Host Utilities

TATA

TATA POWER

TATA POWER-DDL

BSES

BSES Rajdhani Power Limited

BSES

BSES Yamuna Power Limited

Co - Host Utilities

CESC LIMITED

POWER CORPORATION LIMITED

ORGANIZER

ISGF

India Smart Grid Forum

India SMART UTILITY Week 2024

Supporting Ministries

MINISTRY OF POWER
GOVERNMENT OF INDIA

MINISTRY OF NEW AND RENEWABLE ENERGY
GOVERNMENT OF INDIA

नीति आयोग
National Institution for Transforming India

MINISTRY OF ELECTRONICS & INFORMATION TECHNOLOGY
GOVERNMENT OF INDIA

MINISTRY OF HEAVY INDUSTRIES
GOVERNMENT OF INDIA

MINISTRY OF JAL SHAKTI
DEPARTMENT OF WATER RESOURCES, RIVER DEVELOPMENT & GANGA REJUVENATION,
GOVERNMENT OF INDIA

MINISTRY OF POWER
GOVERNMENT OF INDIA
CENTRAL ELECTRICITY AUTHORITY

Session : Climate Resilience of Future Grids

Topic: Climate Resilience in Distribution System

Presented By

ARVIND SINGH, CEO, TPCODL

Impact of Climate change on Distribution Sector

Major Climatic Changes	Types	Impact on Distribution Network
EXTREME WEATHER EVENTS	**Storms / Cyclones, floods, Kalbaisakhis (Nor' westers)**	▪ Damage Distribution infrastructure, including poles, wires, substations, and distribution transformers ▪ Service disruptions and outages
TEMPERATURE EXTREMES	**Higher ambient temperatures during heatwaves**	▪ Strain power distribution equipment, increase electricity demand for cooling, and lead to thermal stress on assets ▪ Reduce the capacity and efficiency of power distribution equipment, such as transformers and switchgear ▪ Lead to de-rating, increased maintenance requirements, and decreased reliability of the power grid during periods of high demand

Addressing climate change threats through

- Risk Assessment
- Robust Engineering design
- Grid modernization
- Improved Emergency Response
- Adequate Investment in Resilient System

Risk to Distribution Sector in Odisha due to Disaster

POWER SECTOR IMPORTANCE

- Critical infrastructure
- Growth is directly correlated with economic growth of country
- Disruption in power sector due to crisis/ disaster creates hardship to the human beings

Cyclones impacting Odisha in the past

Name of Cyclone	Occurence	Severity Class	Peak Wind Speed (kmph)
Sitrang	October, 2022	Tropical Storm	88
Asani	May, 2022	Severe Cyclonic Storm	100
Jawad	December, 2021	Cyclonic Storm	100
Gulab	September, 2021	Severe Cyclone	95
Yaas	May, 2021	Very Severe Cyclonic Storm	140
Amphan	May, 2020	Super Cyclonic Storm	120
Bulbul	November, 2019	Very Severe Cyclonic Storm	110
Fani	May, 2019	Extremely Severe Cyclonic Storm	200 – 215
Titli	October, 2018	Very Severe Cyclonic Storm	60 - 80
Phailin	October, 2014	Extremely Severe Cyclonic Storm	214
Hudhud	October, 2013	Extremely Severe Cyclonic Storm	180 – 190
Super Cyclone	October, 1999	Extremely Severe Cyclonic Storm	260 – 270

