OCTOBER 26, 2023

Centralized Scheduling Monitoring System (DSM)

Aux Power Consumption Monitoring System (APC)

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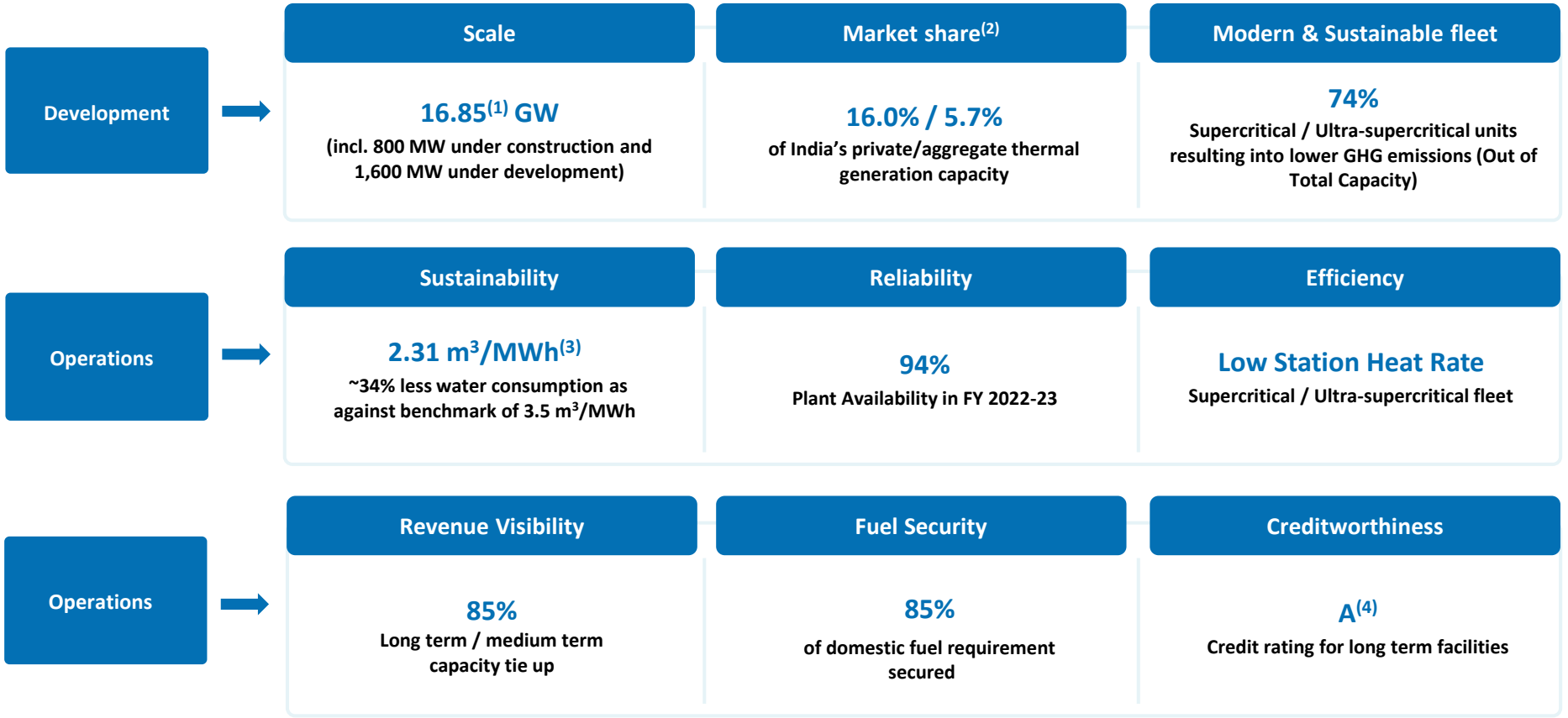
APL: Leading private sector power generator



Leading private sector power generator with revenue visibility, fuel security and credibility

(1) Includes 40 MW solar power plant at Bitta, Gujarat (2) APL's operational thermal capacity share; Source: CEA Mar'23 monthly report (3) In FY22-23 for fresh water-based power plants (4) Rating assigned by CRISIL Ratings and India Ratings |GW: Giga Watt; MW: Mega Watt; m3: Cubic meter; MWh: Mega Watt hour; GHG: Green House Gas

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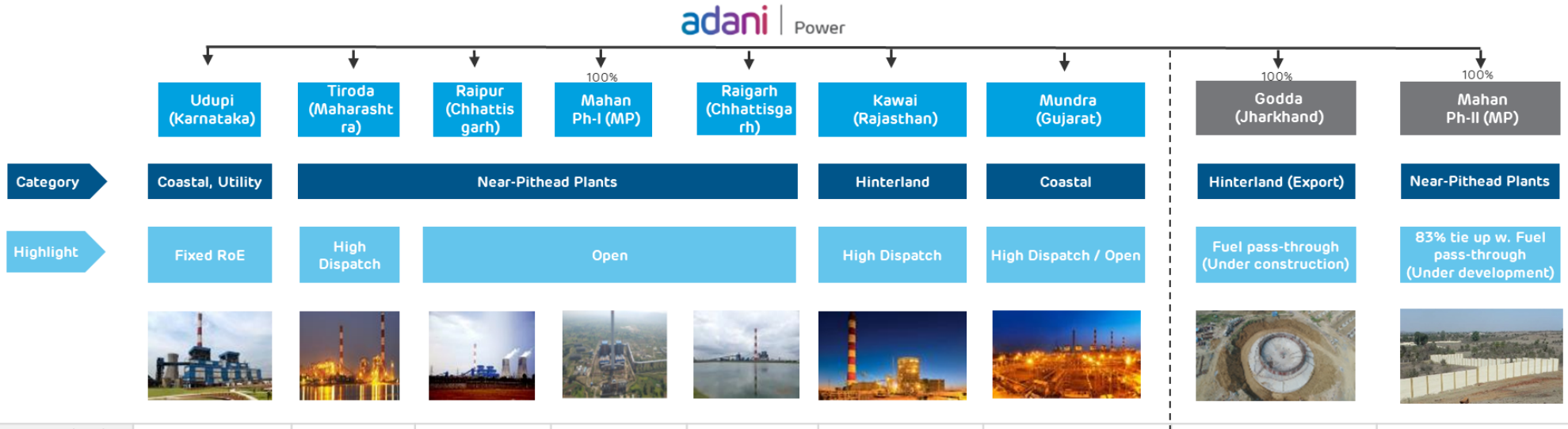
APL: Strategically located, diversified operating fleet



Capacity (MW)	1,200	3,300	1,370	1,200	600	1,320	4,620	1,600	1,600
Technology	(600MW x 2) Subcritical	(660MW x 5) Supercritical	(685MW x 2) Supercritical	(600MW x 2) Subcritical	(600MW x 1) Subcritical	(660MW x 2) Supercritical	(330MW x 4) Sub-critical / (660MW x 5) Supercritical	(800MW x 2) Ultra-supercritical	(800MW x 2) Ultra-supercritical

Category	Near-pithead	Coastal	Hinterland
Capacity MW	8,070 (48%)	5,820 (35%)	2920 (17%)
Supercritical / Ultra-supercritical	78%	57%	100%

16.85 GW capacity under 3 legal entities spread across 9 different locations (14.45 GW operational

APL also has a 40 MW solar power plant at Bitta, Gujarat; GW: Giga Watt; MW: Mega Watt; MP: Madhya Pradesh; RoE: Return on Equity

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Background of Scheduling and DSM

- DC, SG V/s Actual monitoring block by block and its commercial impact, with Deviation rate, Tabular and graphical view.

- Monitoring of schedule V/s actual in 15 minutes IP.

- Monitoring of block-by-block DSM Summary with trend

- Based on Declared Capacity, Schedule Generation is allowed by Dispatch Center (SLDC / RLDC).

