</li> <li>- Automated event logging including user activity</li> <li>- Secure alerting</li> <li>- Automatic BIOS recovery</li> <li>- OS recovery</li> <li>- System erase</li> </ul> <p>Should provide system lockdown feature to prevent change (or “drift”) in system firmware image(s) &amp; prevent malicious modification of server firmware</p>	
13.	Mounting	Rack mountable Server	
14.	Certification and compliances	Microsoft Windows Server, Hyper-V, VMWare, Red Hat Enterprise Linux (RHEL), SUSE Linux Enterprise Server (SLES).	
15.	Pre-failure alert	Should provide predictive failure monitoring & proactive alerts of actual or impending component failure for memory, CPU, SSD.	
16.	Power Supply	Redundant Hot plug Power Supplies with redundant fans.	
17.	Heat Load		

## 2. Server: DSA Application

Sl. No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
1.	Application		
2.	Manufacturer		
3.	Model No.		
4.	Specint & Specfp	As per the base runtime requirements of SPEC CPU 2017 Benchmarking Standards.	
5.	Processor	Min 2x18 core, x86 64-bit <b>third generation</b> or latest processor (with compatible chipset) with 3.0 GHz or more base frequency  <b>The OEM software should be tested on the offered processor &amp; chipset</b>	
6.	RAM	256 GB delivered, expandable up to 386 GB or Above DDR4 RDIMMs/LRDIMMs.  The operating system delivered should support expansion up to 386 GB of RAM.	
7.	Internal Auxiliary memory	<b>3.84 TB</b> SSD delivered after RAID 1 disk configuration, expandable up to 8 TB, Hot-pluggable	
8.	Spare Disk	one hot spare shall be provided	
9.	Interfaces	1. 2 x 10 Gbps Ethernet/FO ports 2. Dedicated 1 Gbps Management port 3. 2 x 16 Gbps FC port for SAN connectivity	
10.	User interface	Through KVM switch & console.	
11.	Configuration & management	<ul style="list-style-type: none"> <li>• Real-time out-of-band hardware performance monitoring &amp; alerting</li> <li>• Agent-free monitoring, driver updates &amp; configuration, power monitoring &amp; capping, RAID management, monitoring of I/O card &amp; system health.</li> <li>• Out-of-band hardware &amp; firmware inventory</li> <li>• Auto configuration to auto deploy a baseline server configuration profile.</li> <li>• Automated hardware configuration and deployment to multiple servers</li> </ul>	
12.	Server Security	Should provide effective protection, reliable detection & rapid recovery using:	

Sl. No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
		<ul style="list-style-type: none"> <li>- Silicon-based Hardware Root of Trust</li> <li>- Signed firmware updates</li> <li>- Secure default passwords</li> <li>- Configuration and firmware drift detection</li> <li>- Automated event logging including user activity</li> <li>- Secure alerting</li> <li>- Automatic BIOS recovery</li> <li>- OS recovery</li> <li>- System erase</li> </ul> <p>Should provide system lockdown feature to prevent change (or “drift”) in system firmware image(s) &amp; prevent malicious modification of server firmware</p>	
13.	Mounting	Rack mountable Server	
14.	Certification and compliances	Microsoft Windows Server, Hyper-V, VMWare, Red Hat Enterprise Linux (RHEL), SUSE Linux Enterprise Server (SLES).	
15.	Pre-failure alert	Should provide predictive failure monitoring & proactive alerts of actual or impending component failure for memory, CPU, SSD.	
16.	Power Supply	Redundant Hot plug Power Supplies with redundant fans.	
17.	Heat Load		

3. Servers:  
 a. DTS Applications  
 b. PDS Applications

Sl. No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
1.	Application		
2.	Manufacturer		
3.	Model No.		
4.	Specint & Specfp	As per the base runtime requirements of SPEC CPU 2017 Benchmarking Standards.	
5.	Processor	Min 2x16 core, x86 64-bit <b>third generation</b> or latest processor (with compatible chipset) with 3.0 GHz or more base frequency  <b>The OEM software should be tested on the offered processor &amp; chipset</b>	
6.	RAM	128 GB delivered, expandable up to 256 GB or Above DDR4 RDIMMs/LRDIMMs.  The operating system delivered should support expansion up to 256 GB of RAM.	
7.	Internal Auxiliary memory	More than 900 GB SSD, delivered after RAID 1 disk configuration, expandable up to 4 TB, Hot-pluggable	
8.	Spare Disk	one hot spare shall be provided	
9.	Interfaces	1. 2 x 10 Gbps Ethernet/FO ports 2. Dedicated 1 Gbps Management port 3. 2 x 16 Gbps FC port for SAN connectivity	
10.	User interface	Through KVM switch & console.	
11.	Configuration & management	<ul style="list-style-type: none"> <li>• Real-time out-of-band hardware performance monitoring &amp; alerting</li> <li>• Agent-free monitoring, driver updates &amp; configuration, power monitoring &amp; capping, RAID management, monitoring of I/O card &amp; system health.</li> <li>• Out-of-band hardware &amp; firmware inventory</li> <li>• Auto configuration to auto deploy a baseline server configuration profile.</li> <li>• Automated hardware configuration and</li> </ul>	

Sl. No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
		deployment to multiple servers	
12.	Server Security	<p>Should provide effective protection, reliable detection &amp; rapid recovery using:</p> <ul style="list-style-type: none"> <li>- Silicon-based Hardware Root of Trust</li> <li>- Signed firmware updates</li> <li>- Secure default passwords</li> <li>- Configuration and firmware drift detection</li> <li>- Automated event logging including user activity</li> <li>- Secure alerting</li> <li>- Automatic BIOS recovery</li> <li>- OS recovery</li> <li>- System erase</li> </ul> <p>Should provide system lockdown feature to prevent change (or “drift”) in system firmware image(s) &amp; prevent malicious modification of server firmware</p>	
13.	Mounting	Rack mountable Server	
14.	Certification and compliances	Microsoft Windows Server, Hyper-V, VMWare, Red Hat Enterprise Linux (RHEL), SUSE Linux Enterprise Server (SLES).	
15.	Pre-failure alert	Should provide predictive failure monitoring & proactive alerts of actual or impending component failure for memory, CPU, SSD	
16.	Power Supply	Redundant Hot plug Power Supplies with redundant fans.	
17.	Heat Load		



**4. Servers:**

- a. Server for Third Party Applications**
- b. Servers for Management Applications**
- c. Servers for Applications in Internal DMZ**
- d. Servers for Applications in External DMZ**

<b>Sl. No</b>	<b>Description of the Features</b>	<b>Minimum Quantity of the features</b>	<b>Offer by the Contractor</b>
1.	Application		
2.	Manufacturer		
3.	Model No.		
4.	Specint & Specfp	As per the base runtime requirements of SPEC CPU 2017 Benchmarking Standards.	
5.	Processor	Min 2x16 core, x86 64-bit <b>third generation</b> or latest processor (with compatible chipset) with 3.0 GHz or more base frequency  <b>The OEM software should be tested on the offered processor &amp; chipset</b>	
6.	RAM	<b>256 GB delivered, expandable up to 512 GB or Above DDR4RDIMMs/LRDIMMs.</b>  <b>The operating system delivered should support expansion up to 512 GB of RAM.</b>	
7.	Internal Auxiliary memory	<b>1.92 TB</b> SSD delivered after RAID 1 disk configuration, expandable up to 4 TB, Hot-pluggable	
8.	Spare Disk	one hot spare shall be provided	
9.	Interfaces	1. 2 x 10 Gbps Ethernet/FO ports 2. Dedicated 1 Gbps Management port 3. 2 x 16 Gbps FC port for SAN connectivity	
10.	User interface	Through KVM switch & console.	
11.	Configuration & management	<ul style="list-style-type: none"> <li>• Real-time out-of-band hardware performance monitoring &amp; alerting</li> <li>• Agent-free monitoring, driver updates &amp; configuration, power monitoring &amp; capping, RAID management, monitoring of I/O card &amp; system health.</li> <li>• Out-of-band hardware &amp; firmware inventory</li> <li>• Auto configuration to auto deploy a</li> </ul>	

Sl. No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
		baseline server configuration profile. • Automated hardware configuration and deployment to multiple servers	
12.	Server Security	Should provide effective protection, reliable detection & rapid recovery using: - Silicon-based Hardware Root of Trust - Signed firmware updates - Secure default passwords - Configuration and firmware drift detection - Automated event logging including user activity - Secure alerting - Automatic BIOS recovery - OS recovery - System erase Should provide system lockdown feature to prevent change (or “drift”) in system firmware image(s) & prevent malicious modification of server firmware	
13.	Mounting	Rack mountable Server	
14.	Certification and compliances	Microsoft Windows Server, Hyper-V, VMWare, Red Hat Enterprise Linux (RHEL), SUSE Linux Enterprise Server (SLES).	
15.	Pre-failure alert	Should provide predictive failure monitoring & proactive alerts of actual or impending component failure for memory, CPU, SSD	
16.	Power Supply	Redundant Hot plug Power Supplies with redundant fans.	
17.	Heat Load		

Note: 5 nos. of DVD RW to be supplied per each control center for servers (Main and Backup CC)

## 5. Back-up Solution

Sl. No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
1.	Manufacturer		
2.	Model No.		
	<b>Technical Requirements</b>		
3.	The proposed appliance must be a <b>purpose built backup appliance</b> for long term data retention and disaster recovery.		
4.	Proposed disk appliance should be offered with battery backed up RAM /NVRAM for protection against data loss in power failure scenario and continuous automated file system check to ensure data integrity		
5.	Proposed appliance should be offered RAID-6 or equivalent with SAS/NL-SAS disk drives along with one hot-spare disks per enclosure.		
6.	Proposed backup appliance should be able to interface with various industry leading server platforms, operating systems and Must support LAN/SAN based D2D backup via NFS v3, CIFS, OST protocols. Solution shall also support NDMP protocols.		
7.	Proposed backup appliance should be offered with protocols like OST, CIFS, NFS. Solution shall also support NDMP protocols. The protocols should be available to use concurrently with global / optimized deduplication for data ingested across all of them.		
8.	Solution shall also support storage of backup-data in other storages i.e. NAS, SAN, Tape Library, HDD etc.		
9.	The solution must support data protection of physical systems as well as virtual environments.		
10.	The solution shall take image backup of Physical as virtual system.		
11.	Should have the ability to perform different backup or restore jobs simultaneously.		
12.	The proposed solution must have the ability to reduce network bandwidth and source side compute overheads by only transferring the changed blocks to the backup target		
13.	The proposed backup solution should support restore a single VM, single file from a VM, a VMDK restore from the same management console for ease of use.		

Sl. No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
14.	Should have min <b>10</b> TB/hr. backup throughput.		
15.	The Proposed backup solutions should support online backup of IBM DB2, IBM Lotus Domino, Microsoft Exchange, Microsoft Office Share Point Server, Microsoft SQL Server, MySQL, Oracle Databases and NoSQL. <b>Contractor has to supply all or any licences without any additional cost, which may be required in Back-up Solution to meet functionalities envisaged of supplied systems and software components under the project.</b>		
16.	Should support Inline data duplication and compression.		
17.	Should support encryption for the data stored / data-at-rest.		
18.	<b>Should have optimized de-duplication Algorithm. The deduplication Solution should significantly improve backup appliance storage utilization and help retain data longer.</b>		
19.	Must protect against data loss in case of power failure and software crashes		
20.	Backup solution shall be configured in a manner that during backup performance of the systems is not impacted.		
21.	The backup solution must be offered with all types of required license (server, agent etc.) for the supplied capacity & it shall not limit the count of server, virtual machines, DB (exchange, Oracle, SQL etc. physical and virtual), FS etc. that can be included in backups.		
22.	The backup solution should support various level of backups including full, incremental, differential backups etc.		
23.	Solution should support 24x7 real-time monitoring, with at-a-glance and drill-down views of health, performance and workload of the virtual hosts.		
24.	Backup solution must have option of immediate recovery/restoration of VM's, databases directly from backed up disk destination.		
25.	The backup solution should be able to encrypt the backed-up data using 256-bit AES encryption on the backup client and should not demand for additional license, any such license if needed should be quoted for the total number of backup clients asked for.		
26.	Proposed backup appliance should be sized appropriately for the backup of 40 TB of (File System, source data, mix of Databases,		

Sl. No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
	VM etc.) and shall maintain following copies of data. a. Daily Incremental Backup – retained for 1 weeks b. Weekly Full Backup – retained for 15 days. c. Monthly Full Backups – retained for 1 Month. d. Yearly Full Backups - retained for 1 year.  Bidder must consider usable capacity to retain the data as per the scope of work specified in technical specification.		
27.	Spare Disk	Global hot spare to be provided.	
28.	Interface ports	The appliance should be offered with Min.4 x 10 Gbps SFP+. If Fiber Ethernet ports are provided then SFPs to be supplied for all ports. <b>The appliance should have minimum 2 x 16 Gbps FC.</b>	
29.	Dual Power Supply	Yes	
30.	Dual Controller	Storage must have two controllers and at least 16GB of DRAM cache.	

## 6. Storage System

### 6.1 Storage Area Network (SAN)

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	Supported Drives and Media	Must be able to support, SSD, SAS & NLSAS with auto tiering across drives.	
4.	Capacity	Minimum usable capacity of 50 TB to be provided using dual ported drives on RAID-5 (SSD and SAS) / 6(NLSAS). Following type disk shall be provided: a. 25% of required capacity on SSD b. 40% of required capacity on SAS c. 35% of required capacity on SAS/NLSAS	
5.	Spare Disk	Global hot spare to be provided via adding drives or distributed sparing.	
6.		The Storage array should be able to support Block protocols since current use case is also for storing Databases via FC.	
7.	Expandability	Min 20 % expandable including slots with storage enclosure	
8.	SAN Type and Interface ports	4x16 Gbps FC Ports	
9.	Snapshot feature with license	Storage must provide snapshot creation for faster execution and less overhead	
10.	Dual Controller	The proposed array should be Active-Active dual controller architecture and NSPOF (No point of Single failure). Each controller shall have minimum 6 Core, x86 64-bit latest processor (with latest chipset) or more and 96 GB DDR4/DRAM Memory.	
11.	Dual Power Supply and Redundant fans	Yes	

## 6.2 Network Attached Storage (NAS)

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	Capacity	Minimum usable capacity of 10TB	
4.	Spare HDD	2 Nos.	
5	Processor	Min 2x6 core, x86 64-bit latest processor (with latest chipset)	
	RAM	64 GB delivered or above DDR4	
5.	Expandability	Min 50% expandable including slots with storage enclosure	
6.	RAID level	6	
7.	Hard Drives speed	10000 or more rpm SAS	
8.	Hot swappable Hard Drives	Yes	
9.	Dual Power Supply	Yes	
10.	Heat Load		
11	Interface Ports	<b>Minimum 4*10G Base T ports (two ports per controller)</b>	
12	Controller	<b>Dual</b>	



## 7. Router cum Firewall: ICCP and RTU Communication

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by The Contracto
1.	Manufacturer		
2.	Model No.		
3.	<p>General:</p> <p>a. The Router shall be Enterprise class and should support modular architecture, multi-core Processor.</p> <p>b. Router should have minimum 4 GB of on-board/inbuilt DRAM/RAM for data plane + control plane processes and 8 GB Flash.</p> <p>c. High performance Routing for data exchange between data centres.</p> <p>d. Layer -2 &amp; Layer-3 routing &amp; Dynamic discovery of routing.</p> <p>e. Router should be IPv6/USGv6 Certified/IPv6 logo ready.</p> <p>f. Router should have traffic load sharing capability on dual WAN Links.</p> <p>g. The router/router OS shall be EAL2/ NDPP /NDcPP certified or above under Common Criteria Program for security related functions or under Indian Common Criteria Certification Scheme (IC3S) by STQC, DEIT, Govt. of India.</p>		
4.	Processing capacity	Routers shall have minimum 4 Gbps WAN throughput.	
5.	IPSec VPN tunnels	Router should support 1000 K IPv4 and IPv6 routes, with 1000 GRE and IPSEC tunnel.	
6.	Features to support	QoS, MPLS, Security, Multiservice, IP to IP Gateway	
7.	Routing protocols	Static Routes, OSPFv2, OSPFv3, BGP4, MP-BGP, BFD, IPCP, IP forwarding, Policy based routing, VLAN & MPLS etc.	
8.	Network protocols	TCP/IP, IPv6, OSI, Telnet, UDP, DHCP	
9.	Router should support SSHv2, SNMPv2c, SNMPv3 and NTP		

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by The Contracto
10.	Router should support HSRP/ VRRP protocol		
11.	The router must support IPSec, IKEv1, IKEv2, GRE. The proposed solution should serve the GRE encryption for traffic from any location to other location and also should able to create GRE tunnel.		
12.	Should have extensive support for IP SLA and best path selection for metrics like delay, latency, jitter packet loss to assure business-critical IP applications from Day1.		
13.	The Router shall have capability to add on demand IPSec VPN tunnels dynamically established hub -to-spoke IPSEC tunnels		
14.	The Router should support interfaces like Gigabit Ethernet modules, Fibre Optic ports.		
15.	Interface Support	a. Router shall support 1 Gbps and 10 Gbps b. Shall have minimum 8 nos. 1 Gbps Ethernet L3 ports. c. Shall have 4 nos. 10 Gbps FO port d. Shall have separate HA port.	
16.	Inbuilt software firewall Features	Yes	
17.	Mounting	Rack mountable	
18.	Power Supply	Router Should have dual Redundant Hot Swappable Power Supply	
19.	Heat Load		

**Note: However, the no of ports in a router shall be as per the network architecture & requirement at site and shall have 50% spare ports.**

**8. Router cum Firewall for PDS, Remote Console, External World Connectivity and others**

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by The Contracto
1.	Manufacturer		
2.	Model No.		
3.	<p>General:</p> <p>a. The Router shall be Enterprise class and should support modular architecture, multi-core Processor.</p> <p>b. Router should have minimum 4 GB of on-board/inbuilt DRAM/RAM for data plane + control plane processes and 8 GB Flash.</p> <p>c. High performance Routing for data exchange between data centre and remote VDU.</p> <p>d. Layer -2 &amp; Layer-3 routing &amp; Dynamic discovery of routing.</p> <p>e. Router should be IPv6/USGv6 Certified/IPv6 logo ready.</p> <p>f. Router should have traffic load sharing capability on dual WAN Links.</p> <p>g. The router/router OS shall be EAL2/ NDPP /NDcPP certified or above under Common Criteria Program for security related functions or under Indian Common Criteria Certification Scheme (IC3S) by STQC, DEIT, Govt. of India.</p>		
4.	Processing capacity	Routers shall have minimum 2 Gbps WAN throughput.	
5.	IPSec VPN tunnels	Router should support 1000 K IPv4 and IPv6 routes, with 1000 GRE and IPSEC tunnel.	
6.	Features to support	QoS, MPLS, Security, Multiservice, IP to IP Gateway	
7.	Routing protocols	Static Routes, OSPFv2, OSPFv3, BGP4, MP-BGP, BFD, IPCP, IP forwarding, Policy based routing, VLAN & MPLS etc.	