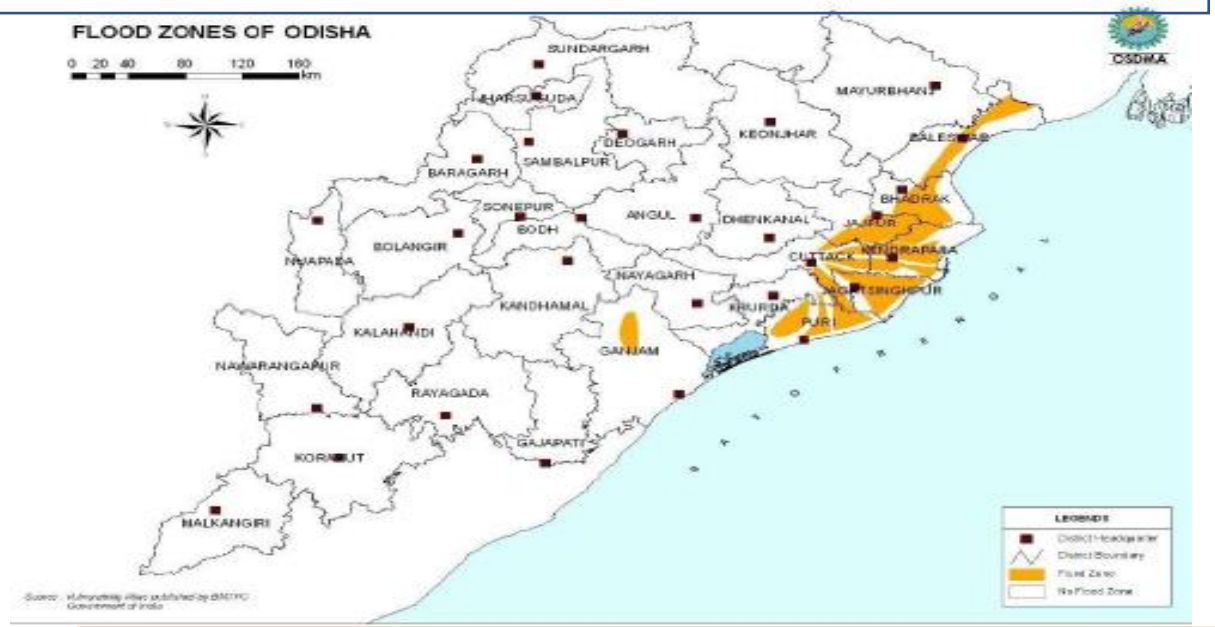
The impact of the cyclone & Flood brought into focus the need for disaster and climate resilient power infrastructure systems in Odisha

Infrastructure Redesign for Flood Protection

9 major river systems and their tributaries and distributaries

Heavy to very heavy rainfall in different parts of the Odisha State

- All districts received substantial rainfall due to Low pressure over Bay of Bengal and active Monsoon
- Heavy rainfall occurred in the upstream catchment area of river system
- Heavy rainfall also in downstream area of river caused flood in several districts in the state



Design Approach

- Installation of all electrical equipment higher than Higher Flood Level
- Distribution Transformers to be installed on elevated plinth
- Substation to be constructed above the road level and with proper drainage system

Wind Zoning Study in TPCODL

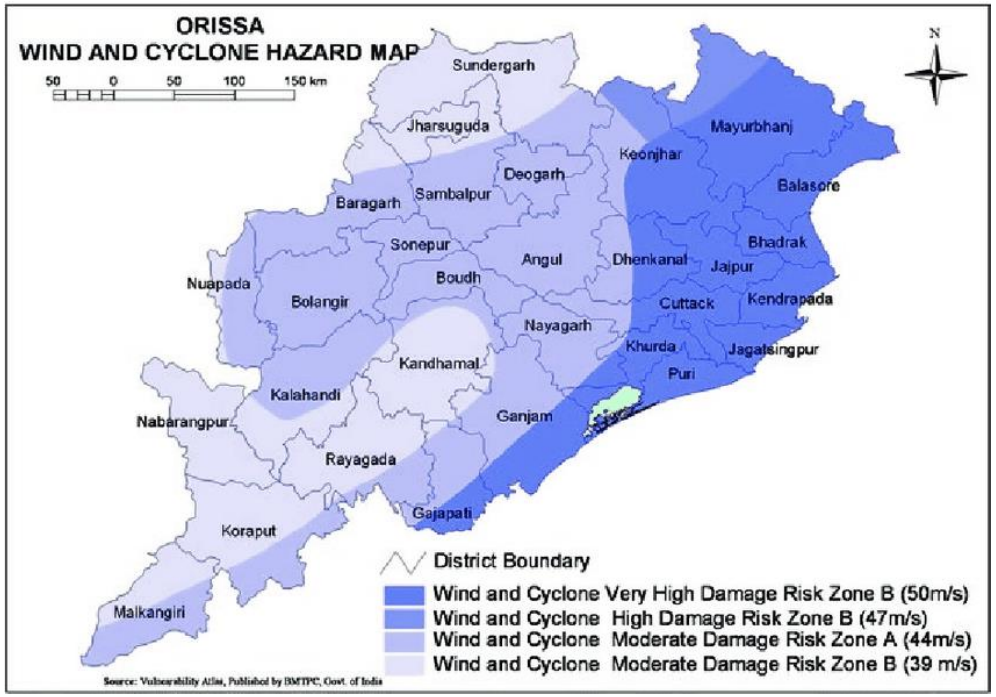
Study of Winds & local zones : A comprehensive study of the high intensity winds & effects on existing Poles & Lines has been carried out. Highest wind speed of 260Kmph was recorded by IMD in the coastal areas.