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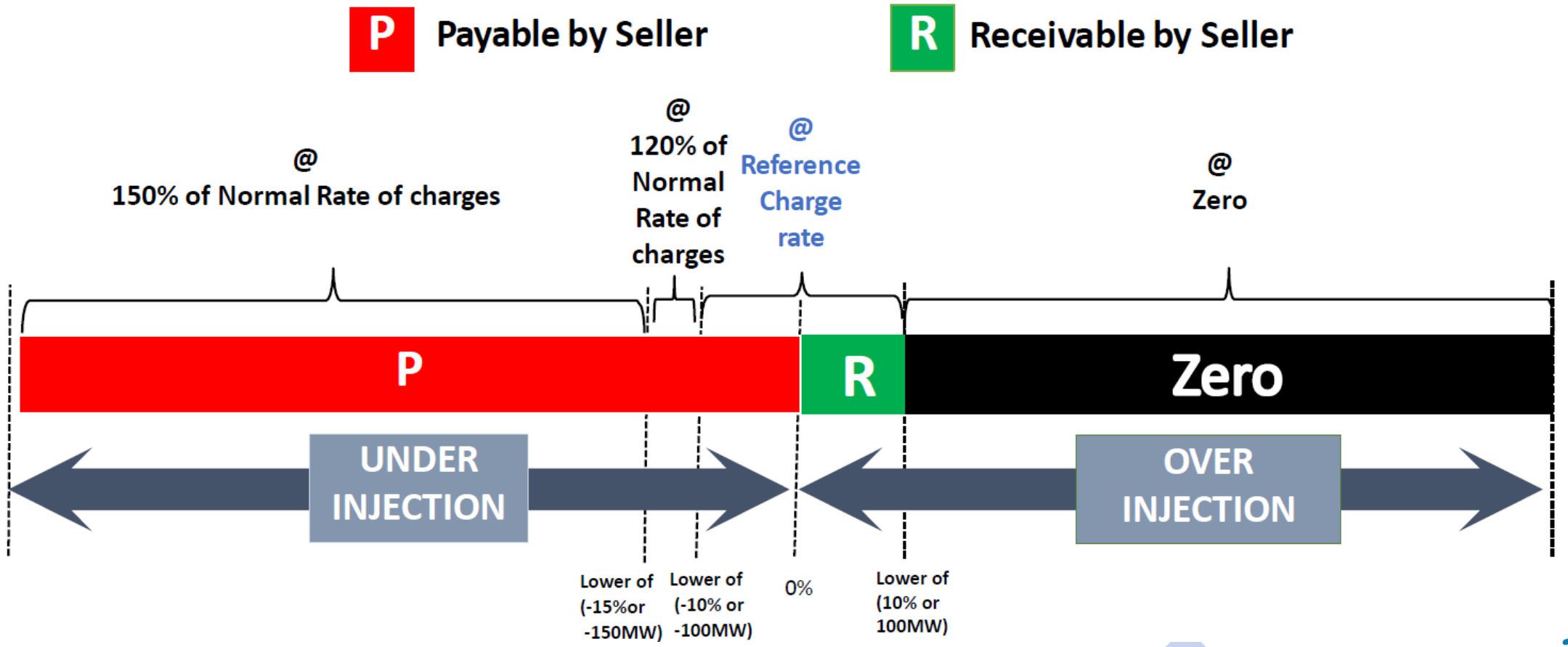
DSM Order Dated 06th Feb 2023
General seller (other than RoR & MSW)(49.95<=f<=50.03)



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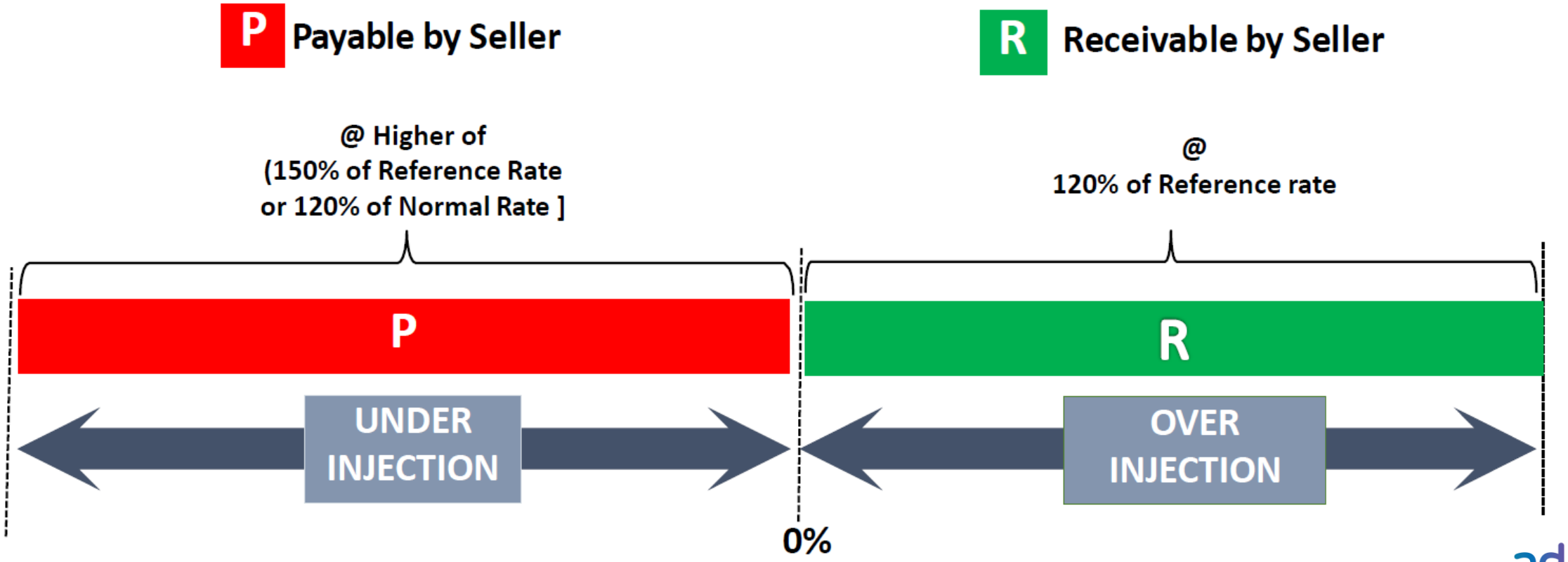
DSM Order Dated 06th Feb 2023

General seller (other than RoR & MSW)

(49.90<f<49.95)(Independent of Volume Limits)



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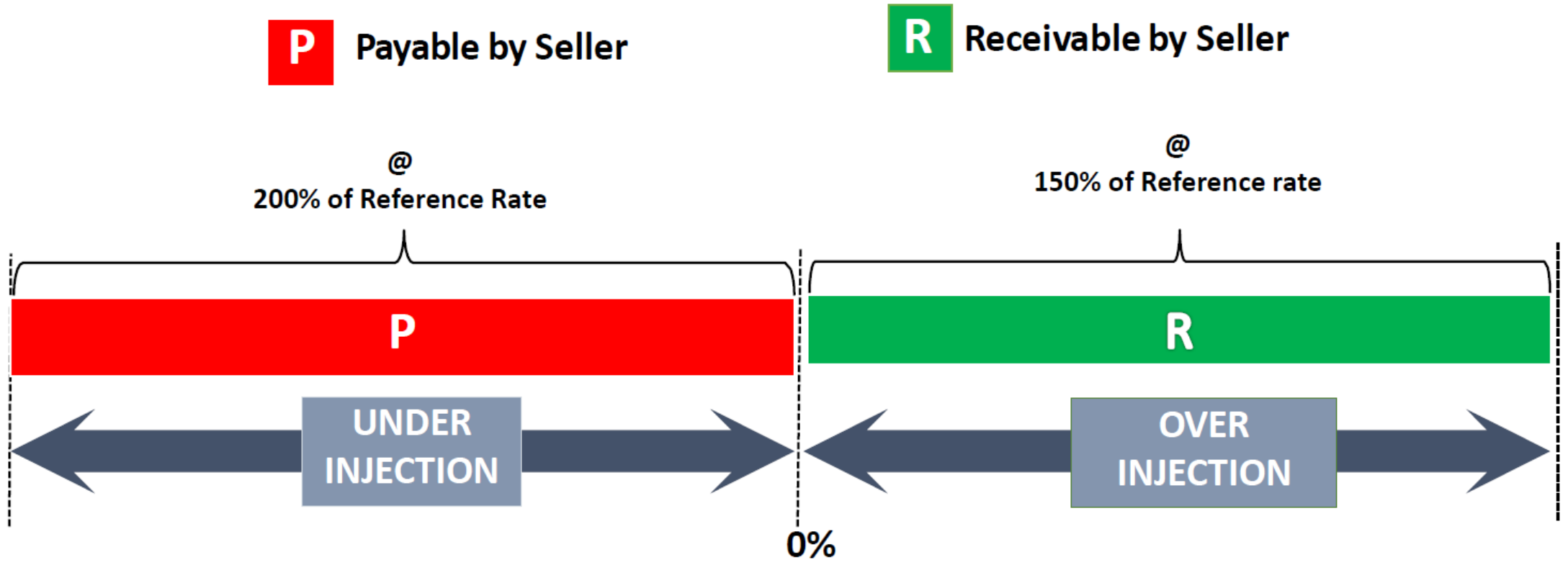
DSM Order Dated 06th Feb 2023

General seller (other than RoR & MSW)

(f<=49.90) (Independent of Volume Limits)



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DSM Order Dated 06th Feb 2023

General seller (other than RoR & MSW)