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by The Contracto
8.	Network protocols	TCP/IP, IPv6, OSI, Telnet, UDP, DHCP	
9.	Router should support SSHv2, SNMPv2c, SNMPv3 and NTP		
10.	Router should support HSRP/ VRRP protocol		
11.	The router must support IPSec, IKEv1, IKEv2, GRE. The proposed solution should serve the GRE encryption for traffic from any location to other location and also should able to create GRE tunnel.		
12.	Should have extensive support for IP SLA and best path selection for metrics like delay, latency, jitter packet loss to assure business-critical IP applications from Day1.		
13.	The Router shall have capability to add on demand IPSec VPN tunnels dynamically established hub -to-spoke IPSEC tunnels		
14.	The Router should support interfaces like Gigabit Ethernet modules, Fibre Optic ports.		
15.	Interface Support	a. Router shall support 1 Gbps and 10 Gbps, b. Shall have minimum 4 nos 1 Gbps Ethernet L3 ports. c. Shall have separate HA port. NOTE: Number of ports in router at control center for connecting remote consoles shall have sufficient number of L2 ports. to connect all the envisaged remote consoles.	
16.	Inbuilt software firewall Features	Yes	
17.	Mounting	Rack mountable	
18.	Power Supply	Router Should have dual Redundant Hot Swappable Power Supply	
19.	Heat Load		

**Note: However, the no of ports in a router shall be as per the network architecture & requirement at site and shall have 20% spare ports.**

**9. LAN Switches:**

- a. 48 Port L3- LAN switch for SCADA/EMS LAN.
- b. 24 Port L3- LAN switch for Historian and Reporting LAN
- c. 24 Port L3- LAN switch for Internal & External DMZ LAN
- d. 24 Port L3- LAN Switch for ICCP & FEP LAN
- e. 24 Port L3- LAN Switch for Server Management LAN

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the contractor
1.	Manufacturer		
2.	Model No.		
3.	Functions	For connecting all servers & peripheral devices on Local Area Network (LAN).	
4.	General	a. Switch should be 1U and rack mountable in standard 19" rack. b. Switch should have redundant hot swappable power supply. c. Switch should have minimum 2 GB RAM and 2 GB Flash/SSD Memory. d. Switch should have 4MB or more packet buffer. e. Switch should have minimum 10K IPv4 and 5K IPv6 unicast routes.	
5.	Standard	Switch should support IEEE Standards of Ethernet: IEEE 802.1D, 802.1s, 802.1w, 802.1x, 802.3ad, 802.3x, 802.1p, 802.1Q, 802.3, 802.3u, 802.3ab, 802.3z. should be supporting	
6.	L-2 Feature:	a. IPv4 & IPv6 Routing features. b. DHCP capabilities c. ACL in IPv4 & IPv6. d. Switch should support MAC address filtering based on source and destination addresses e. Switch should support up to 10 K MAC addresses and min 1K active VLAN/VLAN ID f. Policy-based routing and Dual IP stack.	
7.	L-3 Feature:	a. Static Routing for IPv4 and IPv6.	

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the contractor
		b. OSPF for IPv4 (OSPFv2) and IPv6 (OSPFv3). c. <b>{IS-IS for IPv4 and IPv6} or {OSPF for IPv4 and IPv6}</b> d. Policy-based routing and Dual IP stack. e. QoS and Security Features. f. Access Control Lists for filtering traffic to prevent unauthorized users from accessing the network. g. Congestion avoidance using Weighted Random Early Detection (WRED) or equivalent feature. h. IEEE 802.1X Port Based Network Access Control i. DHCP Snooping support.	
8.	Interface ports	a. 24/48 nos of port b. 5 nos 10 Gbps FO ports c. 12 nos 1Gbps Ethernet ports Balance 1/10 Gbps as per site requirement and switch type. All pre-populated ports should have compatible transceivers along-with required FO cables. Switch shall have virtualization feature for HA (through FO Port), so that two different switches to appear as a single port channel	
9.	Certification	The Switch/Switch OS shall be EAL2/ NDPP /NDcPP certified or above under Common Criteria Program for security related functions or under Indian Common Criteria Certification Scheme (IC3S) by STQC, DEIT, Govt. of India.	
10.	Management Features	a. Configuration through secure command-line interface (CLI) over Telnet and SSH b. SNMP v3 c. Port mirroring to enable traffic on a port to be simultaneously sent to a network	

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the contractor
		analyzer for monitoring. d. Network Time Protocol (NTP) or equivalent support. e. Switch should store multiple configuration, image files and have capability to revert to the last known good configuration/image f. Shall have the capability to monitor link connectivity and prevent loops if uni-directional traffic is detected by shutting/disabling the ports	
11.	Cable standard	Cat 6 or higher bandwidth cable	
12.	Heat Load		

**\*\* However, the no of ports in a LAN switch shall be as per the network architecture & the no of servers/devices on that LAN.**

**10. LAN Switch:**

**a. 24 Port L3- LAN Switch for DCPC/Terminal Server LAN**

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the contractor
1.	Manufacturer		
2.	Model No.		
3.	Functions	For connecting all servers & peripheral devices on Local Area Network (LAN).	
4.	General	a. Switch should be 1U and rack mountable in standard 19" rack. b. Switch should have redundant hot swappable power supply. c. Switch should have minimum 2 GB RAM and 2 GB Flash/SSD Memory. d. Switch should have 4MB or more packet buffer. e. Switch should have minimum 10K IPv4 and 5K IPv6 unicast routes.	



Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the contractor
5.	Standard	Switch should support IEEE Standards of Ethernet: IEEE 802.1D, 802.1s, 802.1w, 802.1x, 802.3ad, 802.3x, 802.1p, 802.1Q, 802.3, 802.3u, 802.3ab, 802.3z. should be supporting	
6.	L-2 Feature:	a. IPv4 & IPv6 Routing features. b. DHCP capabilities c. ACL in IPv4 & IPv6. d. Switch should support MAC address filtering based on source and destination addresses e. Switch should support upto 10 K MAC addresses and min 1K active VLAN/VLAN ID f. Policy-based routing and Dual IP stack.	
7.	L-3 Feature:	a. Static Routing for IPv4 and IPv6. b. OSPF for IPv4 (OSPFv2) and IPv6 (OSPFv3). c. <b>{IS-IS for IPv4 and IPv6} or {OSPF for IPv4 and IPv6}</b> d. Policy-based routing and Dual IP stack. e. QoS and Security Features. f. Access Control Lists for filtering traffic to prevent unauthorized users from accessing the network. g. Congestion avoidance using Weighted Random Early Detection (WRED) or equivalent feature. h. IEEE 802.1X Port Based Network Access Control i. DHCP Snooping support.	
8.	Interface ports	<ul style="list-style-type: none"> <li>• 18 nos 1Gbps Ethernet ports</li> <li>• 4 nos 10 Gbps FO ports</li> <li>• Balance 1/10 Gbps as per site requirement and switch type.</li> </ul> Switch should have virtualization feature for HA (through FO Port), so that two different switches to appear as a single port channel	

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the contractor
9.	Certification	The Switch/Switch OS shall be EAL2/ NDPP /NDcPP certified or above under Common Criteria Program for security related functions or under Indian Common Criteria Certification Scheme (IC3S) by STQC, DEIT, Govt. of India.	
10.	Management Features	<ul style="list-style-type: none"> <li>a. Configuration through secure command-line interface (CLI) over Telnet and SSH</li> <li>b. SNMP v3</li> <li>c. Port mirroring to enable traffic on a port to be simultaneously sent to a network analyzer for monitoring.</li> <li>d. Network Time Protocol (NTP) or equivalent support.</li> <li>e. Switch should store multiple configurations, image files and have capability to revert to the last known good configuration/image</li> <li>f. Shall have the capability to monitor link connectivity and prevent loops if uni-directional traffic is detected by shutting/disabling the ports</li> </ul>	
11.	Cable standard	Cat 6 or higher bandwidth cable	
12.	Heat Load		

**\*\* However, the no of ports in a LAN switch shall be as per the network architecture & the no of servers/devices on that LAN.**

#### 11. FC Switch for SAN Storage

S.No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	Functions	For Server and Storage connectivity	
4.	Interface ports	** 16 GB ps FC ports	
5.	Mounting	Rack mountable	

S.No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
6.	Dual Power Supply (in Watts)		
7.	Heat Load		

**\*\* However, the no of ports in a FC switch shall be as per the network architecture & the no of servers/devices to be connected.**

## 12. Link Load Balancer (LLB)

Sl. No.	Minimum Required Specifications	Offered by the Contractor
	<b>Hardware specification of each LLB appliance</b>	
1.	LLB shall be appliance based.	
2.	Appliance shall have minimum 02 nos.1 Gbps copper ports and should have 2x10G ports on the same appliance. 8 port (FO) 10 Gbps redundant switch shall be provided by contractor to connect LLB with router and firewall.	
3.	Appliance shall have minimum 16 GB Memory so as to efficiently meet all the capability parameters as well as functionalities laid down in the specifications.	
4.	It shall have redundant Power Supply (RPS) which is hot swappable and no downtime / reboot shall be required for addition / removal of power supply module.	
5.	It shall be rack mountable.	
6.	LLB appliance shall support minimum 1 Lakh concurrent TCP sessions or more	
7.	LLB appliance shall be able to deliver minimum 10 Gbps system throughput	
8.	LLB appliance shall be able to deliver minimum 5 Gbps encrypted throughput and 10 Gbps of compression throughput on day one	
9.	The proposed appliance shall have capability to run in standalone as well <b>as in HA mode.</b>	
10.	LLB appliance should support dynamic routing protocol OSPF, BGP, IPv6 OSPF etc.	

Sl. No.	Minimum Required Specifications	Offered by the Contractor
11.	LLB appliance shall be configured in High Availability Mode and both active-backup and active-active topology need to be supported.	
	<b>Solution Functional Requirements:</b>	
12.	Have to load balance inbound traffic across multiple communication (MPLS/PtP/Internet) to communicate with other control centre.	
13.	Shall support VLAN Tagging and balance link load between two VLAN networks.	
14.	LLB should minimum support these algorithms.	
	a) Round Robin	
	b) Hops	
	c) Least bandwidth/Packet Rate	
	d) Least connections, etc.	
15.	LLB should support persistence for connections to be sustained on a specific link.	
	a) Source IP address-based	
	b) Destination IP address-based	
	c) Source IP and destination IP address-based	
16.	Solution to use monitor to detect failure in any device that exists in the path from the appliance to the destination IP address specified in the monitor.	
17.	LLB shall be designed to run both IPv4 & IPv6 simultaneously (Dual Stack) from day one <b>and appliance should be IPV6 Ready logo certified from day one.</b>	
	<b>Management &amp; Reporting</b>	
18.	LLB appliance shall support Syslog, SNMP (v2c & v3) & MIB-II.	
19.	LLB appliance should be manageable (both GUI and CLI) using SSH, Web based management (HTTPS) etc.	
20.	Central Management & Reporting Solution need to be proposed by bidder. 'At-a-glance-Dashboard' to provide overall status health (CPU, Memory etc.), network traffic, concurrent sessions, connections /sec etc.	
21.	The Historical Reports shall be provided for multiple timeframe i.e. hourly, daily, weekly, monthly and customized period.	

**13. External Network Firewall with NIPS (For DMZ and RTU-ICCP Connectivity):**

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	<p><b>General:</b></p> <ul style="list-style-type: none"> <li>a. The appliance-based security platform should provide firewall, AVC, Anti malware, Anti-Bot, Ant-Spyware, URL and IPS functionality in a single appliance from day one.</li> <li>b. Proposed appliance shall have minimum 200 GB SSD drive; however, size must be considered to meet other requirement specified under the specification.</li> <li>c. Multicore CPU architecture with a hardened 64-bit operating system to support higher memory with min 6 physical CPU cores on device and minimum 16 GB RAM on device or higher.</li> <li>d. Firewall should have integrated redundant hot-swappable power supply.</li> <li>e. Firewall should have redundant fan.</li> </ul>		
4.	<p><b>Sizing Parameters:</b></p> <ul style="list-style-type: none"> <li>a. <b>Should have Minimum NG Threat prevention throughput in real world/production environment (by enabling and measured with Application-ID/AVC, NGIPS, Anti-Virus, Anti-Spyware, Anti Malware, Anti-Bot, Zero-day attacks and logging security threat prevention features enabled – 6 Gbps real world/production environment/Application Mix.</b></li> <li>b. Firewall should support at least 3000 new connections per second or more and shall support at-least 1 Million concurrent session/connection with all application control enabled.</li> <li>c. No of VLANs – 100</li> <li>d. Minimum IPSec VPN peers – 200</li> <li>e. <b>Firewall should have at least 1.5 Gbps of VPN throughput.</b></li> </ul>		
5.	<p><b>NG Firewall Features:</b></p> <ul style="list-style-type: none"> <li>a. Should support manual NAT and Auto-NAT, Static NAT, Dynamic NAT, Dynamic PAT.</li> </ul>		

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
	<p>b. The firewall should have the capability of identifying, network hosts, network traffic from both virtual and physical machines and their activities.</p> <p>c. Should be capable of detecting and blocking IPv4 and IPv6 attacks including capabilities like DNS sinkhole/equivalent.</p> <p>d. Solution should support capability to detect threats emerging from inside the network.</p> <p>e. The solution must provide IP reputation feed that comprised of several regularly updated collections of poor reputation of IP addresses determined by the proposed security vendor.</p> <p>f. The detection engine should support capability of detecting and preventing a wide variety of threats (e.g., network probes/reconnaissance, VoIP attacks, buffer overflows, P2P attacks, etc.).</p> <p>g. The proposed firewall shall perform content-based signature matching beyond the traditional hash base signatures.</p> <p>h. The proposed firewall shall be able restrict application traffic to its default ports to prevent evasive applications from running on non-standard ports.</p> <p>i. The proposed firewall shall be able to protect the user from the malicious content upload or download by application/protocol by enforcing the total threat protection for known and unknown malicious content such as virus, malware or a bad URL.</p> <p>j. Support NAT, PAT &amp; Policy based NAT/PAT, Mapped IP (MIP), Virtual IP(VIP) &amp; MIP/VIP grouping.</p> <p>k. IPSec and SSL VPN Tunneling</p>		
6.	Data encryption support	DES, 3DES, AES 128-, 256-bit	
7.	Support Active-Active Mode	Yes	
8.	Tunneling functionality	Nat66 (IPv6-to-IPv6), Nat 64 (IPv6-to-IPv4) & Nat46 (IPv4-to-IPv6) / IPv4 over IPv6.	
9.	IP address assignment features	PPPoE, DHCP	
10.			
11.	IPv6 features	Syn Cookie, Syn-proxy DoS attack detection, SIP, ALG's, BGP4, DHCPv6 Relay, IPv4 to IPv6 translations &	

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
		Encapsulations.	
12.	System management and configuration	Using web GUI/client based (without any limitation in number of clients), Command Line interface (console/telnet/SSH).	
13.	Supporting Protocols	FTP, <b>SFTP</b> , SMTP, HTTP, HTTPS, SNMP, UDP, ICMP, RPC, DNS, DHCP, ARP, TCP, POP3, IGMP, PIM.	
14.	Authentication protocols	RADIUS, LDAP methods	
15.	Routing protocols	Static, RIP, OSPF, OSPFv3 and BGP, BGPv6.	
16.	Content filtering	JAVA & ActiveX blocking	
17.	Proposed FW shall also support: a. DoS & DDoS prevention b. TCP reassemble for fragmented packet protection c. Brute Force attack mitigation d. SYN cookie protection e. Zone/Interface based IP spoofing f. Malformed packet protection g. Stateful packet inspection h. Detail logging and packet capture		
18.	Filtering of packets based on Source address, destination address, protocol type, user, port number, URL ( <b>including URL blocking</b> ).		
19.	The Appliance OEM must have its own threat intelligence analysis center and should also use the global footprint of security deployments for more comprehensive network protection		
20.	Should be able to identify attacks based on Geo-location and define policy to block on the basis of Geo-location.		
21.	Solution should support the capability to quarantine/blocking end point traffic by integrating with threat feeds from other security solution like Network Admission Control, if provisioning of additional licensing is required same may be considered.		
22.	Interface Requirement:		



Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
	<p>a. Minimum number of 1 Gbps LAN ports: 8 (DMZ) / 4(RTU&amp; ICCP)</p> <p>b. Minimum number of 10 Gbps FO ports – 4 (DMZ) /8 (RTU &amp; ICCP)</p> <p>c. Separate HA port</p> <p>All the SFP+ port should have compatible transceivers (short range transceiver) along-with required FO cables.</p>		
23.	<p>The Proposed solution should have VPN license for 20 Users for Firewall placed in DMZ only.</p> <p>The proposed Firewall should be able to perform URL filtering capability for remote user’s as well, either using VPN or any similar technology (user accessing SCADA infrastructure through VPN shall bind with SCADA security policy and not able to use restricted activity during VPN connection). If any extra hardware/software is needed to achieve this, same shall be provided from day 1 without any additional cost.</p> <p>Multi-factor/OTP Authentication for 20 users shall be provided from Day1The proposed solution based on appliance/VM must be scalable and should support integration with Active Directory/LDAP. It must provide capability to users to resolve their own password issues, registration etc. to ensure improved user satisfaction.</p>		
24.	Multifactor Authentication: SMS and Email for 20 Users. (Through FW placed in DMZ or separate application)		
25.	<b>All features in the firewall should be functional/operational within 5 minutes of Power ON.</b>		
26.	<b>Any new policy/ policies should be applied in the firewall in not more than 5 minutes. The time shall be measured from the pushing of the policy from management console to the policy becoming effective.</b>		
27.	<b>Shall support inbuilt IPS inspection for all traffic including IEC60870-5- 104, ICCP and other SCADA protocols</b>		
28.	Power Supply (in Watts)		
29.	Heat Load		

**Note:** In case of any license is required, same shall be provided by the contractor during the contract period without any extra cost

#### 14. Internal Network Firewall with NIPS:

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	<p><b>General:</b></p> <p>a. The appliance-based security platform should provide firewall, AVC and IPS functionality in a single appliance from day one.</p> <p>b. Proposed appliance shall have minimum 200GB SSD drive, however size must be considered to meet other requirement specified under the specification.</p> <p>c. Multicore CPU architecture with a hardened 64-bit operating system to support higher memory with min 6 physical CPU cores on device and minimum 16 GB RAM on device or higher.</p> <p>d. Firewall should have integrated redundant hot-swappable power supply.</p> <p><b>e. Firewall should have at least 1.5 Gbps of VPN throughput.</b></p>		
4.	<p><b>Sizing Parameters:</b></p> <p>a. Should have Minimum NG Threat prevention throughput in real world/production environment (by enabling and measured with Application-ID/AVC, NGIPS, Anti-Virus, Anti-Spyware, Anti Malware, Anti-Bot, Zero-day attacks and logging security threat prevention features enabled – <b>6 Gbps</b> real world/production environment/Application Mix.</p> <p>b. Firewall should have at least 1 Gbps of VPN throughput.</p> <p>c. Firewall should support at least 3000 new connections per second or more and shall support at-least 1Million concurrent session/connection with all application control enabled.</p> <p>d. No of VLANs – 100</p> <p>e. Minimum IPSec VPN peers – 1000</p> <p>f. Proposed solution should support minimum 6 Gbps or more IPS throughput</p>		
5.	<p><b>NG Firewall Features:</b></p> <p>a. Should support manual NAT and Auto-NAT, Static NAT, Dynamic NAT, Dynamic PAT.</p> <p>b. The firewall should have the capability of identifying, network hosts, network traffic from both virtual and physical machines and their activities.</p>		

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
	<p>c. Should be capable of detecting and blocking IPv4 and IPv6 attacks including capabilities like DNS sinkhole/equivalent.</p> <p>d. Solution should support capability to detect threats emerging from inside the network.</p> <p>e. The solution must provide IP reputation feed that comprised of several regularly updated collections of poor reputation of IP addresses determined by the proposed security vendor.</p> <p>f. The detection engine should support capability of detecting and preventing a wide variety of threats (e.g., network probes/reconnaissance, VoIP attacks, buffer overflows, P2P attacks, etc.).</p> <p>g. The proposed firewall shall perform content-based signature matching beyond the traditional hash base signatures.</p> <p>h. The proposed firewall shall be able restrict application traffic to its default ports to prevent evasive applications from running on non-standard ports.</p> <p>i. The proposed firewall shall be able to protect the user from the malicious content upload or download by application/protocol by enforcing the total threat protection for known and unknown malicious content such as virus, malware or a bad URL.</p> <p>j. Support NAT, PAT &amp; Policy based NAT/PAT, Mapped IP (MIP), Virtual IP(VIP) &amp; MIP/VIP grouping.</p>		
6.	Data encryption support	DES, 3DES, AES 128-, 256-bit	
7.	Tunneling functionality	Nat66 (IPv6-to-IPv6), Nat 64 (IPv6-to-IPv4) & Nat46 (IPv4-to-IPv6) / IPv4 over IPv6.	
8.	Support Active-Active Mode	Yes	
9.	IP address assignment features	PPPoE, DHCP	
10.	IPv6 features	Syn Cookie, Syn-proxy DoS attack detection, SIP, ALG's, BGP4, DHCPv6 Relay, IPv4 to IPv6 translations & Encapsulations.	
11.	System management and configuration	Using web GUI /client based (without any limitation in number of clients), Command Line interface (console/telnet/SSH).	

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
12.	Supporting Protocols	FTP, <b>SFTP</b> , SMTP, HTTP, HTTPS, SNMP, UDP, ICMP, RPC, DNS, DHCP, ARP, TCP, POP3, IGMP, PIM.	
13.	Authentication protocols	RADIUS, LDAP methods	
14.	Routing protocols	Static, RIP, OSPF, OSPFv3 and BGP, BGPv6.	
15.	Content filtering	JAVA & ActiveX blocking	
16.	Proposed FW shall also support: a. DoS & DDoS prevention b. TCP reassemble for fragmented packet protection. c. Brute Force attack mitigation d. SYN cookie protection e. Zone/Interface based IP spoofing. f. Malformed packet protection g. Stateful packet inspection h. Detail logging and packet capture i. Antivirus, anti-worm, anti-spam and anti- spyware protection.		
17.	Filtering of packets based on Source address, destination address, protocol type, user, port number, URL ( <b>Including URL blocking</b> ).		
18.	The Appliance OEM must have its own threat intelligence analysis center and should also use the global footprint of security deployments for more comprehensive network protection		
19.	Solution should support the capability to quarantine/blocking end point traffic by integrating with threat feeds from other security solution like Network Admission Control, if provisioning of additional licensing is required same may be considered.		
20.	Interface Requirement: a. Minimum number of 1 Gbps LAN ports: 8 b. Minimum number of 10 Gbps ports – 10 c. Separate HA port  All the SFP+ port should have compatible transceivers (Short Range Transceiver) along-with required FO cables.		
21.	<b>All features in the firewall should be functional/operational within 5 minutes of Power ON.</b>		

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
22.	<b>Any new policy/ policies should be applied in the firewall in not more than 5 minutes. The time shall be measured from the pushing of the policy from management console to the policy becoming effective.</b>		
23.	<b>Shall support inbuilt IPS inspection for all traffic including IEC60870-5- 104, ICCP and other SCADA protocols</b>		
24.	Power Supply (in Watts)		
25.	Heat Load		

**Note:** In case of any license is required, same shall be provided by the contractor during the contract period without any extra cost.

### 15. Centralized Management of Firewalls

Sl. No.	Minimum Required Specifications	Bidder's proposed specifications
1.	<p>The Firewall management Solution must provide dedicated centralized management for central configuration, provisioning, real-time monitoring, fault management, logging and customized reporting with the capability to create scheduled reports. The management platform must be accessible via a web-based interface / client-based GUI (without any limitation in number of client) for all the management facility. Same OEM FWs must be managed centrally through single software.</p> <p>In case of software-based application, required VM for the installation of software <b>to be considered by the contractor</b> Also, if specific OS is required to make it operational, same shall be provided by the vendor. All other necessary licenses shall be provided by the bidder.</p> <p>If bidder wish to provide appliance-based management instead software based all necessary requirement shall be considered by the bidder.</p>	
2.	The management platform must support role-based multi-user management.	
3.	The management platform must provide centralized logging and reporting functionality.	
4.	The management / logging platform must be capable of integrating with API for Automation and Orchestration.	

Sl. No.	Minimum Required Specifications	Bidder's proposed specifications
5.	The management platform must be capable of role-based administration, enabling different sets of views and configuration capabilities for different administrators subsequent to their authentication.	
6.	For troubleshooting packet tracer/debugging and capture are the two primary capabilities needed.	
7.	Should support REST API for monitoring and config programmability	
8.	The management platform must provide multiple report output types or formats, such as <b>PDF and CSV</b> .	
9.	The management platform must support multiple mechanisms for issuing alerts (e.g., SNMP, e-mail, SYSLOG).	
10.	Logs must be available for at-least six months, hardware sizing may be considered accordingly.	
11.	The management platform must provide built-in robust reporting capabilities, including a selection of pre-defined reports and the ability for complete customization and generation of new reports.	
12.	The management platform support running on-demand and scheduled reports	
13.	The management platform must risk reports like advanced malware, attacks and network	
14.	The management platform must include an integration mechanism, preferably in the form of open APIs and/or standard interfaces, to enable events and log data to be shared with external network and security management applications, such as Security Information and Event Managers (SIEMs), and log management tools. All licenses required for above mentioned security solution must be activated from day one.	
15.	<b>Same OEM Firewalls located at main and back-up control centre shall be configured and managed by centralised management system located at both locations i.e., main and backup control centre. So that if there is problem in main control centre then all the firewalls from same OEM at both locations shall be managed centrally from backup control centre and vice versa.</b>	

#### 16. Anti-APT

<b>Sl. No.</b>	<b>Minimum Required Specifications</b>	<b>Offered by the Contractor</b>
1.	The Solution should be able identify bi-directional malicious communication originating from endpoints and servers for automatic blocking/threat update.	
2.	Should support deep packet inspection of traffic (including HTTPS, SMTPS) for both incoming and outgoing either on box or with the help of another solution/device. Bidder must consider complete solution to meet the desired functionality for HTTP, HTTPS, SMTP, SMTPS, IMAP, POP3, SMBv3 / CIFS.	
3.	Should provide detection, Prevention; analysis and remediation capability against APT & SSL based APT attacks. Should be able to block zero-day infected file.	
4.	The proposed solution should be able to detect and prevent advanced Malware, Zero-day attack, spear phishing attack, and targeted Advanced Persistent Threat without relying on just Signature database.	
5.	The proposed solution should automatically detect and confirm multistage zero-day malware and targeted attacks without prior knowledge of the malware.	
6.	The proposed solution should detect the entire infection lifecycle and trace the stage-by-stage analysis of an advanced attack, from system exploitation to outbound malware communication protocols leading to data exfiltration.	
7.	The proposed solution should analyze advanced malware of different operating systems and various versions of pre-defined applications.	
8.	The solution must support pre-populated licensed copies of Operating systems and applications/software's (like Microsoft Office).	
9.	The system should be able to support file sizes at least 100 mb or more.	
10.	The proposed solution should have the ability to analyze, detect and block malware in common file formats including but not limited to executables, JAVA, PDF, MS Office documents,	
11.	common multimedia contents such as HTML/FLASH/file etc. and ZIP/RAR/7ZIP etc. archives to prevent advanced Malware and Zero-day attacks.	
12.	The proposed solution should be capable to block inbound malicious exploits delivered via a web channel and outbound	



Sl. No.	Minimum Required Specifications	Offered by the Contractor
	call-back communications when deployed in inline, or out-of-band mode.	
13.	The proposed solution should be able to analyze malicious links for static and dynamic analysis.	
14.	Should have anti-evasion capabilities to prevent malwares detection of being run/executed in the virtualized environment.	
15.	Should support for SIEM log integration.	
16.	Should be able to schedule reports and also provide the flexibility to generate on-demand reports like daily/weekly/monthly/ yearly/specific range (day and time) etc.	
17.	There should be Separate purpose-built Appliance for Zero Day/Sandbox/ATP with minimum <b>4x 1GE/FO</b> Ethernet/FO interface (depends on proposed architecture), 950 GB or more Storage on appliance.	
18.	Number of VM's/sandbox images should be more than <b>8</b> from day 1 and running simultaneously.	
19.	It should support Sandbox Analysis for files: <b>a. Which can run on multiple operating systems of windows environment.</b> <b>b. Linux file types etc.</b> <b>The contractor shall supply all necessary licenses for above functionalities and future version shall also be supported.</b> If any additional licenses are required, same may be considered by contractor.	
20.	Sandbox effective Throughput shall be 50 Files/Hour if NGFW send unknown traffic for sandboxing	
21.	Should have dual AC power supply.	

### 17. Workstation consoles (24x7 Operational)

Sl. No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	Processor	Min 16 core latest processor (along with latest	

Sl. No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
		chipset), Clock Speed 3.0 GHz or more (minimum base frequency)	
4.	RAM	32 GB delivered, expandable up to 64 GB 2133Mhz ECC DDR4 or Above	
5.	Dedicated Graphics Card	Min 4 GB	
6.	Internal Auxiliary memory	1. 512 GB SSD 2. 512 SATA HDD- expandable up to 1 TB	
7.	Optical Drive	DVD-RW	
8.	Audio	Integrated Audio with Internal Speaker	
9.	Interfaces	Two nos 1 Gbps Ethernet ports, USB Ports (2 nos), HDMI Port/ Display Port, Universal Audio Jack	
10.	User interface	Two 23.8” wide screen (16:9 aspect ratio), Full HD with minimum Resolution (1920x1080) resolution with anti-glare coating, LED Colour Monitor, keyboard & optical mouse.	
11.	Operating system	Preinstalled OEM Licensed Microsoft Windows Pro 64-bit or equivalent in Primary SSD hard-drive	
12.	Certifications and Rating	Energy Star 6.1 Compliant or equivalent	
13.	OS Certifications	Windows & Linux OS certification	
14.	Security	TPM2.0	
15.	Mounting	Desktop mounting	
16.	AC Power Supply (in Watts)		
17.	Heat Load		

**18. Remote console (All-in-One):**

Sl. No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	Processor	Min 8 core latest processor (along with latest chipset), Clock Speed 3.0 GHz or more (minimum base frequency)	
4.	RAM	16 GB delivered, expandable up to 64 GB 2133Mhz Non-ECC/ECC DDR4 or Above	
5.	Dedicated Graphics Card	Min 4 GB	
6.	Internal Auxiliary memory	512 GB SSD	
7.	Optical Drive	DVD-RW	
8.	Audio	Integrated Audio with Internal Speaker	
9.	Interfaces	One no 1 Gbps Ethernet ports, USB Ports (2 nos), HDMI Port/ Display Port, Universal Audio Jack.	
10.	User interface	23.8” wide screen (16:9 aspect ratio) (or more). Full HD with minimum Resolution (1920x1080) with anti-glare coating, Wide Viewing Angle WLED Monitor, keyboard & optical mouse.	
11.	Operating system	Preinstalled OEM Licensed Microsoft Windows Pro 64-bit or equivalent in Primary SSD hard-drive.	
12.	Certifications and Rating	Energy Star 6.1 Compliant or equivalent	
13.	OS Certifications	Windows & Linux OS certification	
14.	Mounting	Desktop mounting	
15.	Security	TPM2.0	
16.	AC Power Supply (in Watts)		
17.	Heat Load		

## 19. Laptops:

- a. For Maintenance
- b. For DTS
- c. For RTU Testing
- d. VAPT
- e. PCMT

Sl. No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	Processor	Min 4 core, latest processor (along with latest chipset) with 3.0 GHz Clock Speed or more (minimum base frequency).	
4.	RAM	16 GB delivered 2133Mhz DDR4 or Above	
5.	Dedicated Graphics Card	Min 4 GB	
6.	Internal Auxiliary memory	512 GB SSD	
7.	Optical Drive	DVD-RW	
8.	Mouse	Wireless	
9.	Keyboard	English keyboard, Backlight	
10.	Wi-Fi wireless LAN adapter	<b>Dual Band Wireless + Bluetooth 4.0</b>	
11.	Interfaces	One no 1 Gbps Ethernet ports, USB Ports (2 nos), HDMI Port/Display Port, Universal Audio Jack.	
12.	Screen	15 inches or more FHD (1920 x 1080) with Full HD Webcam	
13.	Operating system	Preinstalled OEM Licensed Microsoft Windows Pro 64-bit or equivalent in Primary SSD hard-drive.	
14.	AC Power Supply (in Watts)		
15.	Heat Load		

## 20. Video Projection System - LASER (VPS)

Sl. No	Description of the Features	Minimum Quantity of the features required	Offered by The Contractor
1.	Manufacturer		
2.	Model No.		
3.	Display technology (DLP)	LASER based rear projection,	
4.	Each VPS module size	70" Diagonal	
5.	Aspect ratio	16:9	
6.	Colours	16.7 million	
7.	VPS projector resolution	Minimum 1920x1080 (Full HD)	
8.	Inter modular gap	< 1.0 mm	
9.	Screen border	0 mm (No border)	
10.	Horizontal & Vertical viewing angle	±160° (approx.)	
11.	Horizontal & Vertical Half gain angle	+30° with tolerance of +5°	
12.	Overall brightness of each module	Minimum 1000 ANSI Lumens	
13.	Luminance measured at the screen	Minimum 450 candelas/sq.m	
14.	Median Laser life	Minimum 80,000 Hours	
15.	Centre to corner uniform brightness	> 90%	
16.	Brightness adjustable through software	Yes	
17.	Contrast ratio	1500:1	
18.	Operating temperature range	16 – 30° C	
19.	Operating Relative Humidity	20-80% non-condensing	
	<b>VPS Controller Features:</b>		
20.	Processor Details	Latest Quadcore or higher	
21.	RAM	32 GB -DDR4 or Above expandable to 64GB	
22.	Internal Auxiliary Memory	<b>480 GB SSD in RAID-1 configuration</b>	