Historical data related to Cyclones/HIW, from IMD and other Govt. sources analyzed and divisions classified into following zones:

a) Very High Intensity wind zone (0 - 60 KM from Coast): **Wind speed 250 to 300kmph**

b) High Intensity wind zone (60 - 100 KM from Coast): **Wind speed 200 to 250kmph**

c) Moderate Intensity wind zone (100 - 150 KM from Coast): **Wind speed 140 to 200kmph**



Distance from Coastline (km)	Max.Wind Speed recorded in this Zone or beyond	Basic Wind Speed (Vb) kmph	Wind Parameters	Design Wind Speed (Vd) kmph Vb*k1*k2*k2*k3*k4
Upto 10	260	180		265.36
10--20	260	180	k1=1.08	265.36
20--30	260	180	k2=1.05	265.36
30--40	260	180	k3=1.0	265.36
40--50	260	180	k4=1.3	265.36
50--60	260	180		265.36
60--70	**260**	180		**204.12**
70--100	203	180		204.12
70--100	203	158.4	k1=1.08	179.63
100-150	140	180	k2=1.05	204.12
100-150	140	158.4	k3=1.0	179.63
150-175	100	180	k4=1.0	204.12
150-175	100	158.4		179.63
>175	100	158.4		179.63

Pole Design and Resiliency During Cyclone

STAAD Pro Analysis of existing Poles : All existing Poles are failing in Wind zone 1 (0-60 Kmph)

S No	Section	Height, mtr	Conductor			Zone (0 to 60 km)		Zone (60 km to 100 km)		
			Area, mm2	Dia mm	Span, mtr	Design wind pressure, N/m2	utilization ratio	Design wind pressure	Utilization ratio	Recommendations
1	ISMC 200 (H POLE)	9.2	100	12.78	40	3880.09	1.356	2933.91	0.891	-
2	ISMC 200 (H POLE)	9.2	232	19.7	50	3880.09	2.22	2933.91	1.2	ISMC 200 (H POLE) With 40M span
4	160 X 152, WPB	9.2	100	12.78	40	3880.09	5.235	2933.91	3.964	ISMC 200 (H POLE)
5	160 X 152, WPB	9.2	232	19.7	40	3880.09	6.316	2933.91	4.247	IISMC 200 (H POLE)
6	160X150, WPB	9.2	80	11.43	35	3880.09	3.8	2933.91	2.97	ISMC 200 (H POLE)
7	150X150, WPB	13	80	11.43	35	3880.09	8.09	2933.91	6.596	ISMC 200 (H POLE)

Rebar Lacing Pole: Cyclone Resilient & Cost Effective

Rebar Lacing Pole for 11 & 33 KV lines : TPCODL has developed a **Low Cost** pole which can **withstand winds upto 300Kmph.** Depending upon the various applications & situations the span length can be 60 to 80 meter.

Type tested at CPRI lab: Pole was designed jointly with TCE, Fabricated locally in Odisha & Type tested in CPRI Bangalore.

Design: Simple design uses a box frame made of ISAs supported by MS rod welded connections from inside. It can be fabricated in one piece or two pieces. Uses suspension insulators.

Foundation: Foundation design can be selected based on soil condition. A prefab STUB will be buried / embedded in foundation & The RLP has detachable bolted connection with the STUB.

Composite Insulated Cross Arm (CICA) : TPCODL has developed low cost Composite Insulated Cross Arm (which will be used on RLP & will help in improving the overall reliability to very high level.

Installation at Puri Konark Marine Drive along coastline

Disaster Preparedness

Ensuring resilience and reliability of the electricity grid during and after natural disasters

Initiatives	Benefits of the initiatives
Backup Power Systems *DG sets at Critical Installations*	▪ Critical electricity supply during outages caused by disasters ▪ Maintain essential services ▪ Support emergency response efforts ▪ Minimize the impact on communities and critical infrastructure
Mobile Substations and Transformers	▪ Rapid restoration of electricity service in affected areas ▪ Quick deployment for replacement of damaged infrastructure ▪ Faster recovery and reducing downtime for customers
Prepositioned Equipment and Supplies	▪ Prepositioning at strategic locations for expedite response and restoration efforts following disasters

- ✓ Building resilience
- ✓ Reducing vulnerability
- ✓ Enhancing the reliability
- ✓ Better prepared for response and recovery from disasters
- ✓ Safeguarding critical infrastructure against the impacts of extreme events