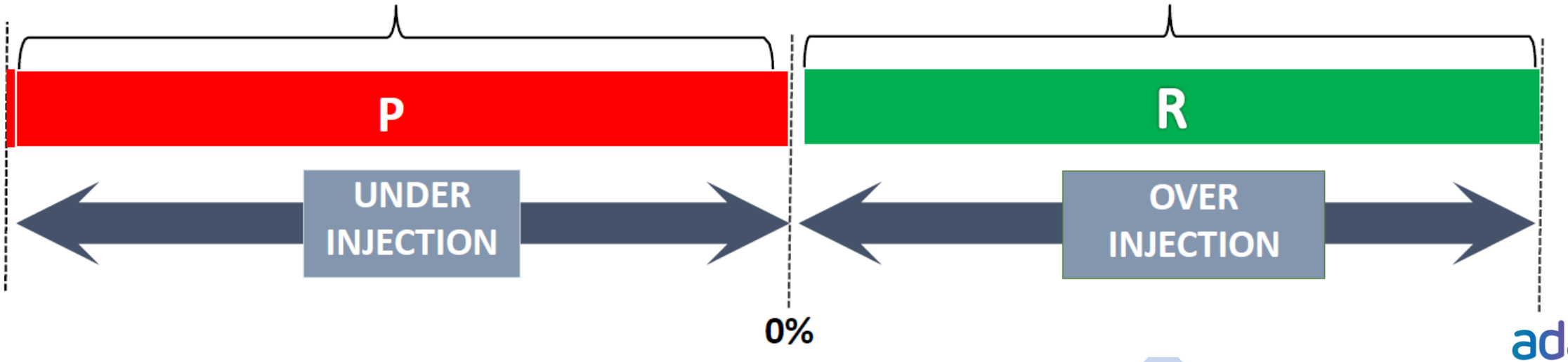
(50.03<f<50.05) (Independent of Volume Limits)

P **Payable by Seller**

R **Receivable by Seller**

@ 75% Reference Charge rate

@ 50% Reference Charge Rate



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DSM Order Dated 06th Feb 2023

General seller (other than RoR & MSW)

(f>=50.05) (Independent of Volume Limits)

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Problem Statement

- Decentralized proprietary software platform at different geographic locations of Thermal Plants
- Plant wise Monitoring healthiness of on-prim servers & installed monitoring software.
- For any amendments in regulation, dependency on third party for changes in software & reports
- Maintaining Multiple licenses and Cyber security compliances for software, database & operating systems
- Decentralized data storage, and difficult to take backup of the data & software versions

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Benefits using AVEVA PI System:

- Standard platform instead of customized proprietary application which decrease the vendor dependency.
- AVEVA PI Platform is Scalable to multiple plants centrally & suitability to incorporate other applications
- For any future expansion / new plants acquisition can be easily integrated with existing systems.

Benefits of AVEVA PI System:

- Easy user management: plant specific and central access of all plants.
- Powerful Asset framework for various logics building.
- The changes / updates in software logics, Graphics & reports can be directly implemented without user interference.
- Easy to manage database backup due to all data are available at central location on GCP.

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- DC, SG V/s Actual monitoring block by block and its commercial impact, with Deviation rate, Tabular and graphical view
- Monitoring of schedule V/s actual with elapsed time during the current integration period of 15 minutes, along with asking rate of rise or fall. Table and graphical view.
- Monitoring of block-by-block DSM Summary with trend.
- Real time APC monitoring with YTD, MTD, Yesterday & Best APC trends.
- View of switchyard SLD with parameter selection (V, I, MW, MVAr, PF, Hz)
- Meter communication Status, Meter Display, Group display, NMS monitoring
- Able to display the numeric values online on pointing of the mouse curser on history of graphical trend
- Trend analysis, grid disturbance & data analytics of each elements connected on platform
- Daily, Weekly & Monthly Graphical displays & Reports for plant operation efficiency, commercial analysis & APC trend

KPI for monitoring in Centralized DSM & APC Monitoring System on AVEVA PI System

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Metering communication architecture across APL plants

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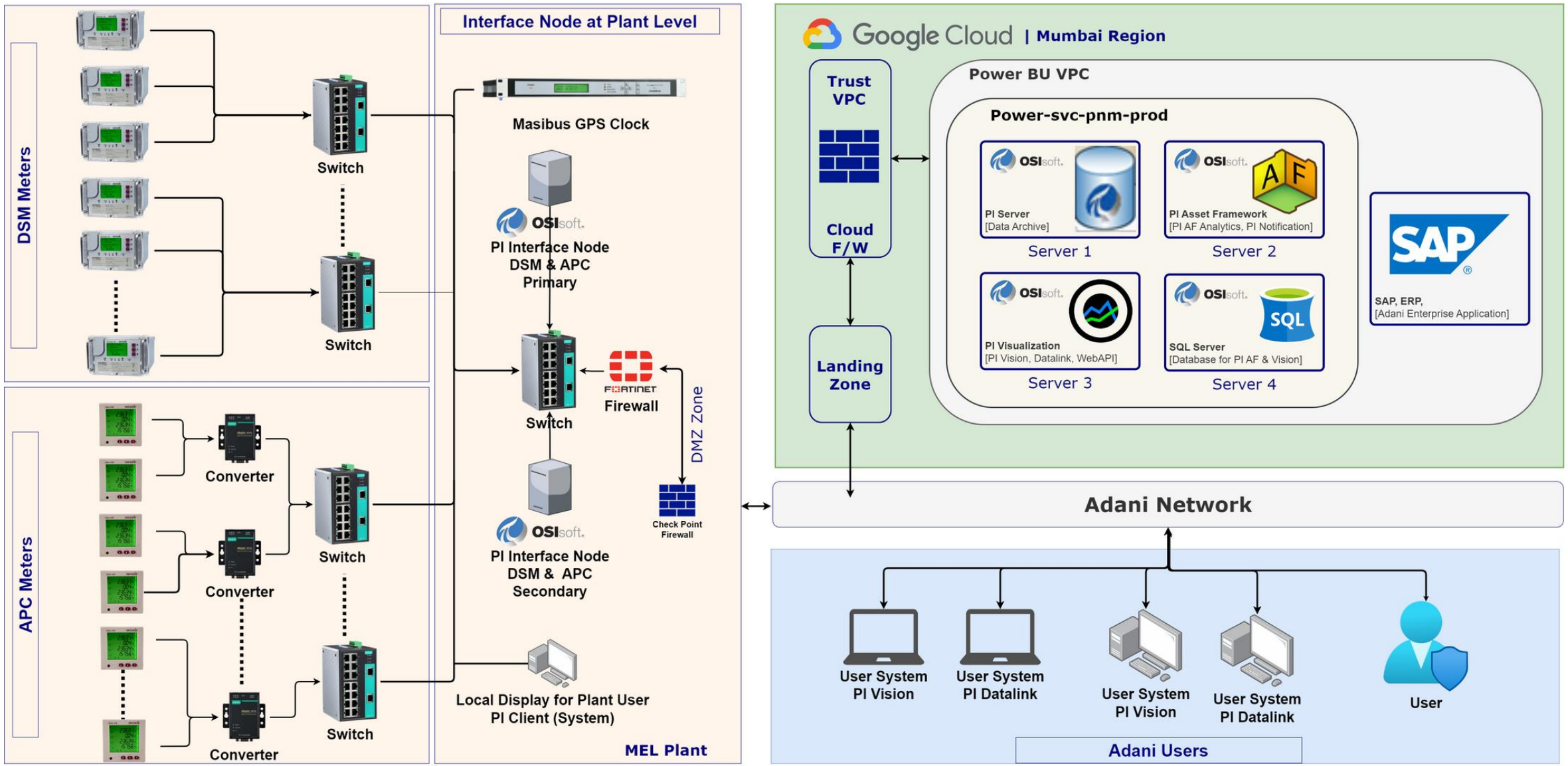
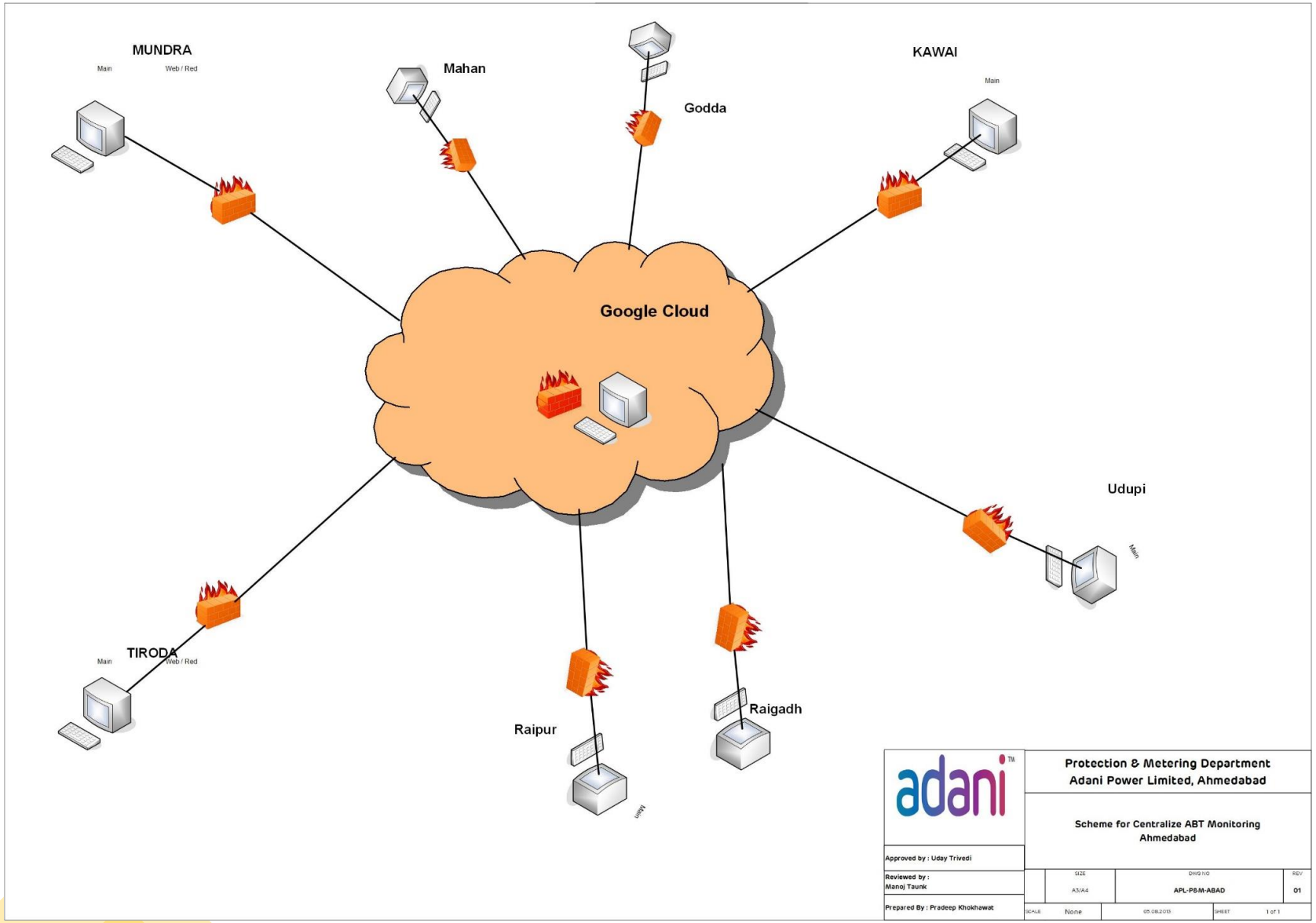
New Implementation Architecture