Sl. No	Description of the Features	Minimum Quantity of the features required	Offered by The Contractor
23.	Optical Drive	DVD±R	
24.	User Interface	Keyboard & Optical Mouse (dual band wireless)	
25.	Ports	1. 2 nos 1 Gbps Ethernet Port 2. 2 nos 10 Gbps FO Port 3. 2 nos. HDMI/DVI/VGA	
26.	Interface with VPS	Audio video signal input module with 2 video inputs, 2 audio inputs, 2 audio outputs for connecting speakers.  <b>Minimum ports of type 2*DP-in, 2*HDMI, 1*DPout</b>	
27.	Types of video signal to be supported by VPS Controller	<b>Video signals supporting through HDMI and DP interface</b>	
28.	Time synchronization	SNTP, NTP	
29.	Operating System	Window latest version or equivalent on 64-bit operating system. Microsoft Office shall be provided and loaded on VPS system for reporting and presentation purposes.	
30.	Streaming Video from Video Camera	Video Client Application Software	
31.	Capability to display Video directly from video camera	Yes	
32.	<b>Graphic Card</b>	<b>Min 8GB</b>	
33.	Dual AC Power Supply (in Watts)	Dual redundant	
34.	Heat Load for- (a) Controller Heat Load (b) Heat Load Per Cube Heat Load for entire VPS		
35.	Power Load for- (a) Controller Power Load (b) Power Load Per Cube (c) Power Load for entire VPS		

**21. Video Wall - Floor / Wall Mounted (55” Diagonal)**

Sl. No.	Description of the Features	Minimum Quantity of the features required	Offered by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	Display technology	LED based	
4.	Grade	Industrial Grade, 24x7 operational	
5.	Screen size	55” diagonal	
6.	Aspect ratio	16:9	
7.	Colours	16.7 million	
8.	Contrast Ratio	<b>Minimum 1500:1</b>	
9.	Dynamic CR	10000:1	
10.	Viewing angle (H x V)	178 X 178	
11.	Input Response Time	Maximum 6 ms	
12.	Native Resolution	Minimum 1920x1080 (FHD)	
<b>13.</b>	<b>Inputs</b>	<b>2 HDMI, 2 DP, 2 USB</b>	
14.	PC connectivity	Yes	
15.	Mounting	For Tower Type with stand (2 M adjustable) For Wall mount: CPU shall be accommodated between wall and screen.	
16.	Operating temperature range	16 – 30 <sup>0</sup> C	
17.	Operating Relative Humidity	20-80% non-condensing	
<b>CPU Features (Mini size to be placed behind screen):</b>			
18.	Processor	Min 1X4 core, Clock Speed 3.0 GHz base frequency	
19.	RAM	16 GB delivered	
20.	Internal Auxiliary memory	300 GB SSD	
21.	Speakers	Yes	
22.	Interfaces	1 GB Ethernet ports and USB Ports	



Sl. No.	Description of the Features	Minimum Quantity of the features required	Offered by the Contractor
23.	Graphic card	Min 4 GB	
24.	User Interface	Wireless Keyboard & Optical Mouse	
25.	Power supply		

## 22. NavIC based (with fail back to GPS) based time facility

S.No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	Time stability of internal time base	Minimum 2ppm	
4.	Propagation delay compensation	Yes	
5.	Include an offset to permit correction to local time	Yes	
6.	Reverting to internal time base upon loss of signal from UTC source	Yes	
7.	Resynchronization Delay	Not more than 5 minutes.	
8.	Accuracy of resynchronization	< 1.5 Micro Sec	
9.	Interfaces	Ethernet ports - 2 IRIG-B port - 2	
10.	Power Supply (in Watts)		
11.	Heat Load		

## 23. Digital Displays for NavIC based (with fail back to GPS) Time facility

Sl. No.	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	Functions	For viewing UTC day of the year and time and frequency	

Sl. No.	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
4.	Day display format	XXX (MON through SUN)	
5.	Time display format	24 Hours, HH:MM: SS, where hour display will be from 00 to 23 hours format.	
6.	Date format	MM: DD: YY	
7.	Frequency display format	XX.XX Hz	
8.	Digital Display for Display of ABT Time block	XXX	
9.	Display digit requirements	Display Digit height >7.5cm	
10.	Mounting of displays	Wall/panel mounting	
11.	SCADA Interfaces	Frequency	
12.	Interfaces	All the displays with time frequency systems shall be connected through ethernet port.	
13.	Power Supply (in Watts)		
14.	Heat Load		

#### 24. Weather Sensors for Server Room

Sl. No.	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	Web Browser Interface	Yes	
4.	Connectivity	LAN with SCADA	
5.	Parameters to be Monitored	Temperature, Humidity	
6.	Data to be available in real-time in SCADA display	Yes	

## 25. Terminal Server

S. No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	Functions	To terminate IEC 101 based serial RTU interface and forward IEC 101 signals	
4.	No. of Ethernet Interface	2 ports	
5.	Ethernet Ports Speed	10/100 Mbps	
6.	Ethernet Connector Type	RJ45, 8 pin	
7.	Magnetic Isolation for Protection	Built in 1.5 KV magnetic isolation	
8.	Serial Ports	16/24/32/48 Ports or above	
9.	Serial Ports Interface	Serial Standard RS-232	
10.	Serial Ports Connection Type	RJ45, 8 pin	
11.	Protection for Serial Ports	15kV ESD for all signals	
12.	Serial Signals	RS232- TxD, RxD, CTS, RTS, DTR, DSR, DCD, GnD	
13.	Serial Port Baud Rate	50 bps – 921.6 kbps, any baud rate	
14.	Console Port	9 Pin DB9 Female	
15.	Supported	IEC 61850-3 complaint for S/S environment	
16.	Remote manageability through TCP/IP	To be supported. Software , if any, to be provided.	
17.	Memory		
17a.	For configuration storage	16 MB Flash Memory	
17b.	For serial information	128 MB works as First in First Out	
18.	Advanced AAA Security and encryption to meet all the data center compliance policies	Yes	
19.	Industrial Grade Type	Yes	

S. No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
20.	Operating Temperature	-10 deg C to 60 deg C	
21.	Power Supply (in Watts)		
22.	Heat Load		
23.	Dimensions		

## 26. PC for DCPC

SI. No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	Description	Rack mountable (19 inch) Industrial PC for Gateway DCPC.	
4.	Features	<ul style="list-style-type: none"> <li>The DCPC shall have the functionality to act as an IEC 60870-5-101(IEC101) to IEC 60870-5-104(IEC 104) protocol converter.</li> <li>It shall acquire data from multiple IEC 101 RTUs, process the data including conversion of data types and communicate the data to multiple Control Centers (at least 4) on IEC 60870-5-104 protocol.</li> <li>The complete failure of communication with an IEC 101 RTUs shall be communicated to the control centers as an event of communication failure with the RTU in addition to the stale/old data.</li> <li>DCPC shall have the capability to report to at least 4 master stations on IEC 104 interface.</li> <li>Data Concentrator shall be supplied with GPS receiver system with</li> </ul>	

		<p>antenna, cable etc. for time synchronization and time stamping of the data. The Data concentrator shall also synchronize the IEC 101 protocol connected RTU/device.</p> <ul style="list-style-type: none"> <li>• Data Concentrator shall come complete with a built-in monitoring mechanism to avoid loss of any data, especially the one reported by exception.</li> <li>• DCPC shall be configured as per DCPC Hardware Connectivity Diagram specified in Volume II Part-A Appendix-F</li> <li>• The DCPC shall have necessary software emulation for communication to serial devices/RTU through a terminal server.</li> <li>• DCPC shall have the capability to work in redundant configuration with a similar device. One DCPC will be in active mode and the other will be in standby.</li> <li>• The RLDC/SLDC computer system shall be able to configure and poll the health of Data concentrator from remote on 104 connected interfaces after due authentication of the users. DCPC shall support remote diagnostics &amp; maintenance activities.</li> <li>• Data Concentrator shall have following communication ports &amp; support for protocols:             <ul style="list-style-type: none"> <li>• IEC 104 for SCADA control centers.</li> <li>• IEC101/104 for Sub-RTUs.</li> <li>• DCPC shall have the capability to restart itself and resume its function in case of software errors, power system failure, without requiring manual intervention.</li> </ul> </li> <li>• Necessary software to meet the above functionality and configuration of data in DCPC shall be provided along with</li> </ul>	
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		<p>DCPC</p> <ul style="list-style-type: none"> <li>Number of slave RTUs at least 10 RTUs supporting a total up to 2000 data points.</li> </ul>	
5.	Processor	Min 8 core latest processor (along with latest chipset) Clock Speed 3.0 GHz or more (minimum base frequency)	
6.	RAM	2x16 GB delivered, expandable up to 64 GB 2133Mhz ECC DDR4 or Above	
7.	Internal Auxiliary memory	<ol style="list-style-type: none"> <li>512 GB SSD</li> <li>512 SATA HDD</li> </ol>	
8.	Optical Drive	DVD-RW	
9.	Interfaces	Two nos 1 Gbps Ethernet ports, 2xUSB Ports, HDMI Port, 2xSerial, 1xParallel Port	
10.	User interface	one 21" wide screen (16:9 aspect ratio), Full HD with minimum Resolution (1920x1080), LED Colour Monitor, keyboard & optical mouse.	
11.	Operating system	Preinstalled OEM Licensed Microsoft Windows Pro 64-bit or equivalent in Primary SSD hard-drive.	
12.	Certifications and Rating	Energy Star 6.1 Compliant or equivalent	
13.	OS Certifications	Windows &Linux OS certification	
14.	Security	TPM2.0	
15.	AC Power Supply (in Watts)		
16.	Heat Load		
17.	Ambient temperature	0 to 55 deg	
18.	Relative humidity	Up to 90%	

**27. Color Laser Printer:**

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
1.	Manufacturer		

2.	Model No.		
3.	Functions	Print, scan, email, fax	
4.	Paper size	A3, A4	
5.	Print speed	30 Colour pages/minute of A4 size & 15 Colour pages/minute of A3 size.	
6.	Print resolution	1200x1200 dpi	
7.	Paper weight	75-200 GSM	
8.	First page out time	10 sec for black and white and 15 sec for colour	
9.	Duty cycle	100000 pages per month	
10.	Paper handling capacity	Minimum 500 sheets for input tray & 500 sheets for output tray.	
11.	Automatic duplex printing	Yes	
12.	Landscape and portrait orientation	Yes	
13.	RAM	1500 or more MB	
14.	Hard Disk Capacity	256 GB	
15.	Interface	Dual 1GB internal LAN ports	
16.	Heat Load		

## 28. Black & White Laser Printer (Multifunction Device)

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	Functions	i) Print, ii) Scan iii) Copy iv) Fax	
4.	Paper size	A3, A4	
5.	Print speed	30 pages/minute of A4 size &	



Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
		15 pages/minute of A3 size.	
6.	Print resolution	600x600 dpi	
7.	Scan resolution	600x600 dpi	
8.	Paper weight	75-200 GSM	
9.	First page out time	10 sec	
10.	Duty cycle	Heavy duty, 100000 pages per month	
11.	Paper handling capacity	Minimum 500 sheets for input tray & 500 sheets for output tray. Duplex automatic document feeder for minimum 15 pages (scan/fax).	
12.	Automatic Duplex printing	Yes	
13.	Landscape and portrait orientation	Yes	
13.	RAM	2500 or more MB	
14.	Hard Disk Capacity	256 GB	
15.	Interface	Dual 1GB internal LAN Ports	
16.	Heat Load		

**29. Smart Server Panels:**

Sl. No.	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	1. 42U racks mounted on the false floor.		

Sl. No.	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
	<p>2. Standing Server Rack - 42U with Heavy Duty Extruded Aluminium Frame for rigidity. Top cover with FHU provision. Top &amp; Bottom cover with cable entry gland plates. Heavy Duty Top and Bottom frame of MS. Two pairs of 19" mounting angles with 'U' marking. Depth support channels - 3 pairs with an overall weight carrying Capacity of 600Kgs.</p> <p>3. All racks should be lockable on all sides with unique key for each rack.</p> <p>4. Racks should have Rear Cable Management channels, Roof and base cable access</p>		
4.	<p><b>Doors:</b></p> <p>1. The racks should have steel (solid / grill / mesh) front / rear doors and side panels. Racks should NOT have glass doors / panels. Front and Back doors should be perforated with at least 63% or higher perforations.</p> <p>2. Both the front and rear doors should be designed with quick release hinges allowing for quick and easy detachment without the use of tools.</p> <p>3. Front-side and Backside of panel shall have double door.</p>		
5.	<p><b>Fans and Fan Tray:</b></p> <p>Fan Housing Unit 4 Fan Position (Top Mounted) (HA) - Monitored - Thermostat based - The Fans should switch on based on the Temperature within the rack. The temperature setting should be factory settable. This unit should also include - humidity &amp; temperature sensor.</p>		
6.	<p><b>Power Distribution Units:</b></p> <p>1. 2 per rack Power in HA with hot swappable, mounting with temperature and humidity monitoring.</p> <p>2. Distribution Unit - Single phase, rack level metering, UL489 certified low-profile circuit breakers, hot swappable LED readout for the total current being drawn. 60-degree C operating temperature</p> <p>3. Compatible to both C13 / C19 and hybrid outlets.</p> <p>4. Power rating should be designed considering the load of equipment's.</p>		
7.	<p>Management: Inbuilt power management and smart management of Rack for monitoring from remote and Alarm and event management</p>		
8.	<p>Certifications: Racks – UL certified, IPDU – UL/EN, CE, TUV</p>		

**30. Monitors for KVM Console:**

Sl. No.	Description of the Features	Offered by the bidder
1.	IP Based	
2.	Able to control a remote computer over the LAN	
3.	Rack Mountable with 1U Housing	
4.	Minimum 16 ports	
5.	Remote & Local User-1	
6.	Shall support IPv4 and IPv6	
7.	Video Resolution@60 Hz 1600/1200	
8.	USB Ports -3	
9.	Storage Peripherals Flash Drivers	
10.	Multiplatform Client Support (Windows, Mac, Linux and Solaris etc.)	
11.	Virtual media and serial device support	
12.	Capable of cascading with analog KVM switches	
13.	Hot Swappable (add/remove components without turning on/off KVM)	
14.	Serial Module Option for Serial Device Support	
15.	Security (CAC Reader for additional Security)	
16.	Authentication and Authorization for the KVM Switch through LDAP, LDAPS, MS Active Directory, RADIUS or KVM Access Management Server Authentication	
17.	Auto Scan Feature Which Permits Automatic Switching from Port to Port at User –Specified Intervals and Can Set values Ranges from 1 to 255 seconds	
18.	Panel Array mode which can display the video output of up to 25 servers at the same time	
19.	Modem Port for out of band management	
20.	Bundled with KVM Access Management Software (UP to 20 nodes).	
21.	Server connectivity should be through cat 5e or higher from KVM to server's interface modules and support upto 50m length	

### 31. Centralized Keyboard & Mouse Control Solution (CKMC)

Sl. No.	Description of the Features	Offered by the bidder
1.	The proposed solution must be platform and operating system independent, so as to integrate computers from different OEMs (Intel, Dell, HP, Lenovo etc.) with different operating systems	

Sl. No.	Description of the Features	Offered by the bidder
	(Windows, UNIX, Linux, Solaris, Mac etc.).	
2.	The proposed solution must be hardware independent so that no changes, interventions or software installations need be made on existing computer and Display Systems.	
3.	It shall be possible to access multiple workstations, other sources and/or Display systems through a single multifunctional keyboard and mouse without loss of performance.	
4.	<b>Selection of sources:</b> Every keyboard shall provide an overview of all sources/systems are currently configured. Keyboard overview shall facilitate information about sources that are accessible and sources that currently accessed by another user. It shall be possible to configure programmable buttons as shortcut to enable instantaneous access to key applications and immediate control of the working environment.	
5.	<b>Channel (Audio-Video, Mouse / Keyboard etc.) Switching:</b> The proposed solution shall facilitate to transmit different types of signals (Video, audio, USB, etc.) in practically latency-free mode over different interfaces independently and concurrently from each other.	
6.	<b>Switching Scenarios:</b> It must always be possible for users to store and recall multiple scenarios/pre-sets using the keyboard, i.e., which sources are assigned to which screens. The users must be able to name and delete scenarios, and define one scenario as the "default" so that it is automatically displayed after every login. It must also be possible to define, manage and edit scenarios for users from the administration console. Movement, additions and changes to all components of the proposed system must be achievable during ongoing operations without adverse impact on functioning of the system.	
7.	<b>Access to all Sources from all Desks:</b> Every operator desk shall have virtually latency-free access to all the distributed input sources. Operators shall not be able to notice difference in performance while accessing local and remote systems. Remote system may be located in an adjacent system room, or a system room located in another building or location.	
8.	Users can access all configured input sources as per respective keyboard/mouse without moving from one desk to another.	
9.	The playback of audio signals from any and all active computers shall be possible either directly over the keyboard as primary audio output and/or over external speakers as secondary audio output.	

Sl. No.	Description of the Features	Offered by the bidder
10.	All hardware shall include self-diagnostic features. On restoration of power after interruption they shall resume operation. All keyboards, controller and network equipment including switches and routers shall be compatible for remote monitoring using secure SNMP Ver. 3.0. All hardware shall support both IPv6 and IPv4 simultaneously.	
11.	It Shall support the video resolutions up to 1920 x 1200 @60Hz for up to 30 meters, 1600 x 1200 @60Hz for up to 40 meters, and 1280 x 1024 @75Hz for up to 50 meters.	
12.	It shall allow flexible interface combinations (PS/2, USB with VGA, DVI, HDMI and DisplayPort video interface, Sun and serial) to control all computer types.	
13.	<b>Two-Level Password Security</b> – It shall support one (01) administrator and ten (10) user profiles. Password protection shall prevent unauthorized access to the installation. The multifunctional keyboard shall be secured with a user-specific password.	
14.	Auto Scan mode shall be provided to enable continuous monitoring of user-selected computers.	
15.	Each set support at-least eight (8) sets of systems.	