Undergrounding Distribution Lines

Major cause of damage to overhead distribution lines

Cyclonic wind speed exceed the wind speed for which towers/ poles are designed

Need for Underground Cables

Underground cables eliminates impact of high wind and direct lightning strikes

Overhead lines are preferred to Underground Cables

Ease of operation & maintenance

Ease of identification of faults

Less time for rectification of faults

Less initial cost as compared to underground cable system

UG : 3 to 5 times more estimated cost

Underground cable cost > 3 to 5 times of Overhead lines (for same voltage & distance)

Way Forward

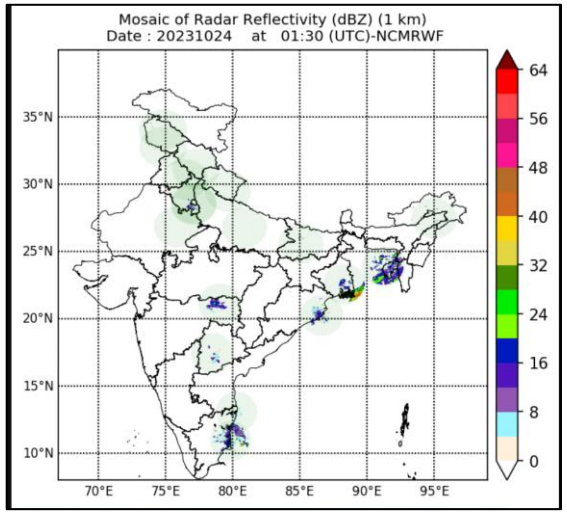
For uninterrupted power supply during cyclone or natural disasters

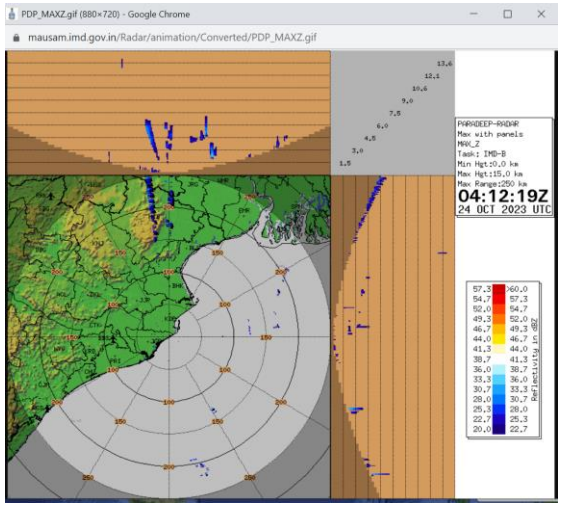
- 33kV and 11kV lines should be planned for underground cable system within 20km from coast line
- Critical links like hospitals, water supply system may be considered with (N-1) contingency level