MUNDRA
Main
Web / Red
Mahan
Godda
KAWAI
Main
Google Cloud
Udupi
Main
TIRODA
Main
Web / Red
Raipur
Raigadh
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Protection & Metering Department
Adani Power Limited, Ahmedabad
Scheme for Centralize ABT Monitoring
Ahmedabad
Approved by : Uday Trivedi
Reviewed by :
Manoj Taunk
Prepared By : Pradeep Khokhawat
SIZE
A3/A4
DWG NO
APL-P&M-ABAD
REV
01
SCALE
None
SHEET
1 of 1

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MUNDRA		TIRODA		KAWAI		UDUPI	
DSM	APC	DSM	APC	DSM	APC	DSM	APC
52	523	31	559	9	337	24	175

RAIPUR		RAIGARH		MAHAN		GODDA	
DSM	APC	DSM	APC	DSM	APC	DSM	APC
13	148	7	145	19	222	16	249

TOTAL	
DSM	APC
171	**2358**

All Thermal Plants Metering Locations integrated

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Parameters Integrated into AVEVA PI System

Instantaneous parameters:

- All Voltages
- All currents
- Power Factor
- Frequency
- Import / Export Power (Active, Reactive & Apparent)

Online monitoring of energy parameters / 15 min block wise

- Active Import & Export Energy
- Reactive Import while active import Energy
- Reactive Export while active import Energy
- Reactive Import while active export Energy
- Reactive Export while active export Energy
- Apparent Import & Export Energy

16-Parameters on Modbus & DLMS Protocol

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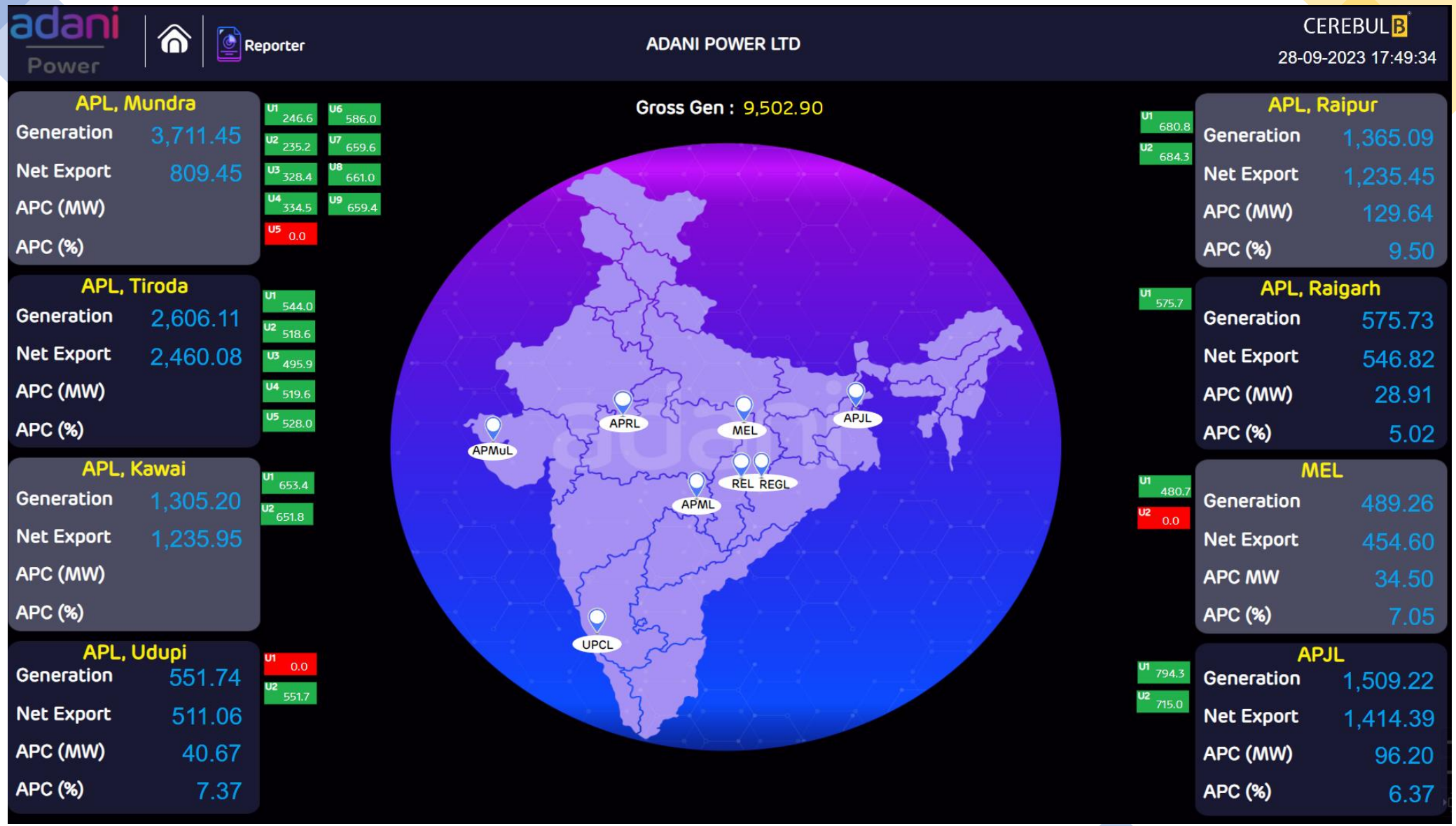
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Reporter
ADANI POWER LTD
CEREBULB
28-09-2023 17:49:34
Gross Gen : 9,502.90
APL, Mundra
Generation 3,711.45
Net Export 809.45
APC (MW)
APC (%)
U1 246.6
U2 235.2
U3 328.4
U4 334.5
U5 0.0
U6 586.0
U7 659.6
U8 661.0
U9 659.4
APL, Tiroda
Generation 2,606.11
Net Export 2,460.08
APC (MW)
APC (%)
U1 544.0
U2 518.6
U3 495.9
U4 519.6
U5 528.0
APL, Kawai
Generation 1,305.20
Net Export 1,235.95
APC (MW)
APC (%)
U1 653.4
U2 651.8
APL, Udupi
Generation 551.74
Net Export 511.06
APC (MW) 40.67
APC (%) 7.37
U1 0.0
U2 551.7
APRL
APMuL
MEL
APJL
REL
REGL
APML
UPCL
U1 680.8
U2 684.3
APL, Raipur
Generation 1,365.09
Net Export 1,235.45
APC (MW) 129.64
APC (%) 9.50
U1 575.7
APL, Raigarh
Generation 575.73
Net Export 546.82
APC (MW) 28.91
APC (%) 5.02
U1 480.7
U2 0.0
MEL
Generation 489.26
Net Export 454.60
APC MW 34.50
APC (%) 7.05
U1 794.3
U2 715.0
APJL
Generation 1,509.22
Net Export 1,414.39
APC (MW) 96.20
APC (%) 6.37