### 32. 55-inch Video Wall with controller

S.No	Description of the Features	Minimum Quantity of the features required	Offered by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	Display technology (DLP)	LED LIT LCD PANELS	
4.	Each module size	55” Diagonal	
5.	Aspect ratio	16:9	
6.	Colors	16.7 million	
7.	VPS projector resolution	Minimum 1920x1080 (Full HD)	
8.	Inter modular gap	< 1.0 mm	
9.	Screen border	0 mm (No border)	

10.	Horizontal & Vertical viewing angle	+1600 (approx.)	
11.	Luminance measured at the screen	Minimum 170 candelas/sq.m	
12.	Median LED life	Minimum 55000 Hours	
13.	Centre corner uniform brightness	> 90%	
14.	Brightness adjustable through software	Yes	
15.	Contrast ratio	1500:1	
16.	Operating temperature range	16 – 300 C	
17.	Operating Relative Humidity	20-80% non-condensing	
18.	Number of Modules		
19.	Input in Panel	2*DP-in, 2*HDMI, 1*DP-out	
20.	PC connectivity	PC connectivity with DVI/HDMI/LAN via Video Wall Controller	
21.	Mounting		
<b>Controller Features:</b>			
23.	Specint & Specfp	As per the base runtime requirements of SPEC CPU 2017 Benchmarking Standards.	
24.	RAM	16 GB expandable to 32 GB	
25.	Internal Auxiliary Memory	<b>480 GB</b>	
26.	Optical Drive	DVD+R	
27.	User Interface	Keyboard & Optical Mouse (dual band wireless)	
28.	Ports	2 nos. HDMI HDMI Port: 5 nos., Ethernet Port: 4 nos., USB 3.0 : 4 nos., DVI port: 4 nos.	
29.	Interface with VPS	Audio video signal input module with 2 video, 2 audio & 2 RGB inputs each.	
30.	Types of video signal	RGB Analog up to 1920x1200 (up to	

	to be supported by Controller	165 MHz pixel clock) DVI up to 1920x1200 (up to 165 MHz pixel clock).	
31.	Time synchronization	SNTP, NTP	
32.	Dual AC Power Supply (in Watts)		
33	Heat Load		
34.	Streaming Video from Video Camera	Video Client Application Software	
35.	Capability to display Video directly from video camera	Yes	
36.	Country of Origin		

**33. Remote console with 55” monitor and CPU:**

Sl. No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
1	Manufacturer		
2.	Model No.		
3.	Processor	Min 8 core latest processor (along with latest chipset), Clock Speed 3.0 GHz or more (minimum base frequency)	
4.	RAM	16 GB delivered, expandable up to 64 GB 2133Mhz Non-ECC/ECC DDR4 or Above	
5.	Dedicated Graphics Card	Min 4 GB	
6.	Internal Auxiliary memory	512 GB SSD	
7.	Optical Drive	DVD-RW	
8.	Audio	Integrated Audio with Internal Speaker	
9.	Interfaces	One no 1 Gbps Ethernet ports, USB Ports (2 nos), HDMI Port/ Display Port, Universal Audio Jack.	
10.	User interface	55” wide screen (16:9 aspect ratio) (or more). Full HD with minimum Resolution (1920x1080) with anti-glare coating, Wide Viewing Angle WLED Monitor, keyboard &	



Sl. No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
		optical mouse.	
11.	Operating system	Preinstalled OEM Licensed Microsoft Windows Pro 64-bit or equivalent in Primary SSD hard-drive.	
12.	Certifications and Rating	Energy Star 6.1 Compliant or equivalent	
13.	OS Certifications	Windows &Linux OS certification	
14.	Mounting	Desktop mounting	
15.	Security	TPM2.0	
16.	AC Power Supply (in Watts)		
17.	Heat Load		

#### 34. LED color monitor for Workstation

S.No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	Diagonal Viewable size	23.8”	
4.	User interface	23.8” wide screen (16:9 aspect ratio), Full HD Resolution (1920x1080), 24x7 duty professional LED display.	
5.	Colour support	16.7 million	
6.	On screen control	Required	
8.	Anti-glare & anti-static	Yes	
9.	Country of Origin		

#### 35. Hard Disk

S.No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
1.	Manufacturer		

2.	Model No.		
3.	Type	HDD	
4.	Connectivity	USB 3.0 or above	
5.	Capacity	4TB	
6.	Form Factor	Portable	
7.	Country of origin		

**36. A4 sized Multi-Function Printer (Multifunction Device)**

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
<b>A4 sized multi-function device having mono-Ink Tank Printing, Copying, Scanning and Fax capabilities with minimum 2.5” touch screen control panel</b>			
1.	Manufacturer		
2.	Model No.		
<b>A.</b>	<b>Integrated Printer Specification</b>		
3.	Minimum Speed per minute as per ISO/IEC 24734 (A4) - Mono	20	
4.	Paper size supported	A4, Letter, Legal	
5.	Duplexing	Automatic two-sided printing	
6.	Memory	Minimum 256 MB	
7.	Original Document feeder type	DADF/RADF	
8.	Feeder Capacity (Minimum Number)	50	
9.	No. of main paper tray (minimum)	10/100 Ethernet network port	
10.	Connectivity Port	Heavy duty, 100000 pages per month	
<b>B.</b>	<b>Integrated Printer Specification</b>		
11.	Scanner Type	Flatbed, Integrated A4 size with single pass duplex Automatic	

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
		Document Feeder (DADF)	
12.	Network Scan	Scan to email, scan to network folder	
13.	Scanned file format	JPEG, TIFF, PDF	

### 37. Splitter

S.No	Description of the Features	Minimum Quantity of the features	Offer by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	Interface	RS232 (Tx, Rx, Gnd)	
4.	No. of Ports	3 nos. (1 input and 2 output)	
5.	Connector Types		
6.	Mounting	Rack mountable	
7	Protection		
8	Auxiliary Power Supply	48 V DC	

### 38. Firewall with NIPS for Remote Location (WBSETCL)

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	<p><b>General:</b></p> <p>a. The appliance-based security platform should provide firewall, AVC and IPS functionality in a single appliance from day one.</p> <p>b. The proposed appliance shall have a minimum of 200 GB SSD drive, however size must be considered to meet other</p>		

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
	<p>requirement specified under the specification.</p> <p>c. Multicore CPU architecture with a hardened 64-bit operating system to support higher memory with minimum 6 physical CPU cores on device and minimum 16 GB RAM on device or higher.</p> <p>d. Firewall should have integrated redundant power supply.</p> <p>e. Firewall should have redundant fan.</p> <p>f. Shall be managed from Centralised Management System supplied at Main &amp; Back up Control Center.</p> <p>g. No separate internet connection shall be provided. This device shall take updates/ upgrades through internet connection of Main &amp; Back up Control center.</p> <p><b>h. Firewall should have at least 1.5 Gbps of VPN throughput.</b></p>		
4.	<p><b>Sizing Parameters:</b></p> <p>a. Should have Minimum NG Threat prevention throughput in real world/production environment (by enabling and measured with Application-ID/AVC, NGIPS, Anti-Virus, Anti-Spyware, Anti Malware, Anti-Bot, Zero-day attacks and logging security threat prevention features enabled – 3 Gbps real world/production environment/Application Mix.</p> <p>b. Firewall should have at least 1 Gbps of VPN throughput.</p> <p>c. Firewall should support at least 3000 new connections per second or more and shall support at-least 1Million concurrent session/connection with all application control enabled.</p> <p>d. No of VLANs – 100</p> <p>e. Minimum IPSec VPN peers – 1000</p> <p>f. Firewall should have at least 1 Gbps of VPN throughput.</p>		
5.	<p><b>NG Firewall Features:</b></p> <p>a. Should support manual NAT and Auto-NAT, Static NAT, Dynamic NAT, Dynamic PAT.</p> <p>b. The firewall should have the capability of identifying, network hosts, network traffic from both virtual and physical machines and their activities.</p> <p>c. Should be capable of detecting and blocking IPv4 and IPv6 attacks including capabilities like DNS sinkhole/equivalent.</p> <p>d. Solution should support capability to detect threats emerging</p>		

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
	<p>from inside the network.</p> <p>e. The detection engine should support capability of detecting and preventing a wide variety of threats (e.g., network probes/reconnaissance, VoIP attacks, buffer overflows, P2P attacks, etc.).</p> <p>f. The proposed firewall shall perform content-based signature matching beyond the traditional hash base signatures.</p> <p>g. The proposed firewall shall be able restrict application traffic to its default ports to prevent evasive applications from running on non-standard ports.</p> <p>h. The proposed firewall shall be able to protect the user from malicious content upload or download by application/protocol by enforcing the total threat protection for known and unknown malicious content such as virus, malware or a bad URL.</p> <p>i. Support NAT, PAT &amp; Policy based NAT/PAT, Mapped IP (MIP), Virtual IP(VIP) &amp; MIP/VIP grouping.</p>		
6.	Data encryption support	DES, 3DES, AES 128-, 256-bit	
7.	Tunneling functionality	Nat66 (IPv6-to-IPv6), Nat 64 (IPv6-to-IPv4) & Nat46 (IPv4-to-IPv6) / IPv4 over IPv6.	
8.	Support Mode	Active-Active	
9.	IP address assignment features	PPPoE, DHCP	
10.	IPv6 features	Syn Cookie, Syn-proxy DoS attack detection, SIP, RSTP, ALG's, BGP4, DHCPv6 Relay, IPv4 to IPv6 translations & Encapsulations.	
11.	System management and configuration	<p>1. Using Centralized Management System supplied at Main &amp; Back up Control Center.</p> <p>2. Using web GUI /client based (without any limitation in number of clients), Command Line interface (console/telnet/SSH).</p>	
12.	Supporting Protocols	FTP, SFTP, SMTP, HTTP,	

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
		HTTPS, SNMP, UDP, ICMP, RPC, DNS, DHCP, ARP, TCP, POP3, IGMP, PIM.	
13.	Authentication protocols	RADIUS, LDAP methods	
14.	Routing protocols	Static, RIP, OSPF, OSPFv3 and BGP, BGPv6.	
15.	Content filtering	JAVA & ActiveX blocking	
16.	Proposed FW shall also support: <ul style="list-style-type: none"> <li>a. DoS &amp; DDoS prevention</li> <li>b. TCP reassemble for fragmented packet protection</li> <li>c. Brute Force attack mitigation</li> <li>d. SYN cookie protection</li> <li>e. Zone/Interface based IP spoofing</li> <li>f. Malformed packet protection</li> <li>g. Stateful packet inspection</li> <li>h. Detail logging and packet capture</li> <li>i. Antivirus, anti-worm, anti-spam and anti- spyware protection.</li> </ul>		
17.	Filtering of packets based on Source address, destination address, protocol type, user, port number, URL <b>(including URL blocking)</b>		
18.	The Appliance OEM must have its own threat intelligence analysis center and should also use the global footprint of security deployments for more comprehensive network protection		
19.	Solution should support the capability to quarantine/blocking end point traffic by integrating with threat feeds from other security solution like Network Admission Control, if provisioning of additional licensing is required same may be considered.		
20.	Interface Requirement: <ul style="list-style-type: none"> <li>a. Minimum number of 1 Gbps LAN ports: 8</li> <li>b. Minimum number of 1 Gbps FO ports: 4</li> <li>c. Separate HA port</li> </ul> <p>All the SFP+ port should have compatible transceivers (Short Range Transceiver) along-with required FO cables.</p>		
21.	<b>All features in the firewall should be functional/operational within 5 minutes of Power ON.</b>		

Sl. No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
22.	Any new policy/ policies should be applied in the firewall in not more than 5 minutes. The time shall be measured from the pushing of the policy from management console to the policy becoming effective.		
23.	Shall support inbuilt IPS inspection for all traffic including IEC60870-5- 104, ICCP and other SCADA protocols		
24.	Power Supply (in Watts)		
25.	Heat Load		

### 39. LAN switch to be supplied along with terminal server and DCPC

S.No	Description of the Features	Minimum Quantity of the features	Offered by the Contractor
1.	Manufacturer		
2.	Model No.		
3.	Functions	For connecting with Terminal servers & DCPC	
4.	Conform to standards	ISO8802 or IEEE 802 Series Standards	
5.	Switching capability	Layer-3 switching & VLAN	
6.	Interface ports	Minimum 8- 10/100Mbps Ethernet ports (RJ45 connector)	
7.	Management Features	g. Configuration through secure command-line interface (CLI) over Telnet and SSH h. SNMPv3 i. Network Time Protocol (NTP) or equivalent support.	
8.	Cable standard	Cat 6 or higher bandwidth cable	
9.	Mounting	Rack mountable	

**Note: Country of Origin for all above items shall be mentioned against each item.**



**APPENDIX- H-1**

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## 1. End Point Security Solution

Sl. No.	Minimum Required Specifications	Bidder's Compliance
1	Endpoint solution should have capability of AV, Vulnerability Protection, Firewall, Device control, Application Control, Virtual Patching, capabilities in a single agent and offering should be completely on - Premise.	
2	Prevents potential damage from unwanted or unknown applications (executables, DLLs, Windows App store apps, device drivers, control panels, and other Portable Executable (PE) files).	
3	Provides global and local real-time threat intelligence based on good file reputation data correlated across a global network.	
4	Endpoint vulnerability protection should scan the machine and provide CVE number visibility and accordingly create rule for virtual patch against vulnerability having Pre and Runtime machine learning capability along with Behavior monitoring with ransom ware protection engine, ransom ware engine should have feature to take backup of ransom ware encrypted files and restoring the same	
5	Defends endpoints—on or off the corporate network—against malware, Trojans, worms, spyware, ransomware, and adapts to protect against new unknown variants and advanced threats like crypto malware and file less malware.	
6	Contains broad coverage of pre-categorized applications that can be easily selected from application catalog (with regular updates) also uses application name, path, regular expression, or certificate for basic application whitelisting and blacklisting.	
7	Features roll-your-own application whitelisting and blacklisting for in-house and unlisted applications.	
8	Ensures that patches/updates associated with whitelisted applications can be installed, as well as allowing your update programs to install new patches / updates, with trusted sources of change.	
9	Should be capable of recommending rules based on vulnerabilities on endpoint and create dynamic rules automatically based on System posture and endpoint posture.	
10	Blends signature-less techniques, including high-fidelity machine learning, behavioral analysis, variant protection, census check, application control, exploit prevention, and good file check with other techniques like file reputation, web reputation, and command and control (C&C) blocking.	

Sl. No.	Minimum Required Specifications	Bidder's Compliance
11	Provides context-aware endpoint investigation and response (EDR) capability, recording and detailed reporting of system-level activities to allow threat analysts to rapidly assess the nature and extent of an attack along with Root cause analysis and and IOC Sweeping capability.	

## 2. HIPS

Sl. No.	Minimum Required Specifications	Bidder's Compliance
1	Solution should support stateful Inspection Firewall, Anti-Malware, Deep Packet Inspection with HIPS, Integrity Monitoring, Virtualised Security, Application Control, and Recommended scan in single module with agentless and agent capabilities.	
2	The proposed server security solution must support multiple platforms of server operating systems i.e. Windows, RedHat, CentOS, Oracle, Debian, SUSE, Ubuntu, Solaris and AIX.	
3	Should be capable of recommending rules based on vulnerabilities with the help of virtual patching and should have capabilities to schedule recommendation scan and entire features of solution should be agentless.	
4	Should provide automatic recommendations against existing vulnerabilities, dynamically tuning IDS/IPS sensors (Selecting rules, configuring policies, updating policies) provide automatic recommendation of removing assigned policies if vulnerability no longer exists	
5	Management of proposed solution should support both window as well as Linux platform also support the logging of events to a non-proprietary, industry-class database such as MS-SQL, Oracle, and PostgreSQL.	
6	Product should support CVE cross referencing when applicable for vulnerabilities and shall also have feature to take backup of infected files and restoring the same.	
7	Deep packet Inspection should protect operating systems, commercial off-the-shelf applications, and custom web applications against attacks such as SQL injections and cross-site scripting.	
8	Rules should be auto- Provisioned based on Server Posture. De-provisioning of rules should also be automatic if the vulnerability no longer exists	
9	Integrity Monitoring module should be capable of monitoring critical operating system and application elements files, directories, registry keys	

SI. No.	Minimum Required Specifications	Bidder's Compliance
	to detect suspicious behavior, such as modifications, or changes in ownership or permissions.	
10	Solution should be able to track addition, modification, or deletion of Windows registry keys and values, access control lists, or web site files are further examples of what can be monitored having automated recommendation of integrity rules to be applied as per Server OS and can be scheduled for assignment/assignment when not required.	