Mix of network maintained as per specific site requirements

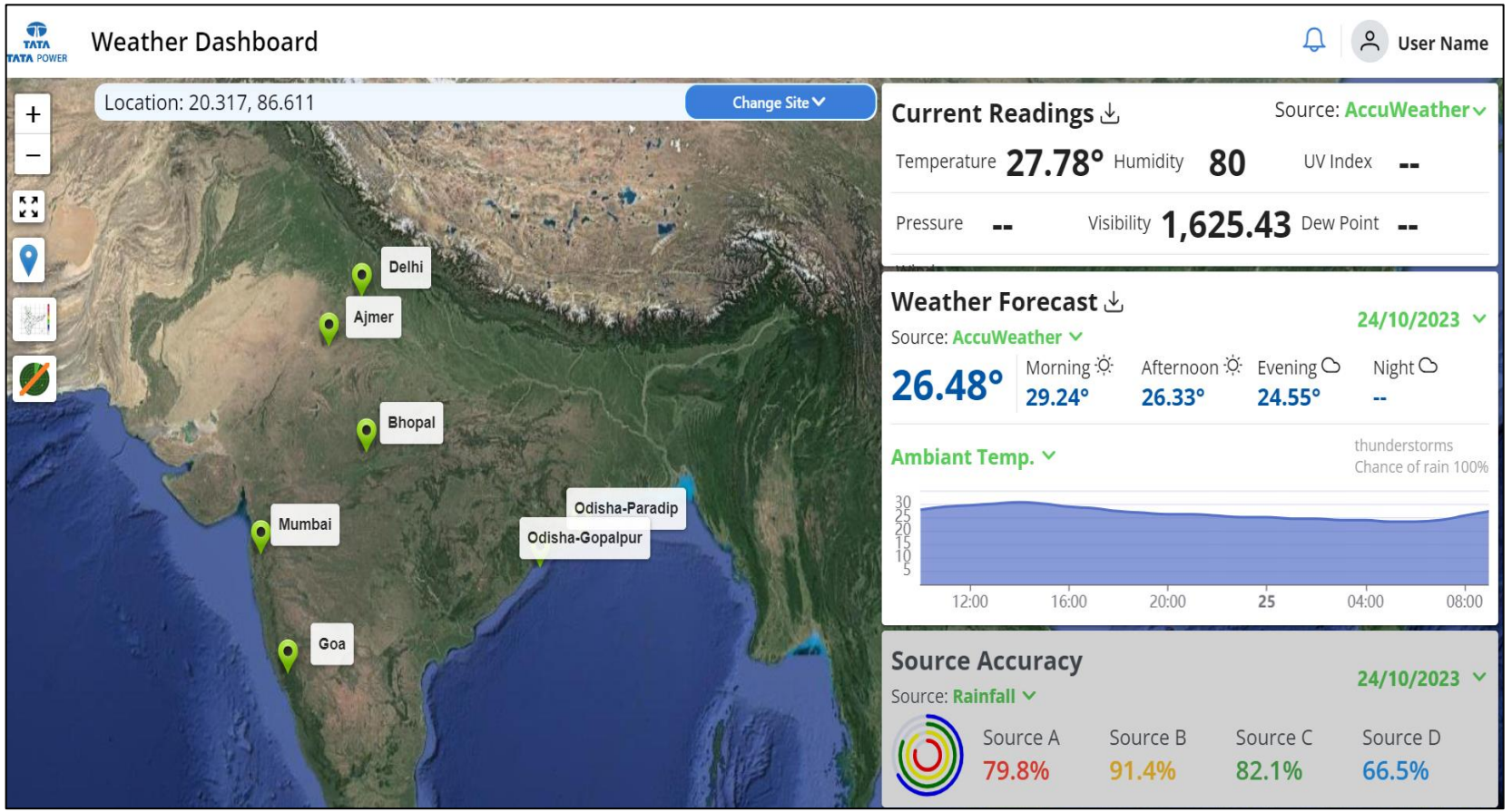
Advance Weather Forecasting: In-house Weather Dashboard