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DSM

Real Time DSM GUI

- Scheduling team take action based on Real time grid condition
- Operator get an idea of full day insights including previous & current block scenario that they need over injection or under injection

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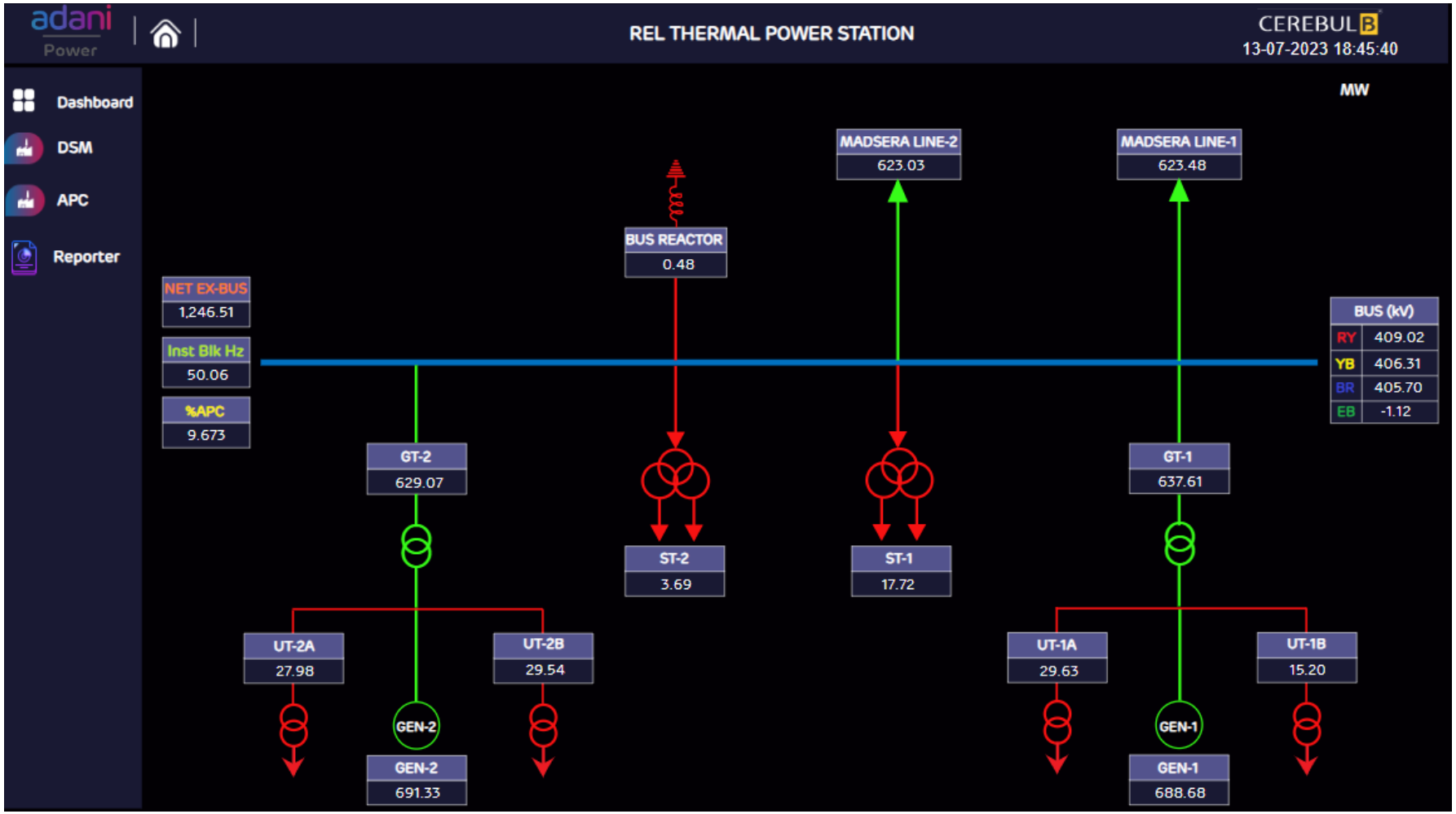
DSM SLD



Single Line Diagram

- Realtime visibility of SLD i.e., all elements connected to Bus (Gen, UT, GT, ST, Lines & Reactors)

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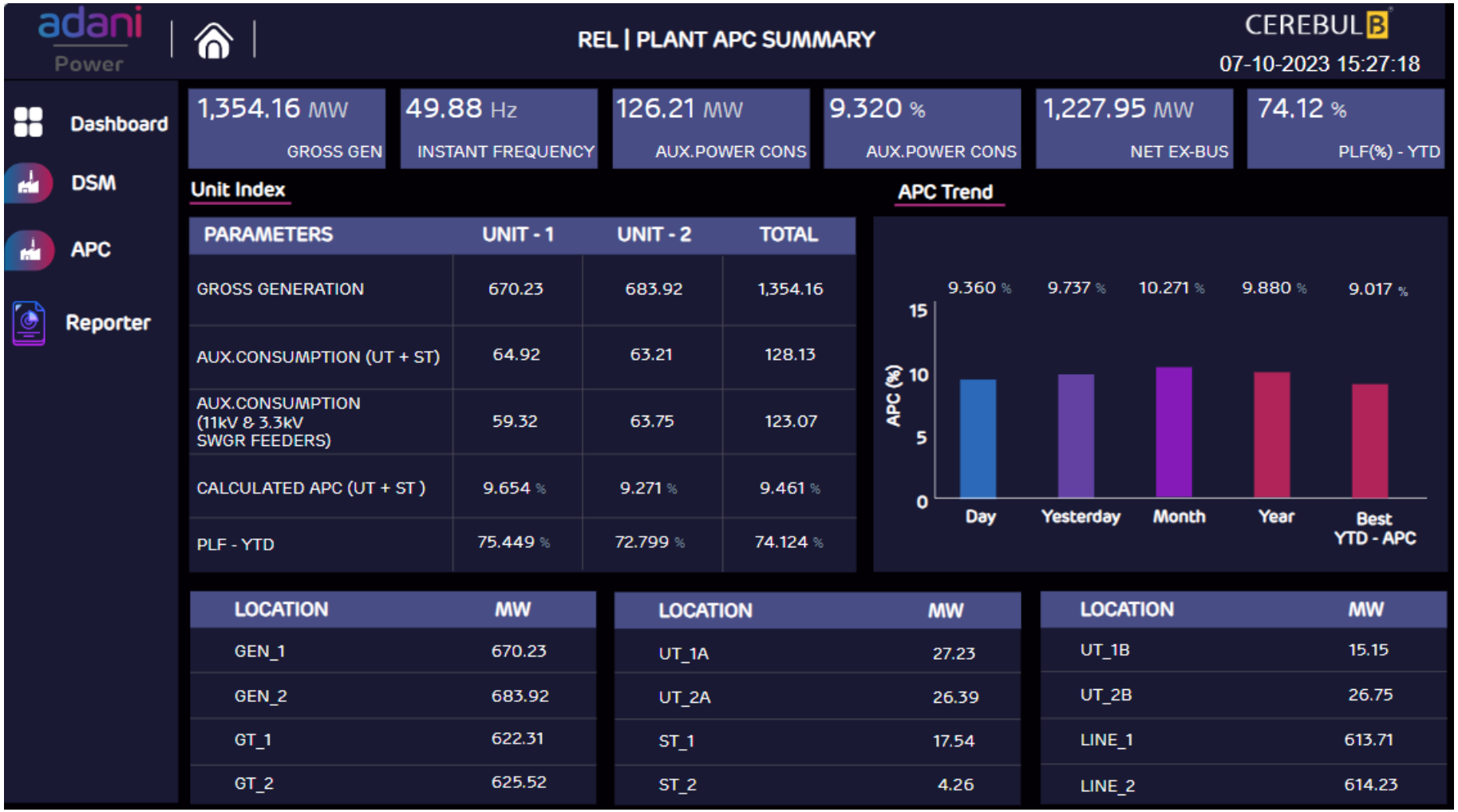
APC



Real Time Visibility of APC

- Realtime Auxiliary Power Consumptions summary view
- APC Trend with Best YTD figures
- Visibility of Plant Load Factor percentage