### 3. SIEM

SI. No.	Minimum Technical Specification	Bidder's Compliance
1.	Intelligent next generation SIEM must be able to detect any anomalies, report in real time and take-action as programmed.	
2.	The solution should support log collection, correlation and alerts for the number of devices envisaged under the project.	
3.	The Solution should ingest security logs from all devices (network, security), applications, servers and database. All events should be captured / not filtered and correlated as an industry best practise	
4.	Solution must be Sized for 3000 Sustained EPS,6000 Peak EPS with burst support for up to 10000 EPS without queuing or dropping any logs in segregated architecture consisting of Collection, log management and Correlation.	
5.	Proposed Solution should be able to get the network samples and analyse it for anomalies and malicious reputation and it should be alerted and investigated.	
6.	Proposed solution should support deep inspection into network traffic and should be able to detect the Ghost RAT protocol in real-time	
7.	SIEM Solution should integrate packet capture/flow data to be provided along with it. Solution should be integrated with NIPS and other Network devices	
8.	Solution should consist Un-obfuscated parsers natively available with log connector to modify existing parser as when required by security operations team.	
9.	The solution should provide the dashboard and Reports for viewing vulnerabilities, and it should provide the aggregated, correlated information	

Sl. No.	Minimum Technical Specification	Bidder's Compliance
	from all devices and applications	
10.	The solution should be able to conduct agent less collection of logs except for those which cannot publish native audit logs.	
11.	The solution should have connectors to support the supplied devices/ applications and additional, if any required, the bidder should develop customized connectors for these at no extra cost.	
12.	Logs must be retained for at least three years (3 months online and remaining offline/ compressed) on centralized storage (SAN/NAS). All logs must get auto archived on centralized storage directly from Log management layer and archived logs must be readable from archival/ central storage directly	
13.	The SIEM OEM shall provide real time threat intelligence feed as part of the solution. The feed should be from the same OEM and should not be an Open source Feed.	
14.	The system should receive feeds from a threat intelligence repository maintained by the OEM and from leading global intelligence sources. The solution should support external threat intelligence which could be used to identify incidents based on knowledge of global security research, to supplement its own threat feed.	
15.	SIEM should be able to be deployed on VM's or physical servers.	
16.	Should generate e-mail and SMS notifications for all critical/high risk alerts triggered from SIEM.	
17.	The dashboard should be in the form of a unified portal that can show correlated alerts/ events from multiple disparate sources such as security devices, network devices, enterprise management systems, servers, applications, databases, etc.	
18.	The solution should provide out of box rules for alerting on threats found in log or network data. e.g. failed logins, account changes, expirations, port scans, suspicious file names, default usernames, default passwords, security tools, AV signature updates, successful authentications, bandwidth by IP, email senders, failed privilege escalations, VPN failed logins, group management system configuration changes, traffic to nonstandard ports, URL blocked, accounts deleted, accounts disabled, top intrusions etc.	
19.	The solution should have the capability to collect and analyse logs from various log sources which include operational Events / Logs of Security devices including IPS, Firewalls, Anti-virus and other such devices, Logs / Events from the servers such as Web server, Mail server, DNS Server,	

Sl. No.	Minimum Technical Specification	Bidder's Compliance
	Application Servers, Operating systems (Windows, Unix, Linux, AIX, Solaris etc), Virtualization platforms, Databases (Oracle, SQL, DB2 etc.), Storage systems, etc. as deemed to be important for the purpose of Security.	
20.	The solution should allow creating standard reports from the rules configured in the system. The solution should also allow customizing reports in accordance with the organization's requirements from time to time.	
21.	The solution shall allow sending alerts to external systems e.g.- syslog, email etc.	
22.	The UEBA must be offered fully integrated within the proposed solution	
23.	The UEBA must be able to detect and respond to insider threats, compromised account, privileged account abuse, data exfiltration etc.	
24.	The UEBA must correlate log information to single identities to know the actors behind the actions impacting the environment with Identity Inference, which attributes identities to anonymous log messages, streamlining forensic investigations.	
25.	The UEBA must collect machine data from across NIC environment and fill in forensic gaps with endpoint and network monitoring.	
26.	The UEBA must use the heuristic baseline to detect unusual behaviors in real time, so it must continuously analyze current activity against baselines established for each identity and peer group. Detect behavioral deviations from user and peer group baselines.	
27.	SIEM shall be integrated with SOAR or another SOC in future and provision of bidirectional message exchange in SYSLOG, CEF or LEEF format shall be provided along with the supplied SIEM system	
28.	Solution shall also meet scope mentioned in various other sections of technical specification.	

#### 4. Identity Management

Sl. No.	Minimum Required Specifications	Bidder's Compliance
1.	The proposed solution must provide centralized administration of user-ids and password management.	

Sl. No.	Minimum Required Specifications	Bidder's Compliance
2.	The proposed solution should support for 'Separation of Duty'.	
3.	Must provide a consolidated audit trail of administrative operations.	
4.	The proposed solution must have LDAP interface to enable queries/updates by authorized third-party Purchaser tools.	
5.	The proposed solution must support enforcement of a centrally-defined security policy, e.g. for access rights, user names, password lengths.	
6.	The proposed solution must provide access rights based on job function to support implementation of role-based administration.	
7.	The proposed solution must have a web-interface for simplified user administration that can be used to introduce and delete users, and assign them to job functions.	
8.	The solution should provide a business-friendly UI for defining and editing access policies, access request, approvals, workflows, reports, self-service, collectors and connectors without the need for coding	
9.	The solution should collect user access privileges from AD, LDAP/LDIF etc.	
10.	The solution should enable Reports for file types, folder sizes and access utilization	
11.	The solution should support risk-based policies be created in the solution to support notification/ alerting when user risk profiles change.	
12.	The solution should support custom types of roles.	
13.	The solution should detect and alert on role violations before assigning roles to users.	
14.	The end-user password management user interfaces should be integrated with the solution's access request user interfaces for a seamless user experience.	
15.	The solution should provide data classification for unstructured targets and to route access requests for those targets through a specified approval flow which must be achieved from the same UI interface as the IDAM solution with real time activity monitoring	
16.	The solution should provide out-of-the-box connectors for automatically pushing changes to enterprise IT systems.	



Sl. No.	Minimum Required Specifications	Bidder's Compliance
17.	The solution should have the integration with SIEM solutions.	
18.	The solution should enforce password strength requirements.	
19.	Solution shall also meet scope mentioned in various other sections of technical specification.	
20.	a. The solution should support the following constraints:	
	b. Minimum/maximum length	
	c. Minimum letters/numbers/special characters	
	d. Password history constraints	
	e. Exclusion dictionary	
	f. Allowable characters	
	g. Number of character types	
	h. Triviality checks (old password)	
	i. ID in password check	

## 5. Network Access Control (NAC)

Sl. No.	Minimum Required Specifications	Bidder's Compliance
<b>General Specifications</b>		
1.	The NAC solution should be of Enterprise class capable of providing necessary automation for policy implementation and monitoring of “AAA” authentication services and similar advanced security capabilities.	
2.	The NAC should immediately detect un-authorized attempt to access network resources and quarantine the device / user till suitable compliance is accorded. The system should be capable of generating necessary reports and statistical analysis of incidences, near miss.	
3.	Any hardware/software/licenses required to enable the desired NAC functionality, shall be provided.	
4.	Solution can be hardware or software based On-Premise.	
5.	Should have all the licenses for minimum 100 concurrent endpoints for AAA, Guest access and TACACS+ from day one. Scalability upto 500 concurrent endpoints must be supported for future use.	

Sl. No.	Minimum Required Specifications	Bidder's Compliance
6.	The NAC solution must offer Network Visibility, Device Profiling, Easy and powerful Onboarding process, Endpoint Compliance, Network Provisioning and Threat Identification module provide security actions through integration.	
7.	NAC solution must be integrated with proposed network and security equipment and application.	
8.	The proposed solution must be capable of working with endpoint agents and agentless.	
9.	Must authorize access via VLAN assignment and/or applying access control lists (ACLs).	
10.	The NAC solution must integrate with infrastructure devices by using SNMP and RADIUS.	
11.	The NAC Solution should not be dependent on 802.1x & RADIUS integration.	
<b>Endpoint profiling Requirements</b>		
12.	Provide automatic detection and categorization of endpoints for security and audit demands, regardless of device type, using contextual data and use this data for optimizing access policies.	
13.	Stored profiling data should identify device profile changes and dynamically modify authorization privileges. For example, if a printer appears as a Windows laptop, the system can automatically deny access.	
14.	Must support profiling for clientless devices based on a DHCP fingerprint, NMAP scan, Vendor OUI, location, open ports and the existence of the persistent agent.	
15.	Profiling via SNMP, NMAP, WMI/Active Directory TCP & UDP characteristic must be supported.	
16.	Must provide the ability to create custom profiling rules.	
17.	Internal device fingerprint dictionaries that provide a way to automatically or manually update periodically. Capable to define custom fingerprints for wired and wireless devices.	
<b>Authentication, Authorization and Accounting (AAA)</b>		
18.	Integrated scalable AAA services (authentication, authorization, and accounting) including access policy management with a complete understanding of context, such as user's role, device type, location, time of day etc.	
19.	Must support RADIUS MAC-address whitelisting & blacklisting natively	

Sl. No.	Minimum Required Specifications	Bidder's Compliance
20.	Must support flexible authentication options to include, 802.1X, non-802.1X, Web Authentication and MAC Authentication.	
21.	Must support integration with LDAP, Microsoft Active Directory etc.	
22.	Should support seamless integration with Active directory in the Infrastructure without the need for any additional components.	
23.	It should support both user and machine authentication without any additional configurations.	
24.	Should be able to append additional attributes to incorporate the authenticator's location, device type, vendor etc. apart from the user attributes.	
25.	The solution must provide the ability to authenticate an endpoint using an agent or an agentless scanning capability	
26.	The solution should allow only authenticated/managed devices to connect to OT networks and enforces security policies by blocking, isolating, and repairing noncompliant machines in a quarantine area without needing administrator attention.	
<b>Endpoint Compliance and Remediation Requirements</b>		
27.	The solution must support both agent-based (Persistent Agent, Dissolvable Agent) and agentless endpoint inspection.	
28.	The NAC solution must perform system checks on service packs, patches, critical updates enabled, Antivirus & Anti-Spyware, static IP, services/processes running, invalid services/processes, file existence, any Microsoft registry settings.	
29.	The solution must provide a quarantine role that ties into the integrated patch management systems. Within this quarantine role the solution shall provide a "self-remediation" web captive portal. Non-compliant devices must be quarantined dynamically and provided with instructions for self-remediation or can be interfaced with auto-remediation systems such as Bugfix and Patch Link.	
<b>Management and Reporting requirements</b>		
30.	Customizable dashboard as per the user requirement along-with built-in monitoring, reporting, and troubleshooting console to assist helpdesk operators and administrators streamline operations.	
31.	It should have a policy creation template with pre-defined templates and wizard for creating policies for easy Enterprise-wide policy deployment.	
32.	Must support the option of having dedicated reporting and monitoring system.	

Sl. No.	Minimum Required Specifications	Bidder's Compliance
33.	Must include integrated monitoring, reporting, and troubleshooting engine accessible through a web-based GUI.	
34.	Customizable Reporting with manual or scheduled reports in PDF/CSV/HTML formats, inventory dashboard showing details of learned devices, real-time monitoring of access requests and events, proactive alerts through Email/SMS.	
35.	HTTP/RESTful API's, syslog messaging and Extensions capability to exchange endpoint attributes with firewalls, SIEM, endpoint compliance suites and other solutions for enhanced policy management.	
<b>Post Connect Assessment (Automated Response)</b>		
36.	The proposed solution MUST provide ongoing integrity through an Automated Response Technology via the integration with other Inline /out-of-band Security solutions.	
37.	Automated Response integration should allow the organization to quickly identify critical security events with precision and reduce threat containment.	
38.	The solution should provide automated response to Contain Threats via multiple control methods.	

## 6. Network Management System (NMS)

Sl. No.	Minimum Required Specifications	Bidder's Compliance
1.	The Network Management function must monitor performance across heterogeneous networks from one end of the enterprise to the other. The proposed NMS solution must be an industry standard, enterprise grade solution.	
2.	Proposed solution shall cover licenses for 100 nodes (which includes devices supplied under the project). Bidder need to assess the requirement in consultation with Owner.	
3.	The solution should allow for discovery to be run on a continuous basis which tracks dynamic changes near real-time; in order to keep the topology always up to date. This discovery should run at a low overhead, incrementally discovering devices and interfaces.	
4.	The proposed Network Fault Management console must also provide network asset inventory reports.	
5.	The tool should automatically discover different type of heterogeneous devices (all SNMP supported devices i. e. Router,	

Sl. No.	Minimum Required Specifications	Bidder's Compliance
	Switches, LAN Extender, Servers, Terminal Servers, Thin-Customer UPS and DG set etc.) and map the connectivity between them with granular visibility up to individual ports level. The tool shall be able to assign different icons/ symbols to different type of discovered elements. It should show live interface connections between discovered network devices.	
6.	It should support various discovery protocols to perform automatic discovery of all L2, L3 Network devices across Network.	
7.	The tool shall be able to discover IPv4, IPv6 as well as devices in dual stack.	
8.	The tool shall be able to work on SNMP V-1, V-2c & V-3 based on the SNMP version supported by the device. It shall provide an option to discover and manage the devices/elements based on SNMP as well as ICMP.	
<b>Network Traffic Flow Analysis System</b>		
9.	It shall be able to capture, track & analyze traffic flowing over the network via different industry standard traffic capturing methodologies viz. Ping, SNMP, WMI, SSH, Http, Packet Sniffing, PowerShell, NetFlow/jflow/sFlow, IPFIX etc.	
10.	It shall provide key performance monitoring capabilities by giving detailed insight into the application traffic flowing over the network.	
11.	It shall be able to monitor network traffic utilization, packet size distribution, protocol distribution, application distribution, top talkers etc. for network traffic.	
12.	It shall collect the real-time network flow data from devices across the network and provide reports on traffic based on standard TCP/IP packet metrics such as Flow Rate, Utilization, Byte Count, Flow Count, TOS fields etc.	
13.	The solution should be user configurable for building additional reports.	
14.	Solution should be able to collect Key performance measurements and statistics from all network domains and store it. This data is to be used for evaluation of performance of the end-to-end network infrastructure/services.	
15.	Historical Data for at-least one year shall be available and accessible through different UI. Export of historical data for selected duration shall be exported in csv/excel.	
16.	The performance management system shall be able to collect and report data like:	

Sl. No.	Minimum Required Specifications	Bidder's Compliance
a.	Packet delay and packet loss	
b.	User bandwidth/Traffic usage rate	
c.	Network availability/Uptime rate	
d.	CPU usage rate	
e.	Input/output traffic through physical ports	
f.	Input/output traffic through logical ports	
g.	Speed/Performance	
h.	Disk Usage Rate	
i.	Memory Usage Rate	
j.	Temperature monitoring	
17.	<b>The Performance Management shall have user defined set of reports like:</b>	
a.	Summary Reports for specific groups: Reports displaying per group of resources the group aggregations for a set of metrics (for example, per City, the maximum traffic or the total traffic).	
b.	Summary Reports for specific Resources: Reports displaying for a set of resources the period aggregations for the same set of metrics (for example, per interface, the maximum traffic over the day)	
c.	Detailed chart Reports: Reports displaying for one resource and the same set of metrics the values over the period (for example, the raw collected values for the day).	
d.	Resource Threshold Violation Reports: Reports displaying the resources for which a threshold was violated	
18.	<b>Administration:</b>	
a.	The solution must have secure Web Browser based Administration UI.	
b.	The solution must support role-based access by operational staff (i.e. role-based user policies).	
c.	Alerts and Audit logs for key functions.	
d.	The solution must support Email and SMS notification for Alerts, incident, events, status change etc.	
19.	Solution shall also meet scope mentioned in various other sections of technical specification.	



## 7. Virtualization Software and Manageability

Sl. No.	Minimum Required Specifications	Bidder's Compliance
1.	Solution should have a commercially available bare metal hypervisor with no dependency on General purpose OS and that should have all Virtualization benefits like High Availability and automated live migration of Virtual Machines from one physical server to another in case of any failure.	
2.	The solution should provide Zero downtime, zero data loss and continuous availability for the applications running in VM's in case of physical host failure without the need for clustering software.	
3.	Migration of VMs in case one server fails all the Virtual machines running on that server shall be able to migrate to another physical server running same virtualization software.	
4.	Hypervisor shall provide the ability to hot add vCPU and memory to live Guest VMs without any reboot or shutdown of Guest VM. Shall also allow to add hot-plug disks and NICs (provided the same is supported by guest OS).	
5.	Virtualization software shall allow heterogeneous support for guest Operating systems like Windows 2016 and 2019 Standard/Data Center, Latest SUSE Enterprise Linux, Latest RHEL as Guest OS. Certification from OEM for guest OS mentioned above are required to verify that the guest OS is supported hypervisor.	
6.	Ability to move and copy virtual machines as easily as moving and copying files. Ability to provision or migrate any virtual machine from one physical server to another physical server (over LAN as well as WAN) with zero downtime, continuous service availability and complete transaction integrity.	
7.	The solution should Track and provide report, facilitate viewing of trends for various metrics like CPU, memory, IOPs, latency etc. for user selected period and also in real-time.	
8.	<b>Centralized Management Application</b>	
	A centralized application with following minimum functionality shall be provided to monitor and manage the supplied Virtualization solution through single application: a. Real-time monitoring of hardware's including VMs and alert generation. b. Solution shall provide a HTML/Web based centralized dashboard for Virtualization Solution.	



Sl. No.	Minimum Required Specifications	Bidder's Compliance
	c. Solution must provide Log Management Solution integrated with Centralized Management application. d. Log Management should store logs for more than 6 months and shall be accessible via GUI.	

## 8. Document Management System (DMS)

Sl. No.	Minimum Required Specifications	Bidder's Compliance
1.	Solution should provide offline document management system.	
2.	Capable of integrating with LDAP, Microsoft Active Directory for authentication.	
3.	Proposed solution should provide context sensitive 'Help' Operation.	
4.	System should have capability of sending alerts in case storage repository reaches limit.	
5.	Any metadata field (content, author, source, keywords, etc.)	
6.	Solution should support bulk import & export of data as XML and CSV format.	
7.	<b>Search features</b>	
	a. Provide search based on actual content of the document.	
	b. Complex and multiple criteria based Boolean search	
	c. Nested searches	
	d. Provide ability to store frequently used searches as Save Searches	
	e. Should provide a detailed and searchable system audit trail/logs	
8.	Solution should support associating metadata both to records and folders.	
9.	Metadata should support data types like String, Integer, Float, date etc.	
10.	Where a hierarchical classification scheme is in use, the solution shall allow the addition of folders to either the lowest level or at the highest level.	

<b>Sl. No.</b>	<b>Minimum Required Specifications</b>	<b>Bidder's Compliance</b>
11.	Should provide ability to define retention schedules and holds	
12.	System should manage entire lifecycle of the content right from capture till disposal.	
13.	Support a 'drag and drop' method of manipulating folders and records, where this is appropriate for the platform supported.	
14.	Support a 'copy and paste' method of manipulating folders and records, where this is appropriate for the platform supported.	
15.	System should provide a generic image viewer supporting common file formats like PDF, Word, Excel.	
16.	System should have ability of defining naming patterns for folders as well as record.	
17.	System should have ability of defining classifications, records as favorites.	
18.	System should have an option of importing content from desktops, network drives etc.	
19.	Should have the ability to automatically remove temporary role assignments after a predefined period.	
20.	Capability of recording and reporting the transfer of documents/records/files to specific secondary storage outlets.	
21.	Capable of storing standard reports requests and formats, which can be run specifying varying parameters, but without additional design alteration, including parameters for:	
	• specific dates and date ranges	
	• specific users or groups of users	
22.	System should provide the capability for the end-user to run standard, pre-formatted reports based on both operator and system entered data.	
23.	Allow reports to be generated for screen display, for printing, and for both display and printing.	
24.	Should provide report designing tool for designing own reports.	
25.	Solution shall also meet scope mentioned in various other sections of technical specification.	