PAN India Live Weather Changes RADAR



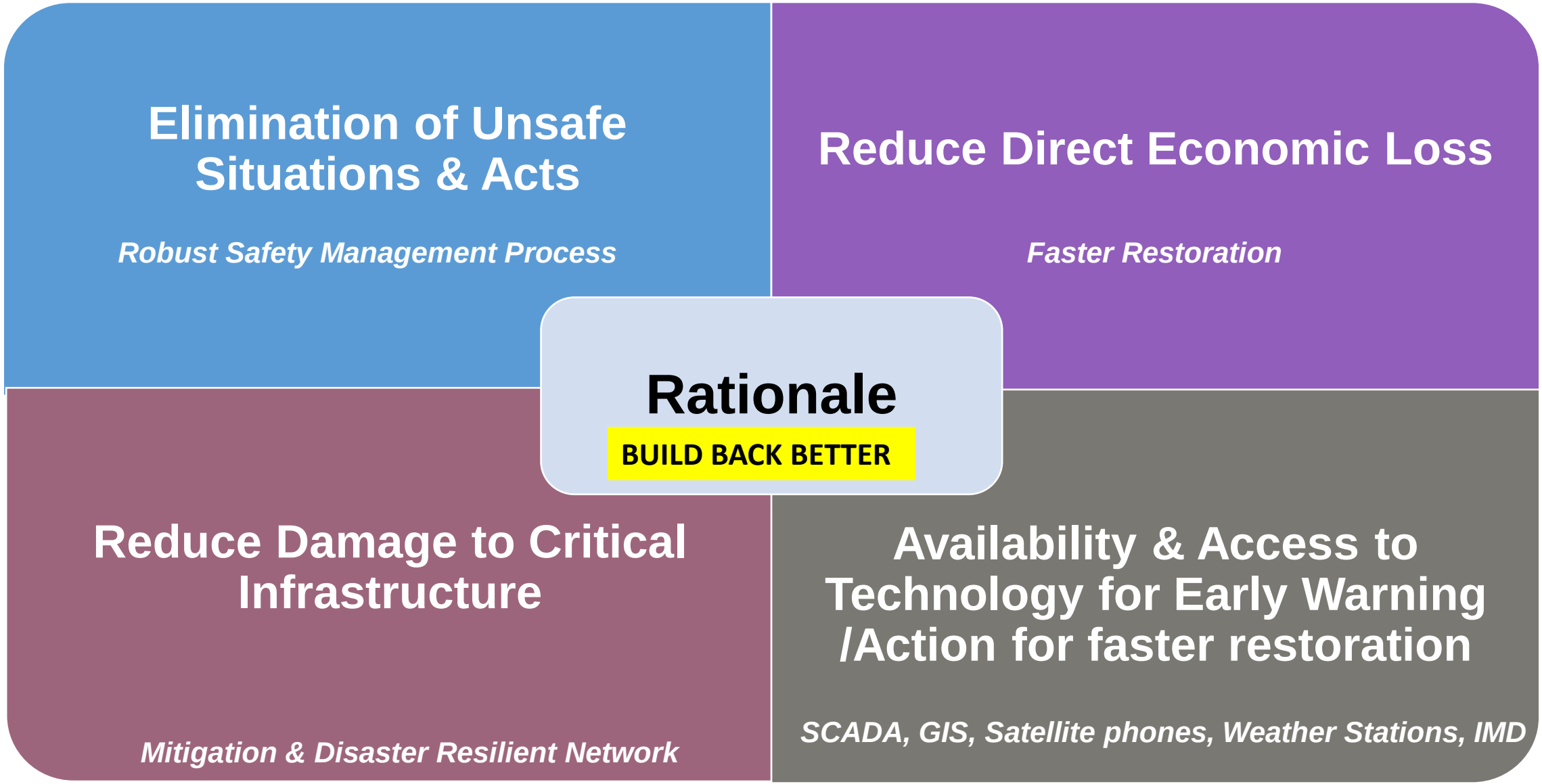


Specific Radar covering 200-350 KM radius to monitor weather conditions

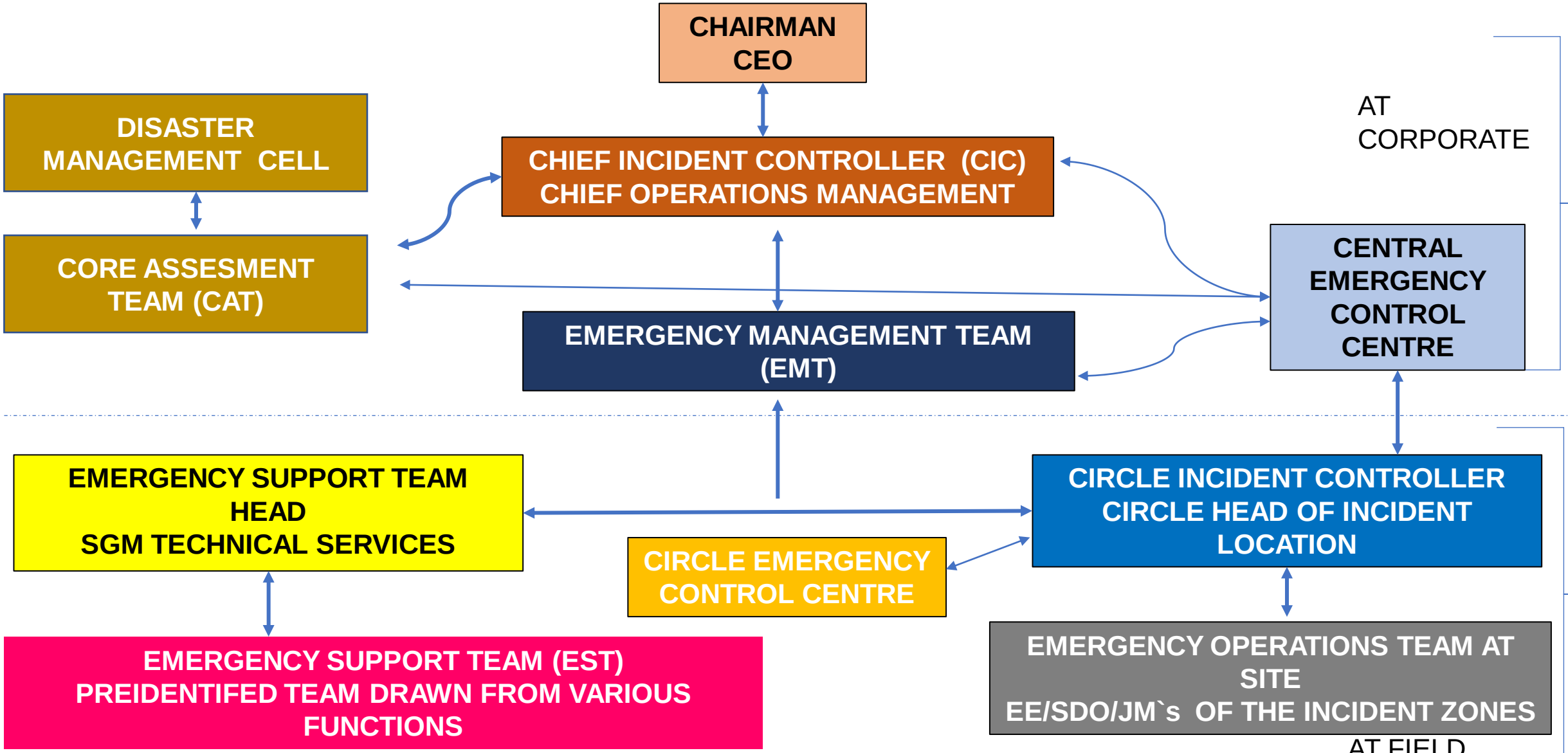


- In-house weather Portal for real time weather monitoring & warning is under development
- Installation of weather stations at Strategic locations across the discom area and establishing connectivity of all field devices to a central server where all weather data can be stored
- 7 Locations have been identified for dedicated weather stations in TPCODL area for predicting disasters

Emergency Plans-Basis for Disaster Management



Emergency Plans-Disaster Management Structure at TPCODL



Emergency Plans- Institutional Structure

DISASTER MANAGEMENT CELL

- CHIEF INCIDENT CONTROLLER
- CORE ASSESMENT TEAM
- EMERGENCY MANAGEMENT TEAM
- EMERGENCY SUPPORT TEAM
- CIRCLE INCIDENT CONTROLLERS
- CENTRAL EMERGENCY CONTROL CENTRE
- CIRCLE EMERGENCY CONTROL CENTRE

- ✓ EMERGENCY RESTORATION SYSTEMS
- ✓ EMERGENCY STORES WITH PREIDENTIFED INVENTORY
- ✓ DISASTER T&P
- ✓ NORMAL & ALTERNATE LOCATIONS FOR CONTROL CENTRES