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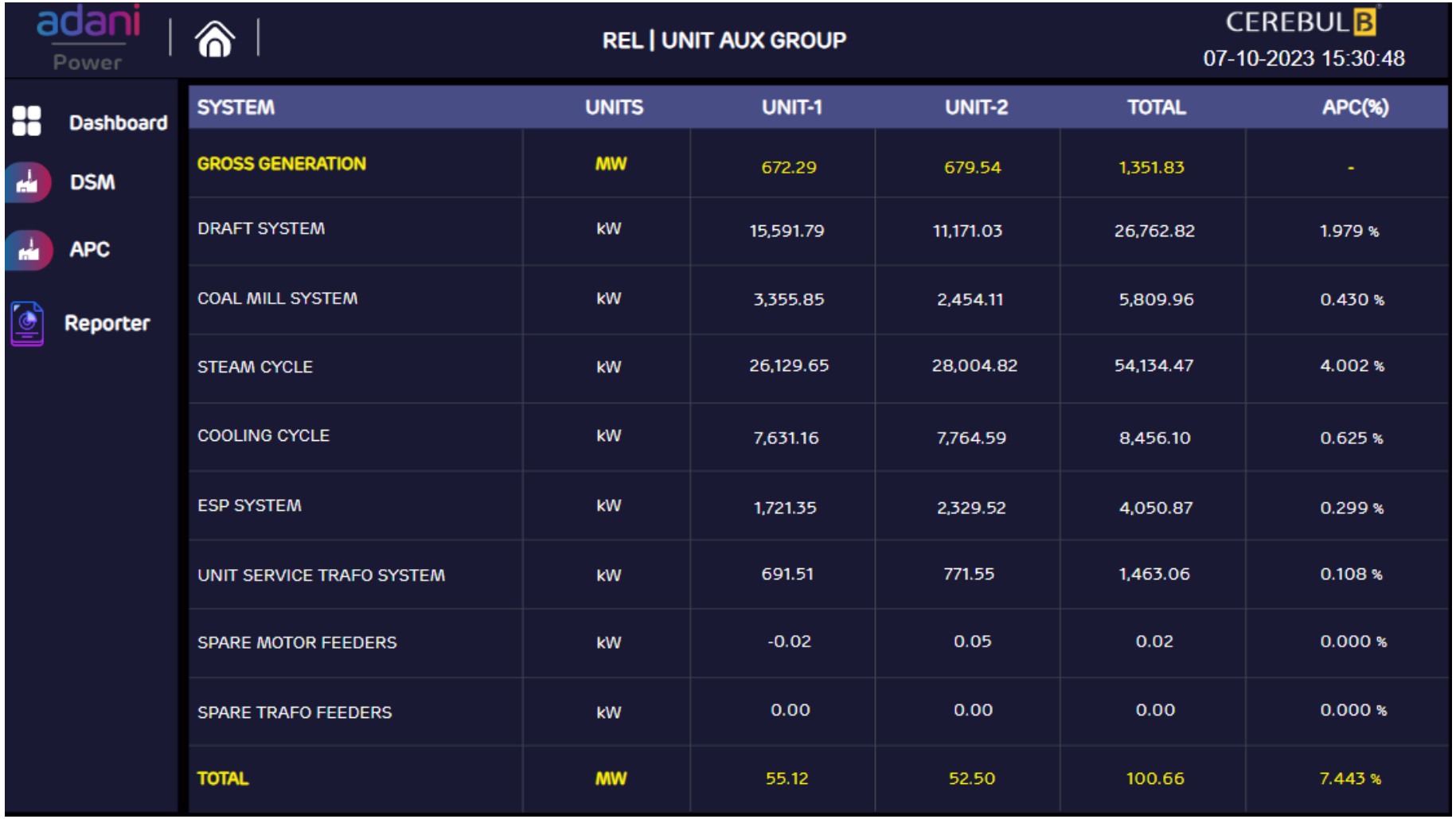
APC - Unit Aux Group



SYSTEM	UNITS	UNIT-1	UNIT-2	TOTAL	APC(%)
GROSS GENERATION	MW	672.29	679.54	1,351.83	-
DRAFT SYSTEM	kW	15,591.79	11,171.03	26,762.82	1.979 %
COAL MILL SYSTEM	kW	3,355.85	2,454.11	5,809.96	0.430 %
STEAM CYCLE	kW	26,129.65	28,004.82	54,134.47	4.002 %
COOLING CYCLE	kW	7,631.16	7,764.59	8,456.10	0.625 %
ESP SYSTEM	kW	1,721.35	2,329.52	4,050.87	0.299 %
UNIT SERVICE TRAFO SYSTEM	kW	691.51	771.55	1,463.06	0.108 %
SPARE MOTOR FEEDERS	kW	-0.02	0.05	0.02	0.000 %
SPARE TRAFO FEEDERS	kW	0.00	0.00	0.00	0.000 %
TOTAL	MW	55.12	52.50	100.66	7.443 %

Unit Auxiliary Group

- Realtime visibility of unit auxiliary consumption

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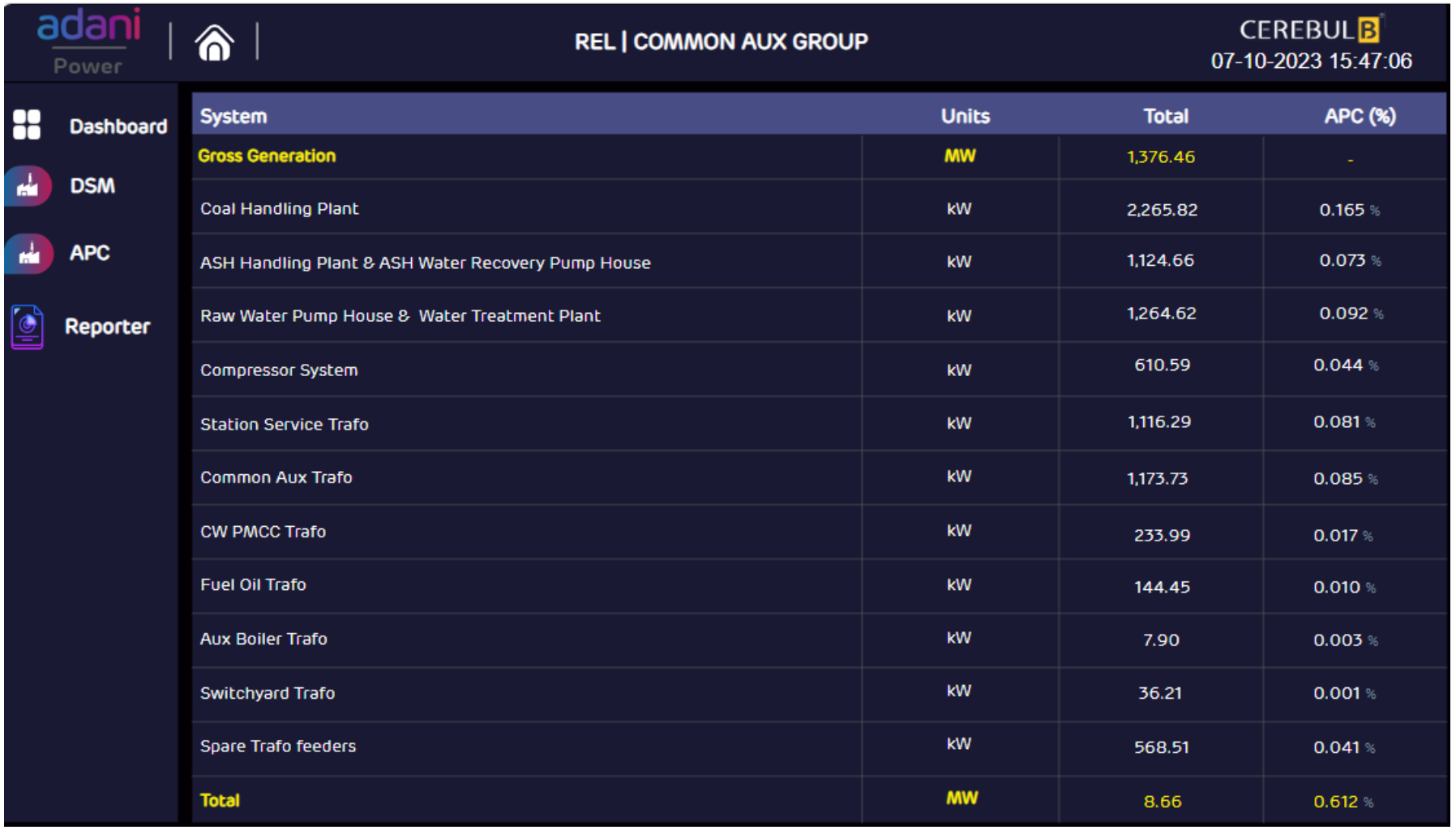
APC - Common Aux Group



System	Units	Total	APC (%)
Gross Generation	MW	1,376.46	-
Coal Handling Plant	kW	2,265.82	0.165 %
ASH Handling Plant & ASH Water Recovery Pump House	kW	1,124.66	0.073 %
Raw Water Pump House & Water Treatment Plant	kW	1,264.62	0.092 %
Compressor System	kW	610.59	0.044 %
Station Service Trafo	kW	1,116.29	0.081 %
Common Aux Trafo	kW	1,173.73	0.085 %
CW PMCC Trafo	kW	233.99	0.017 %
Fuel Oil Trafo	kW	144.45	0.010 %
Aux Boiler Trafo	kW	7.90	0.003 %
Switchyard Trafo	kW	36.21	0.001 %
Spare Trafo feeders	kW	568.51	0.041 %
Total	MW	8.66	0.612 %