**Vol. II, Part-B**  
**APPENDIX-I**  
**Tentative Data Structure for**  
**Historian system**

## APPENDIX I

### Tentative Data Structure for Historian system

#### For SCADA/EMS Applications

#### A.1 Minimum Information to be associated with an analog with Time Stamp:

- Device Database Name
- Device Actual Name
- Instantaneous Value
- Maximum Value
- Time of Maximum Value
- Minimum Value
- Time of Minimum Value
- Average Value
- Rate of change of Analog
- Quality Flags as per SCADA
- etc.

#### A.2 Minimum Information to be associated with an analog for Time block (for each 15 min)

- Device Database Name
- Device Actual Name
- Active energy
- Reactive Energy
- Reactive Energy as per SEM philosophy
- etc.

**Note:** 1. The sampling rate for the instantaneous value is per 10 sec. (user configurable).  
2. The other end values with proper sign correction should be transferred to Historian.

#### B. Minimum Information to be associated with a Digital status with Time Stamp:

- Device Database Name
- Device Actual Name
- Status (open/close/between/invalid)
- Quality Flags as per SCADA etc.

**Note:** Only topological status change device should be transferred to Historian on exception.

C. Minimum information to be associated with Sequence of events (SoE) –

- Time Stamp (in milli-seconds)
- Device Database Name
- Device Actual Name
- Status
- Clock Synchronization status
- Associated Quality flags
- etc.

D. Minimum information to be associated with Alarm/ System Activity Log –

- Time Stamp
- Device Database Name
- Device Actual Name
- Status
- Violation Type
- Application (SCADA/ Configuration/ ICCP/ State Estimator/ Contingency Analysis/ OPF/ etc.)
- etc.

**Sizing:**

1. The sizing requirement for SCADA and Historian points will be same as per the **Appendix F: System Sizing**.
2. Mass storage of files for 5 save cases of each EMS applications, 10 Output results of each.
3. For State Estimation, storage of save cases for 13 Months

**Vol. II, Part-B**  
**Appendix – J**  
**EXTRACTS OF IEC 62351-5**

## EXTRACT OF IEC 62351-5 Clause 11

### 11 Protocol implementation conformance statement

#### 11.1 Overview of clause

Implementors of this specification shall supply the information in this section on request. An "X" in a box means that the implementation supports the listed feature.

#### 11.2 Required algorithms

If the implementor does not declare support for an algorithm marked "(required)", interoperability cannot be guaranteed.

If an algorithm is not supported due to export restrictions, the implementor shall provide a copy of the export restriction that prohibits its export. This algorithm shall not be supported if and only if export restrictions do not allow any mechanism of exportation. If this algorithm is not supported, the implementation shall be clearly documented as adhering to the export restrictions, as supplied. The documentation shall also specify that the interoperable/base specification requirements are not supported. Samples of the documentation shall be provided.

#### 11.3 HMAC algorithms

- HMAC-SHA1 (required)
- Other \_\_\_\_\_

#### 11.4 Key wrap algorithms

- AES-128 key wrap (required)
- Other \_\_\_\_\_

#### 11.5 Maximum error count

- Fixed at 2
- Configurable

#### 11.6 Use of error messages

- Transmits error messages



**EXTRACT OF IEC 62351-4 Clause 7**

**7 Conformance**

**7.1 General conformance**

Conformance to this part shall be determined by the implementation of Clauses 5 and 6.

Additionally, the following table of supported cipher suites shall be provided:

- m (mandatory): shall be supported;
- (optional): may be supported.

**Table 3 – Supported cipher suites**

Key Exchange		Encryption	Hash	Support		
Algorithm	Signature			Interoperable	Export restriction	Supported
TLS_RSA_		WITH_RC4_128_	SHA	o	C1	
TLS_RSA_		WITH_3DES_EDE_CBC_	SHA	o	C1	
TLS_DH_	DSS_	WITH_3DES_EDE_CBC_	SHA	o	C1	
TLS_DH_	RSA_	WITH_3DES_EDE_CBC_	SHA	o	C1	
TLS_DHE_	DSS_	WITH_3DES_EDE_CBC_	SHA	o	C1	
TLS_DHE_	RSA_	WITH_3DES_EDE_CBC_	SHA	o	C1	
TLS_DH_	DSS_	WITH_AES_128_	SHA	o	C1	
TLS_DH_	DSS_	WITH_AES_256_	SHA	o	C1	
TLS_DH_		WITH_AES_128_	SHA	o	C1	
TLS_DH_		WITH_AES_256_	SHA	m	C1,C2	

C1 – at least one of the cipher suites shall be supported based upon export restrictions. TLS interoperability may not be possible if TLS\_DH\_WITH\_AES\_256\_SHA is not supported.

C2 – if support is not declared, the implementation shall provide a copy of the export restriction that prohibits the export of the cipher suite. This suite shall not be supported if and only if export restrictions do not allow any mechanism of exportation. If this suite is not supported, the implementation shall be clearly documented as adhering to the export restrictions, as supplied. The documentation shall also specify that the interoperable/base specification requirements are not supported. Samples of this documentation shall be provided as part of user documentation so that users can understand that the implementation may not be interoperable due to export restrictions.

**7.2 Conformance of IEC 60870-6 TASE.2 security**

IEC 60870-6 implementations, claiming to support standardized security, shall conform to this specification.

**Vol-II, Part B**  
**APPENDIX-K**  
**Philosophy for Development of**  
**SCADA System displays**

## List of Acronyms

AC	Alternating Current
CBIP	Central Board of Irrigation and Power
CEA	Central Electricity Authority
CTU	Central Transmission Utility
DC	Direct Current
DISCOM	Distribution Company
EHVAC	Extra High Voltage Alternating Current
EMS	Energy Management System
FSC	Fixed Series Compensator
GSM	Grams Per Square Metre
HVDC	High Voltage Direct Current
Hz	Hertz
ICT	Inter Connecting Transformer
IEC	International Electrotechnical Commission
kV	Kilo-Volt
MVA	Mega Volt Ampere
MVAR	Mega Volt Ampere Reactive
MW	Mega Watt
NLDC	National Load Despatch Centre
PST	Phase Shifter Transformer
RLDC	Regional Load Despatch Centre
SCADA	Supervisory Control and Data Acquisition
SLD	Single Line Diagram
SLDC	State Load Despatch Centre
STATCOM	Static Compensators
SVC	Static VAR Compensator
TCSC	Thyristor Controlled Static Compensator
UG	Under Ground
ULDC	Unified Load Despatch and Communication

## SCOPE

This document describes the display conventions to be used for development and maintenance of displays in SCADA system for State/Regional and National level power system in India.

## REFERENCES

The standards listed in listed below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed in listed below. In case the standards are to be referred in this clause they are to be listed as follows:

Serial no	IS no	Title
1.	Survey of India and IEC 60617-SN 01/05/2009.	The symbols are to be used for the power maps
2.	IS 11954:1987	Guide for colour coding of electrical mimic diagrams

## TERMINOLOGY

**3.1** For the purpose of this standard the following definitions shall apply.

**3.2 Display** - An electronic device for the visual presentation of data or images.

**3.3 DWG Format** - DWG (“drawing”) is a binary file format used for storing 2D and 3D design/drafting data. It is the native format for several CAD packages including AutoCAD, Intelli CAD, Caddie and by many other CAD applications.

**3.4 Aspect Ratio** - The ratio of the width to the height of an image or screen.

**3.5 Substation** - A substation is a part of an electrical generation, transmission, and distribution system. Substations transform voltage from high to low, or the reverse, or perform any of several other important functions.

**3.6 Geographical Coordinate** - A geographic coordinate system is a coordinate system that enables every location on Earth to be specified by a set of numbers, letters or symbols.

**3.7 Single Line Diagram** - In power engineering, a one-line diagram or single-line diagram is a simplified notation for representing a three-phase power system. The one line diagram has its largest application in power flow studies.

**3.8 Node** – A node is any point on a circuit where the terminals of two or more circuit elements meet. In circuit diagrams, connections are ideal wires with zero resistance, so a node may consist of the entire section of wire between elements, not just a single point.

**3.9 DXF Format** - DXF is a file extension for a graphic image format typically used with AutoCAD (Computer Assisted Drafting) software. DXF stands for Drawing exchange Format.

## 1.0 BACKGROUND

A good visualization of SCADA displays in the form of geographical power maps, map board displays, single line diagrams of substations, etc. is an essential requirement to improve situational awareness for any grid operator. The philosophy used in representation of the power system elements on SCADA displays was adopted on the basis of the requirements, preferences and instructions given to the person involved in making and updating these displays. Furthermore, locations of generating stations and sub-stations on the map were not based on its actual geographical position as per the corresponding Latitudes and Longitudes.

As existing SCADA projects are being upgraded and displays are also to be recreated simultaneously, the standardization of SCADA display conventions across all RLDCs and SLDCs is required. This document describes the display conventions to be used for development and maintenance of displays in SCADA system for State/Regional and National level power system in India. The below guidelines should be used as a reference to develop SCADA system Display and in this regard, latest published BIS standard LITD-10 along with owner/employer requirement should be considered by the contractor.

## STANDARDS FOR SCADA DISPLAY

### 2.0 FORMAT AND SCALE

The power maps are used for reference in online system (SCADA/EMS) as well as for offline analysis. Therefore, power maps and displays in SCADA system should be based

on the geographical representation of State/Regional/National power system of India. SCADA system power maps should be developed by importing a base map (file with “.dwg” or “.dxf” extension) developed and based on the geographical locations of substations and generating stations. SCADA systems should have the capability of importing such files with DWG or DXF file format into their display building software.

The SCADA displays are generally not-to-scale but efforts should be made to make it as close as possible to the actual relative positions and distancing between stations.

### **3.0 TEXT LANGUAGE, FONT AND LAYOUT**

Power maps to be used for reference in Online System (SCADA/EMS), should have text displayed in Hindi as well as English assigned to separate layers. The text size and font should be such that they are visible with clarity when maps are displayed on screen. The text for 400kV level and above stations should be written in Upper Case while that of 220kV and below should be written in Lower Case with only the first alphabet in Upper Case. Different font size for different voltage levels could be adopted without affecting the clarity and readability of the text. The general layout of the map should be such that its height to width ratio is suitable to display on wide screen i.e. aspect ratio of display should be 16:9; which shall be modified by the utilities in case the display-monitor technology changes and some other aspect-ratio is adopted by the electronics hardware industry.

### **4.0 LEGENDS**

The legends can be grouped in following four categories viz. Borders; Nodes; Interconnections; Other elements. The symbols are to be used for the power maps as recommended by Survey of India and IEC 60617-SN 01/05/2009. The graphical symbols for diagrams and color to be used are listed in sub-sections below.





#### **4.1 LEGEND CATEGORY-A: BORDER (4 Types)**

The pattern of the boundary can be assigned as follows:

- a) Round-Dot for Distribution Companies Boundary
- b) Dash-Dot for State Boundary
- c) Dash for Regional Boundary
- d) Solid for International Boundary

The colour of the boundary could be black or some other colour based upon the proper

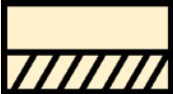
visibility on different background for SCADA and printed maps. For e.g.- In SCADA displays with black background, the boundary colour could be White as shown below.

Description	Illustration
DISCOM Boundary	 <p style="text-align: right;">(Round-Dot)</p>
State Boundary	 <p style="text-align: right;">(Dash-Dot Pattern)</p>
International Boundary	 <p style="text-align: right;">(Dash Pattern)</p>
Regional Boundary	 <p style="text-align: right;">(Solid Pattern)</p>

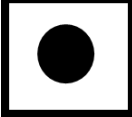
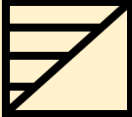

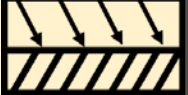


**Table 1: Boundary patterns**





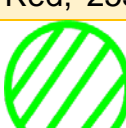


In cases where the State, Regional and International Boundaries overlap; then the precedence order of the boundaries to be displayed on top can be decided by the utilities based on its requirements.







**4.2 LEGEND CATEGORY-B: NODE (20 Types)**

Description	Illustration
Thermal Generating Station (Coal/ Gas/ Lignite)	 <p>(preferably to be shown in <i>White</i> colour with <i>Black</i> background)</p>





Nuclear Generating station	 <p>(preferably to be shown in <i>White</i> colour with <i>Black</i> background)</p>
Hydro Generating Station	 <p>(preferably to be shown in <i>White</i> colour with <i>Black</i> background)</p>
Wind Generating Station/Farm	 <p>(preferably to be shown in <i>White</i> colour with <i>Black</i> background)</p>
Solar Generating Station	 <p>(preferably to be shown in <i>White</i> colour with <i>Black</i> background)</p>
Other Renewable Power Plants (excl. Wind and Solar)	 <p>(preferably to be shown in <i>White</i> colour with <i>Black</i> background)</p>
11kV Substation	 <p>Brown (hex #A52A2A; 165 Red, 42 Green and 42 Blue)</p>

33kV Substation	 Pink (hex #FFC0CB; 255 Red, 192 Green and 203 Blue)
66kV Substation	 Golden Brown (hex #996515; 153 Red, 101 Green and 21 Blue)
132kV Substation	 Cyan (hex #00FFFF; 0 Red, 255 Green and 255 Blue)
220kV Substation	 Lime Green (hex #00FF00; 0 Red, 255 Green and 0 Blue)
400kV Substation ( <i>charged at 220kV level</i> )	 Lime Green (hex #00FF00; 0 Red, 255 Green and 0 Blue)
400kV Substation	 Red (hex #FF0000; 255 Red, 0 Green and 0 Blue)
765kV Substation ( <i>charged at 400kV level</i> )	 Red (hex #FF0000; 255 Red, 0 Green and 0 Blue)

765kV Substation	 Yellow (hex #FFFF00; 255 Red, 255 Green and 0 Blue)
1200kV Substation	 Light Cold Blue (hex #00B0F0; 0 Red, 176Green and 240 Blue)
HVDC Bipole Terminal Station (± 500kV)	 Magenta (hex #8B008B; 139 Red, 0 Green and 139 Blue)
HVDC Back-to-Back Terminal Station (± 500kV)	 Magenta (hex #8B008B; 139 Red, 0 Green and 139 Blue)
Multi-Terminal HVDC Station (± 500kV)	 Magenta (hex #8B008B; 139 Red, 0 Green and 139 Blue)
HVDC Bipole Terminal Station (± 800kV)	

Description	Illustration
	Purple (hex #800080; 128 Red, 0 Green and 128 Blue)

HVDC Back-to-Back Terminal Station ( $\pm 800\text{kV}$ )	 <p>Purple (hex #800080; 128 Red, 0 Green and 128 Blue)</p>
Multi-Terminal HVDC Station ( $\pm 800\text{kV}$ )	 <p>Purple (hex #800080; 128 Red, 0 Green and 128 Blue)</p>

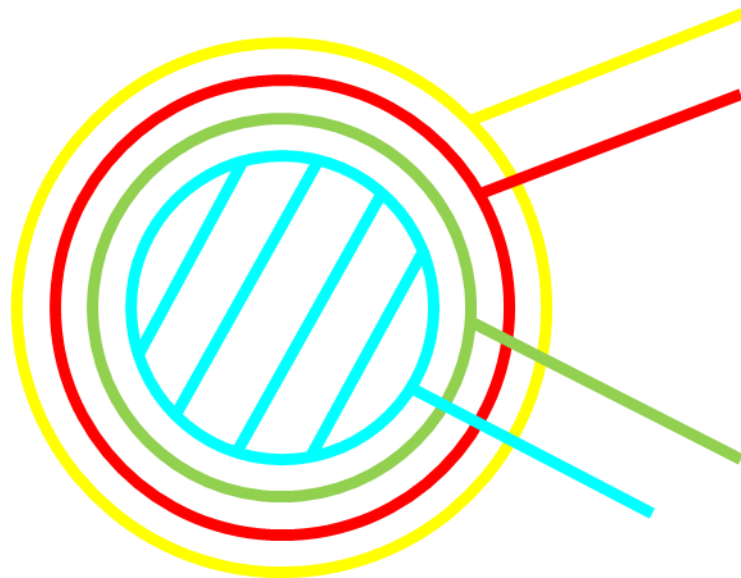
**Table 2: Symbols for Nodes**

Transmission substation having multiple voltage levels should be represented by concentric circles of the color representing appropriate voltage level. The higher voltage level should be represented by a circle of larger radius.

The size and placement of the legend of generating station should be such that it fits in within the circle representing the voltage level of the transmission substation at which the generation is being evacuated.