- ✓ COMMUNICATION PLAN FOR CONSUMERS
- ✓ TRANSPORATATION ,STAY,FOOD ,MEDICAL ,SECURITY INCHARGES FOR EACH CIRCLE
- ✓ ENGAGEMENT OF LOCAL SKILLED AND UNSKILLED WORKFORCE
- ✓ TIE UP WITH VARIOUS BUSINESS ASSOCIATES
- ✓ ARRANGEMENT FOR MANPOWER FROM OTHER DISCOMS FOR COORDINATED AND COLLABORATIVE EFFORTS

Emergency Plans-Technology As A Enabler

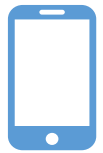
Communications Technology - IT, GIS, Early Warning Systems, Efficient Information Dissemination, Digital Command Centre

Power System Control Centre (PSCC) - Centralized Monitoring & Control of Power Supply across the Discom. It also acts as Central Emergency Control Centre (CECC) during Disasters

Supervisory Control & Data Acquisition System (SCADA) - Real Time Visibility and Control of the Network

Weather Stations - Integration of Weather Stations to SCADA for Weather Info

Geographical Information System (GIS) - Mapping of Electrical Assets on Geographical Land base, Optimum Placement of Crew, Damage Assessment. Integration of GIS with Weather Information for Real Time Visibility of Area Affected