Common Auxiliary Group

- Realtime visibility of common auxiliary consumption

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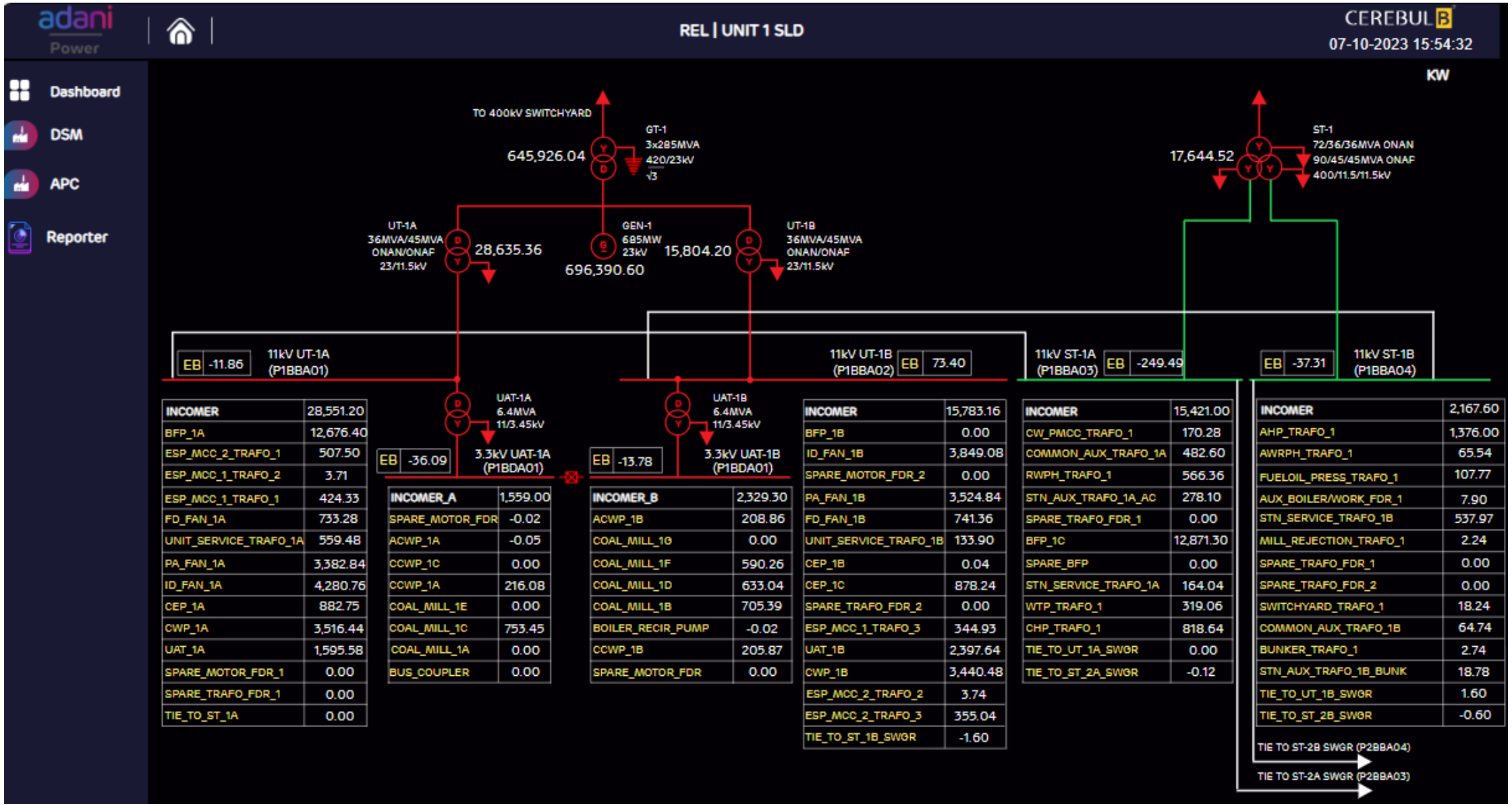
APC SLD



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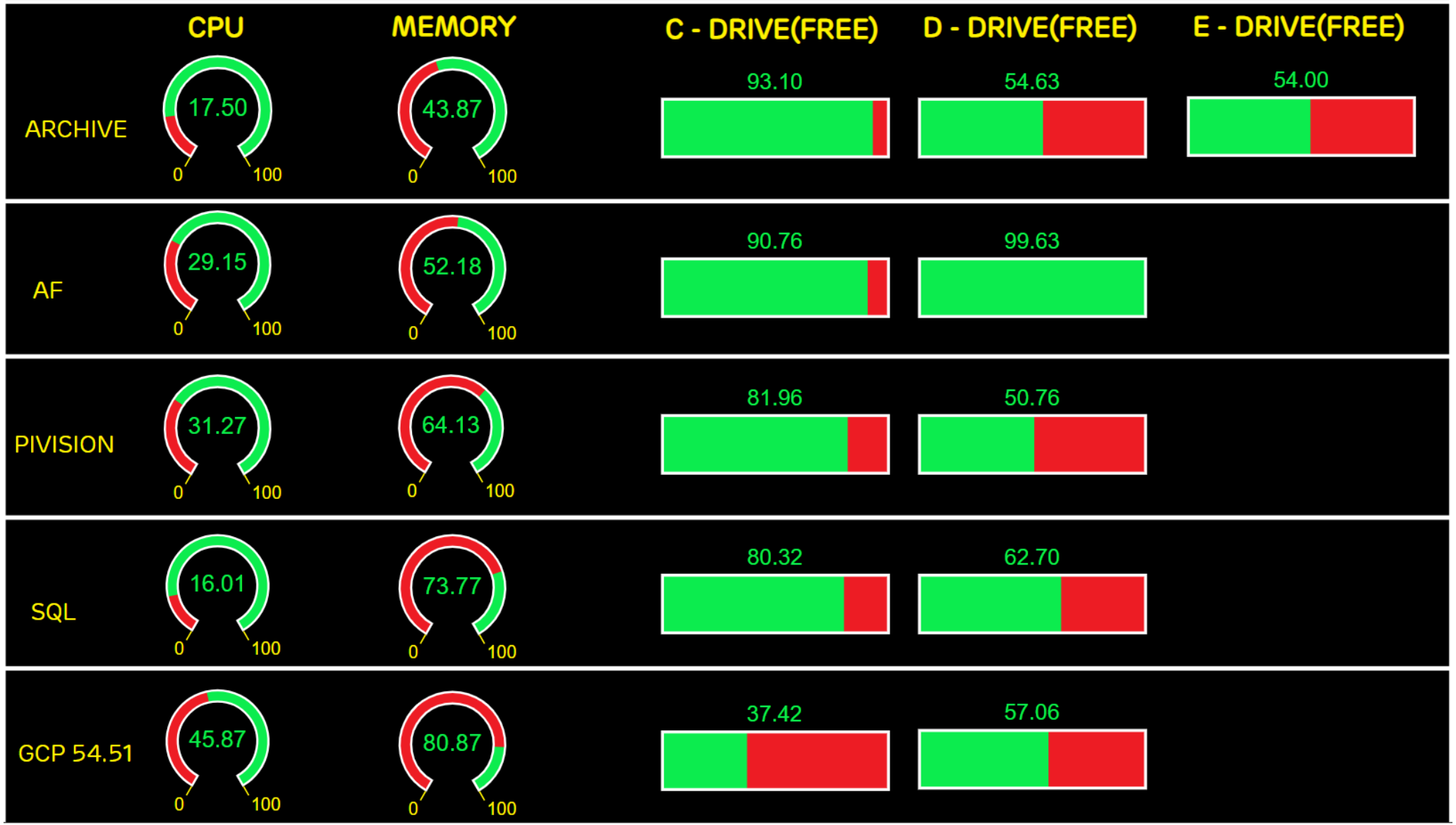
GCP servers utilization by AVEVA PI System



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Interface communication status