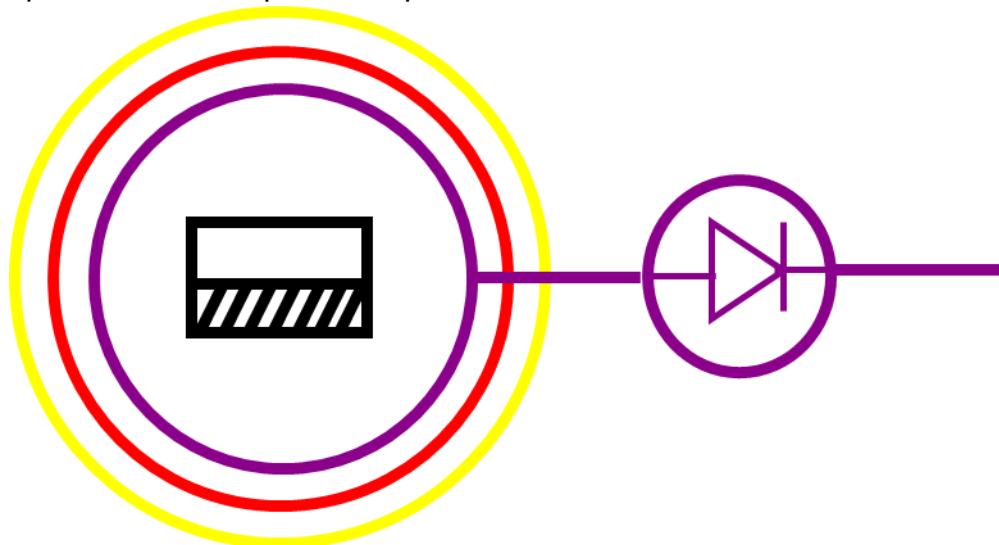
The above representations are shown in *example 1* and *example 2* below.

**Example 1:** Suppose there is a 765/400/220/132 kV substation having interconnections at all the four voltage levels. The above substation along with its associated feeders should be represented in the power map as under:



**Figure 1: Substation representation with multiple voltage levels**






**Example 2:** Suppose there is a thermal (coal) generating station switched at 400 kV and this station also has a 765 kV level. Further assume that there is a +/- 500 kV HVDC connected at 400 kV. The above substation along with generating station and HVDC lines should be represented in the power map as under:


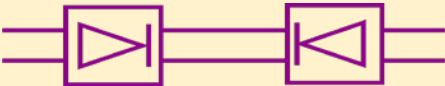

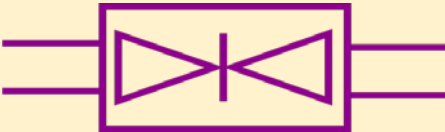


**Figure 2: Generating station representation with HVDC link**

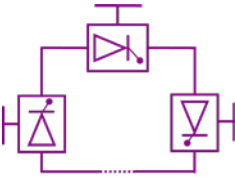

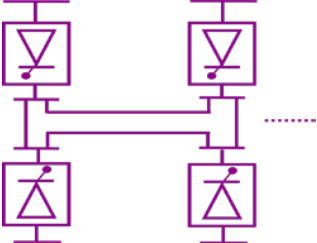
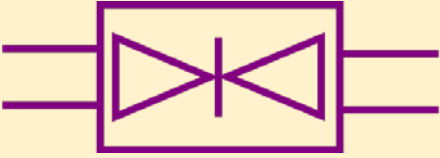
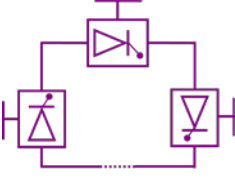
The placement of nodes should be accurate with regards to its geospatial coordinates. Exceptions may be taken only in case of certain nodes with coordinates too close to be represented with adequate clarity.

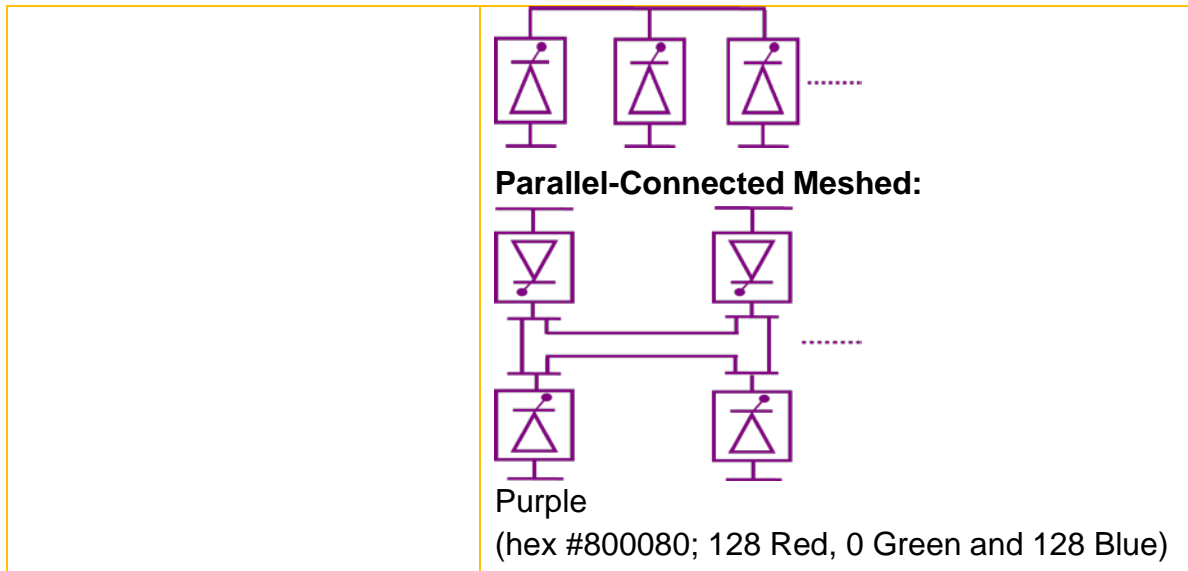
#### 4.3 LEGEND CATEGORY-C: INTERCONNECTIONS (14 Types)

Description	Illustration
Line at 11kV voltage Level	 Brown (hex #A52A2A; 165 Red, 42 Green and 42Blue)
Line at 33kV Voltage Level	 Pink (hex #FFC0CB; 255 Red, 192 Green and 203Blue)
Line at 66kV Voltage Level	 Golden Brown (hex #996515; 153 Red, 101 Green and 21 Blue)
Line at 132kV Voltage Level	 Cyan (hex #00FFFF; 0 Red, 255 Green and 255 Blue)
Line at 220kV Voltage Level	 Lime Green (hex #00FF00; 0 Red, 255 Green and 0Blue)
Line at 400kV Voltage Level	 Red (hex #FF0000; 255 Red, 0 Green and 0 Blue)
Line at 765kV Voltage Level	 Yellow (hex #FFFF00; 255 Red, 255 Green and 0Blue)
Line at 1200kV Voltage Level	 Light Cold Blue (hex #00B0F0; 0 Red, 176 Green and 240 Blue)
Line at HVDC (± 500kV)	 Magenta (hex #8B008B; 139 Red, 0 Green

	and 139Blue)
Line at HVDC ( $\pm 800$ kV)	 Purple (hex #800080; 128 Red, 0 Green and 128Blue)
$\pm 500$ kV HVDC Bi-pole	 Magenta (hex #8B008B; 139 Red, 0 Green and 139Blue)
$\pm 800$ kV HVDC Bi-pole	 Purple (hex #800080; 128 Red, 0 Green and 128 Blue)
$\pm 500$ kV HVDC Back-to-Back	 Magenta (hex #8B008B; 139 Red, 0 Green and 139Blue)







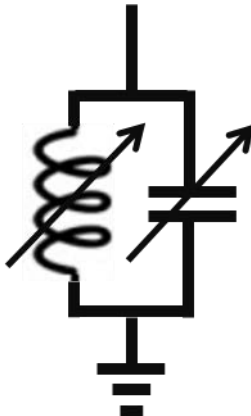
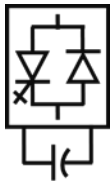
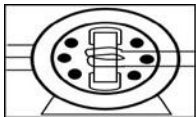
<p>± 500kV HVDC Multi-Terminal</p>	<p><b>Series-Connected:</b></p>  <p><b>Parallel-Connected Radial:</b></p>  <p><b>Parallel-Connected Meshed:</b></p>  <p>Magenta (hex #8B008B; 139 Red, 0 Green and 139Blue)</p>
<p>± 800kV HVDC Back-to-Back</p>	 <p>Purple (hex #800080; 128 Red, 0 Green and 128Blue)</p>
<p>± 800kV HVDC Multi-Terminal</p>	<p><b>Series-Connected:</b></p>  <p><b>Parallel-Connected Radial:</b></p>
<p><b>Description</b></p>	<p><b>Illustration</b></p>


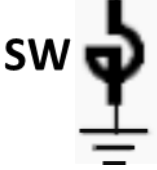


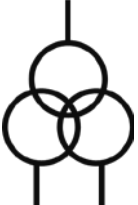





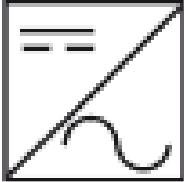
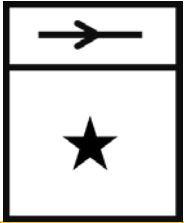



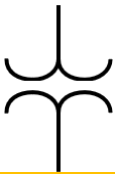

**Table 3: Representation for Interconnections**



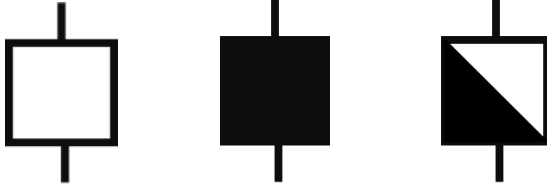
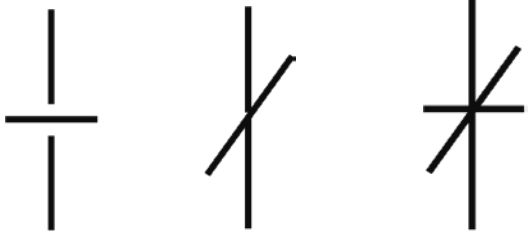
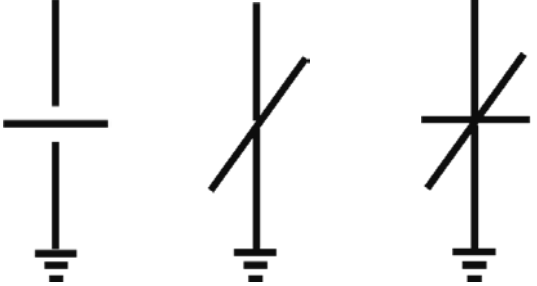
The interconnections should be represented by lines connecting two nodes. All the available interconnections (no. of circuits and voltage level) between two nodes should be represented distinctly. The thickness of the transmission line should preferably be in increasing order of its voltage level. The transmission lines should be drawn as per its geospatial coordinates, if possible. However, in the absence of the geospatial coordinates of the transmission line route the representation on the map may be indicative only.

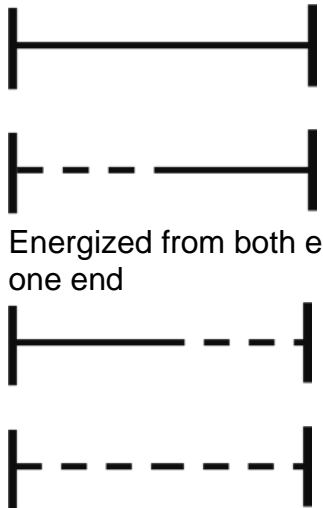
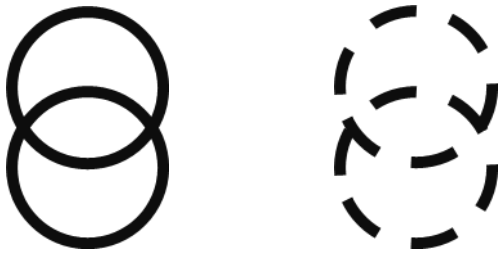

**LEGEND CATEGORY-D: OTHER POWER SYSTEM ELEMENTS (28 Types)**

Description	Symbols for Power Maps
Generator	
Fixed Series Capacitor (FSC)	
Thyristor Controlled Series Reactor (TCSC)	
Shunt Capacitor Bank	
Shunt VAR Compensator(SVC)	
STATCOM (Voltage Source)	
Synchronous Condensator	

Series Reactor	
Switchable Shunt Reactor (Bus Reactor as well as Line Reactor)	
Non-Switchable Reactor (Bus Reactor as well as Line Reactor)	
Inter Connecting Transformer (ICT)	
Three Winding Transformer	
Phase Shifter Transformer	
Wind Farm Turbine	

Wind Farm Inverter	
Solar Farm Inverter	
Interface Meters	
Battery Energy Storage Systems	
Lightning Arrestor	
Current Transformer	
Potential Transformer/ Capacitor Voltage Transformer	
Motor	

Load	
Fuse	
Circuit Breaker (Open, Closed and Invalid position)	
	<p style="text-align: center;"><i>OPEN</i>      <i>CLOSE</i>      <i>INVALID</i></p>
Isolator (Open, Closed and Invalid position)	
	<p style="text-align: center;"><i>OPEN</i>      <i>CLOSE</i>      <i>INVALID</i></p>
Earth Switch	
	<p style="text-align: center;"><i>OPEN</i>      <i>CLOSE</i>      <i>INVALID</i></p>

<p>Energized/De-energized Elements</p>	<p><b>Transmission Line:</b></p>  <p>Energized from both ends    De-energized from one end</p> <p>De-energized from other end    De-energized from both ends</p>
	<p><b>Transformer:</b></p>  <p>Energized    De-energized</p> <p><b>Generator:</b></p>  <p>In Service    Out of Service</p> <p><b>Note:</b> Similar energization/ de-energization effects can be assigned to other elements also as per requirements of the utilities.</p>

**Table 4: Symbols for other power system elements**

The color of the above equipment would be same as the voltage level at which they are energized/installed. For instance, an interface meter on a 400kV line should be red in colour.



## 5.0 REPRESENTATION OF FUTURE ELEMENTS

The SCADA displays should have power system elements currently in service as well as the power system elements expected in future. These future elements can be represented with a similar legend but distinguishable in the form of *Square-Dot* pattern. For instance, the existing elements could be drawn with line style as “*solid*” while the future elements could be drawn with line style as “*Square-Dotted*”.

## 6.0 COLOUR CODE

Indian Standard: 11954, 1987 (reaffirmed 2004) recommends the colour coding of electrical mimic diagrams. In choosing the shades vis-à-vis the voltage level it is recommended to choose colours closer to ‘Red’ for higher voltages and those closer to ‘Violet’ for lower voltages. In line with the above standards with certain deviations at some voltage levels the following coding scheme should be adopted.

Voltage Level	Colour Coding
800kV HVDC	<b>Purple</b> (hex #800080; 128 Red, 0 Green and 128 Blue)
500kV HVDC	<b>Magenta</b> hex #8B008B; 139 Red, 0 Green and 139 Blue)
1200kV AC	<b>Light Cold Blue</b> (hex #00B0F0; 0 Red, 176 Green and 240 Blue)
765kV AC	<b>Yellow</b> (hex #FFFF00; 255 Red, 255 Green and 0 Blue)
400kV AC	<b>Red</b> (hex #FF0000; 255 Red, 0 Green and 0 Blue)
220kV AC (incl. 230kV)	<b>Lime Green</b> (hex #00FF00; 0 Red, 255 Green and 0 Blue)
132kV AC (incl. 110kV)	<b>Cyan</b> (hex #00FFFF; 0 Red, 255 Green and 255 Blue)

66kV AC	<b>Golden Brown</b> (hex #996515; 153 Red, 101 Green and 21 Blue)
<b>Voltage Level</b>	<b>Colour Coding</b>
33kV AC	<b>Pink</b> (hex #FFC0CB; 255 Red, 192 Green and 203 Blue)
11kV AC	<b>Brown</b> (hex #A52A2A; 165 Red, 42 Green and 42 Blue)

**Table 5: Colour coding for different voltage levels**

Additional voltages not covered in the table, wherever necessary shall be indicated by a colour so chosen making it distinguishable from the other colours appearing in the diagram. The background colour of the display shall preferably be Black by default. If other colours are chosen for the display-background, then it shall be such as to render good contrast with the shades representing the voltage levels.

## 7.0 LAYER SYSTEM

The power system elements represented on the maps should be displayed on separate layers to de-clutter the display and provide flexibility in the visualization. For instance, it should be possible to visualize the geographical position of the different kinds of substations or different kinds of generating station in the State/Region/Country. It should also be possible to clearly visualize the transmission system on the basis of its voltage level and types (AC/DC). Suggested layer philosophy is mentioned in sub-sections below. This is purely for illustration purpose and based over requirement of operator, system performance etc. various information can be displayed on separate layer.

### 7.1 LAYER 0

In the geographical maps, the boundary representing international border, State border should be distinguishable. Layer 0 should be ON by default while the other layers shall be switchable by choice.

Layer	Particulars
-------	-------------

0 (or DEFAULT layer)	<ul style="list-style-type: none"> <li>▪ Map border</li> <li>▪ Logo</li> <li>▪ Legend Box</li> <li>▪ Scale used in map</li> <li>▪ Date on which map was updated</li> <li>▪ Geographical boundaries</li> <li>▪ Respective Legend of the geographical boundary</li> </ul>
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**Table 6: Particulars of Layer 0**

## 7.2 LAYER 1 TO 17: NODES

The contents of the legend box should be linked to the respective layers in which the element is being displayed by the User i.e. only those legends (along with its description) that have been chosen to be displayed by the User must be visible in the legend box.

The text associated with a power system element should be linked to the respective layers in which the element is being displayed by the User.

Layer	Particulars
1	Generating station (Coal/Gas/Nuclear) switched at 11, 33 , 66 kV level
2	Generating station (Coal/Gas/Nuclear) switched at 110 kV & 132 kV
3	Generating station (Coal/Gas/Nuclear) switched at 220 kV
4	Generating station (Coal/Gas/Nuclear) switched at 400 kV & above level
5	Generating station (Hydro/Renewable) switched at 11, 33 , 66 kV level
6	Generating station (Hydro/Renewable) switched at 110 kV & 132 kV
7	Generating station (Hydro/Renewable) switched at 220 kV
8	Generating station (Hydro/Renewable) switched at 400 kV & above level
9	11kV voltage level substation
10	33kV voltage level substation
11	66kV voltage level substation
12	132 kV substation and 220 kV substation charged at 132 kV
13	220 kV substation and 400 kV substation charged at 220 kV
14	400 kV substation and 765 kV substation charged at 400 kV
15	765 kV voltage level substation
16	1200kV voltage level substations