Interface Name	10.150.208.208			10.150.208.209			
DSM_MB_GEN_1_N		1	0 | Good	●	5	0 | Good	●
DSM_MB_GEN_2_N	●	14	0 | Good		3	0 | Good	●
DSM_MB_KEMAR_LINE_1_N	●	2	0 | Good		2	70 | Error | Zero devices are currently communicating with the interface.	●
DSM_MB_KEMAR_LINE_2_N	●	4	0 | Good		8	0 | Good	●
DSM_MB_HASSAN_LINE_1_N	●	9	0 | Good		13	0 | Good	●
DSM_MB_HASSAN_LINE_2_N	●	8	0 | Good		12	0 | Good	●
DSM_MB_KASARGODE_LINE_1_N		9	70 | Error | Zero devices are currently communicating with the interface.	●	2	70 | Error | Zero devices are currently communicating with the interface.	●
DSM_MB_KASARGODE_LINE_2_N		6	70 | Error | Zero devices are currently communicating with the interface.	●	3	70 | Error | Zero devices are currently communicating with the interface.	●
DSM_MB_UAT_1A	●	14	0 | Good		15	70 | Error | Zero devices are currently communicating with the interface.	●
DSM_MB_UAT_1B	●	10	0 | Good		13	0 | Good	●
DSM_MB_ST_1	●	4	0 | Good		9	70 | Error | Zero devices are currently communicating with the interface.	●
DSM_MB_UAT_2A	●	10	0 | Good		14	0 | Good	●
DSM_MB_UAT_2B	●	12	0 | Good		2	0 | Good	●
DSM_MB_ST_2	●	2	0 | Good		4	0 | Good	●
DSM_MB_GT_1		15	0 | Good	●	13	0 | Good	●
DSM_MB_GT_2	●	13	0 | Good		13	70 | Error | Zero devices are currently communicating with the interface.	●
DSM_HV_ICT_1	●	1	0 | Good		10	0 | Good	●
DSM_HV_ICT_2		14	0 | Good	●	2	0 | Good	●
DSM_LV_ICT_1	●	5	0 | Good		13	0 | Good	●
DSM_LV_ICT_2		6	0 | Good	●	4	0 | Good	●
DSM_BUS_REACTOR_1		7	70 | Error | Zero devices are currently communicating with the interface.	●	9	0 | Good	●
DSM_BUS_REACTOR_2		14	70 | Error | Zero devices are currently communicating with the interface.	●	1	0 | Good	●
DSM_BUS_SECTION_1	●	2	70 | Error | Zero devices are currently communicating with the interface.		15	70 | Error | Zero devices are currently communicating with the interface.	●
DSM_BUS_SECTION_2		4	70 | Error | Zero devices are currently communicating with the interface.	●	14	70 | Error | Zero devices are currently communicating with the interface.	●
APC_6.6kV_UAT_1A_L1		14	70 | Error | Zero devices are currently communicating with the interface.	●	14	36 | Error | 3 device(s) failed all of their retries while requesting data.	●
APC_6.6KV_UAT_1B_L1	Intf Shut		99 | Intf Shutdown	●	15	35 | Error | 3 device(s) failed all of their retries while requesting data.	●
APC_6.6kV_UAT_2A_L1	●	7	34 | Error | 2 device(s) failed all of their retries while requesting data.		10	70 | Error | Zero devices are currently communicating with the interface.	●
APC_6.6KV_UAT_2B_L1	●	1	34 | Error | 2 device(s) failed all of their retries while requesting data.		10	70 | Error | Zero devices are currently communicating with the interface.	●
APC_11KV_ST_1A_L1		11	0 | Good	●	13	38 | Error | 5 device(s) failed all of their retries while requesting data.	●
APC_11KV_ST_1B_L1	●	8	40 | Error | 3 device(s) failed all of their retries while requesting data.		12	70 | Error | Zero devices are currently communicating with the interface.	●
APC_11KV_ST_2A_L1		3	70 | Error | Zero devices are currently communicating with the interface.	●	14	41 | Error | 7 device(s) failed all of their retries while requesting data.	●
APC_11KV_ST_2B_L1		2	70 | Error | Zero devices are currently communicating with the interface.	●	11	37 | Error | 2 device(s) failed all of their retries while requesting data.	●

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DSM Analysis Report for Users for performance monitoring

From Date	09-07-2023		Total SG (MU)	20.001		Net exp/SG %	0.989
To Date	10-07-2023		Net EXP (MU)	19.774		Gross UI(Rs.Lakhs)	
Report Gen time	14-07-2023 10:32		Total UI (MU)	0.227		Profit(+)/Loss(-) (Rs. Lakhs)	

Date	Blk	Freq. (Hz)	Normal Rate (Rs/kWh)	Ref. Charge. (Rs/kWh)	Basic Chrgs & Add. Dev. Chrgs (R			
					Schedule (MW)	Injection (MW)	Deviation (MW)	Dev (%)
09-07-2023 00:15	1	49.98	4.24	2.94	1143.95	1167.15	23.20	2.03%
09-07-2023 00:30	2	49.96	4.24	2.94	1043.25	1074.17	30.92	2.96%
09-07-2023 00:45	3	49.96	4.10	2.94	943.25	945.47	2.22	0.24%
09-07-2023 01:00	4	49.96	4.00	2.94	843.25	842.42	-0.83	0.10%
09-07-2023 01:15	5	49.99	4.00	2.94	885.25	884.39	-0.86	0.10%
09-07-2023 01:30	6	50.00	4.10	2.94	914.25	924.50	10.25	1.12%
09-07-2023 22:45	91	50.03	9.00	2.94	1243.95	1156.53	-87.42	7.03%
09-07-2023 23:00	92	50.02	9.00	2.94	1243.95	1152.15	-91.80	7.38%
09-07-2023 23:15	93	50.05	10.00	2.94	1243.95	1150.86	-93.09	7.48%
09-07-2023 23:30	94	50.05	6.51	2.94	1243.95	1150.29	-93.66	7.53%
09-07-2023 23:45	95	50.03	6.50	2.94	1243.95	1148.71	-95.24	7.66%
10-07-2023 00:00	96	50.06	5.60	3.58	1243.95	1146.69	-97.26	7.82%
		50.00	**0.00**	**0.24**	**80005.04**	**79095.34**	**-0.23**	**0.02**

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APC Report for analysis & comparison of Unit Auxiliary Loads for ease of decision making for taking preventive / corrective actions

APJL AUXILIARY POWER CONSUMPTION REPORT		Date:		From	05-10-2023 00:30	To	06-10-2023 00:00	
11kV / 6.6kV SWITCHGEAR BOARDS		* All Values are in MWh	UNIT AUXILIARY CONSUMPTION					
			UNIT-1		UNIT-2		TOTAL	
11kV UT-1A	400.04	GROSS GENERATION	14399.46		13859.22		28258.67	
11kV UT-1B	234.70	% PLF	75.00%		72.18%		73.59%	
		% APC (GEN - GSUT - COLONY FEEDERS)	**6.99%**		**6.54%**		**6.77%**	
		% APC STATION (GEN - LINES - COLONY FEEDERS)	**6.83%**					
11kV UT-2A	310.71	NET LINE EXPORT	**Bogura-1**	**13171.46**	**Rohanpur-2**	**13149.31**	**26320.77**	
11kV UT-2B	329.49	NET GSUT EXPORT	**GSUT-1**	**13380.26**	**GSUT-2**	**12958.03**	**26338.29**	
		APC MWh (GEN - GSUT - COLONY FEEDERS)	**1007.17**		**906.66**		**1913.84**	
6.6kV UAT-1A	54.12	DRAFT SYSTEM	314.59	2.18%	258.89	1.87%	573.48	2.03%
6.6kV UAT-1B	54.39	COAL MILL SYSTEM	51.47	0.36%	51.41	0.37%	102.88	0.36%
		STEAM & COOLING CYCLE	217.57	1.51%	303.93	2.19%	521.50	1.85%
6.6kV UAT-2A	48.92	ESP SYSTEM	49.72	0.35%	52.38	0.38%	102.10	0.36%
6.6kV UAT-2B	63.32	UNIT SERVICE TRAFO	20.64	0.14%	19.54	0.14%	40.18	0.14%
		SPARE FEEDERS	0.00	0.00%	0.00	0.00%	0.00	0.00%
11kV ST-A	105.43	FGD SYSTEM	71.15	0.49%	48.55	0.35%	119.70	0.42%
11kV ST-B	88.87	TRANSFORMATION LOSSES (GSUT+UT+ET)	66.04	0.46%	59.84	0.43%	125.88	0.45%
		COMMON AUXILIARIES (APP)	112.64	0.78%	108.41	0.78%	221.05	0.78%

adani Power

Adani Power implements centralized scheduling and monitoring system for data-centric decision making

Challenge

- Decentralized proprietary software platform at different geographic locations of Thermal Plants
- Multiple licenses and Cyber security compliances for software, database & operating systems
- Decentralized system made it difficult to store, retrieve and analyze data.
- Multiple third-party systems required for changes in software and reports.

Solution

- Centralized Scheduling Monitoring System (DSM) Auxiliary Power Consumption Monitoring System (APC) to streamline data collection, access, analysis, and reporting

Results

- **Centralized monitoring and analysis of all thermal plants on one platform.**
- **DSM provides data-centric and real-time decision making, reducing commercial losses and optimizing profitability.**
- **Improved Plant efficiency with real time as well as historical data**

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Way Forward

- ENOC for Asset performance management (migration from conventional system) - Adani Thermal Plats.
- Asset health performance of primary equipments – Adani Energy Solutions ltd
- Usage by other Business verticals in Adani Group
- Common talent expertise in development.

Questions?

Please wait for the microphone.

State your name and company.

Please remember to…

Navigate to this session in the mobile app to complete the survey.

Thank you!

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