Satellite Phones - At Critical Locations for uninterrupted Communication

SAP CRM - For Customer Information and Customer Management

Emergency Plans-Technology As A Enabler - SCADA-Real Time Monitoring

India SMART UTILITY Week 2024 | ISGF India Smart Grid Forum

BCDD-1 (MW) **27.86MW**

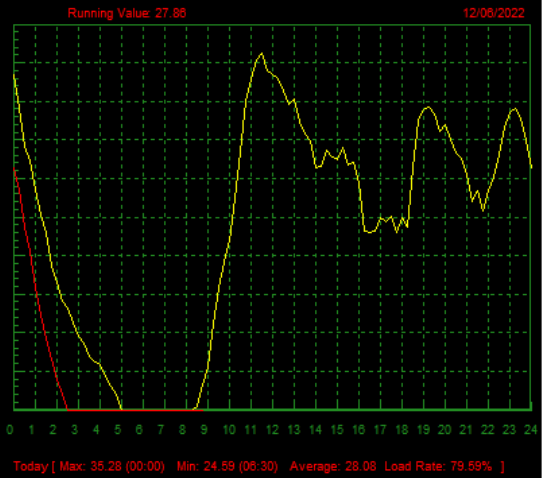
KALABAISAKHI -BCDD-1

TPCODL
TP CENTRAL ODISHA DISTRIBUTION LIMITED

PSS Name	33kV INC	PTR 11kV INC	11kV FDR	Amp (Y-Ph)	Priority Consumer
Airport	Unit-6	PTR-1	Palaspalii	6.00	1488
			Ganga Nagar	48.00	1265
	RMU	PTR-2	JP RMU F-34	0.00	1
			F-4 Airport	60.00	
Board Colony	INC-1 (FDR-3)	PTR-1	BM RMU_2	27.20	745
			BM RMU-1	49.00	1265
			SM RMU-1	38.80	984
			Flat Unit-9	2.40	
			Gridco Colony	15.00	1345
		PTR-2	JP RMU-36	16.20	
			JP RMU-37	15.00	2364
			SM RMU-2	33.60	462
Delta	(Unit8/Baramunda)	PTR-1	Fire Station	72.00	1765
			Satabdi Nagara	49.60	1443
		PTR-2	Siripur	63.60	1835
Saheed Nagar	Manch FDR-3	PTR-1	JP RMU-2	21.00	1
			F-2 Feeder -3	65.10	
			F-3 Feeder -1	65.50	
	Manch FDR-4	PTR-2	F-4 Feeder -2	50.00	
			F-5 Feeder -4	10.70	
	Rasulgarh(9 pole)		F-6 JP RMU_	13.30	2
			F-7 JP RMU_3	25.00	1
Satya Nagar	(Satyanagar RMU)	PTR-1	JP RMU_14	33.50	708
			F-2 Rahul CO	6.30	162
			F-3 Press	2.90	1036
			JP RMU -13	14.00	346
	(Unit-3 satyanagar OG)	PTR-2	F-5 Plaza	12.70	
			F-6 Satyanagar	44.40	
			F-7 JP RMU-46	22.80	575
			F-8 JP RMU-45	40.00	192
Unit-2	(IG Park)	PTR-1	Market Building	20.04	1050
			Ashok Nagar	47.04	
	(Unit-2 RMu)	PTR-2	Suchana Bhawan	65.04	150
			Janpath	29.04	

PSS Name	33kV INC	PTR 11kV INC	11kV FDR	Amp (Y-Ph)	
Unit-3	KharabelaNagar	PTR-1	RMU SM-5	0.00	
			RMU JP-41	6.90	856
			UNIT-3	39.40	1241
		PTR-2	Maa Giri Durga	14.50	805
			UNIT-2	11.10	459
			RMU JP-42	51.00	1254
			RMU SM-4	22.10	1
Unit-4	SainikSchool	PTR-1	RMU-7	19.20	297
			RMU-23	23.70	314
			RMU-5	27.00	1665
			RMU-6 MS NAGAR	32.20	917
	Unit-6/ Unit2	PTR-2	Sashtri Nagar	0.00	
			RMU-22	7.70	600
			RMU-14	10.30	1
			RMU-15	11.00	625
Unit-6	Unit8 GIS -Unit6/2	PTR-1	Spring Tank	33.50	934
			Medical	15.60	1600
			Unit-1	24.50	1517
	Unit8 GIS -Unit6/1		RMU-7	0.00	178
			RMU-16	0.00	565
	Unit-4/Unit-2	PTR-1	RMU-19	5.90	435
			RMU-8	12.50	438
			Bapuji Nagar	65.20	
			Forest Park	38.80	1142
			Unit-6	15.30	
Unit-8	Chandka 2	PTR-1	Unit-5	9.00	331
			Rajbhawan	1.40	2
	Chandka 1		O.E.R.C	64.60	
			C.B.I	89.20	
	Secretariet-2		Delta	4.00	598
		PTR-2	Assembly	15.60	90
			O,U.A.T	76.00	
	Secretariet-1	PTR-3	Telephone	10.00	809
			Ashok Nagar	12.80	1082
			G.B Nagar	64.80	2913

	TOTAL	IN SERVICE	OUT OF SERVICE
33kV LINES	28	20	8
11kV I/C	21	21	0
11kV FDR	68	67	1



Home

BCDD-2 BED

LEGENDS

11kV FEEDER(LEAST)

11kV FEEDER(MID)

11kV FEEDER(HIGH)

33kV FEEDER(NORMAL FED)

Emergency Plans-Technology As A Enabler - SCADA-Real Time Monitoring

India SMART UTILITY Week 2024

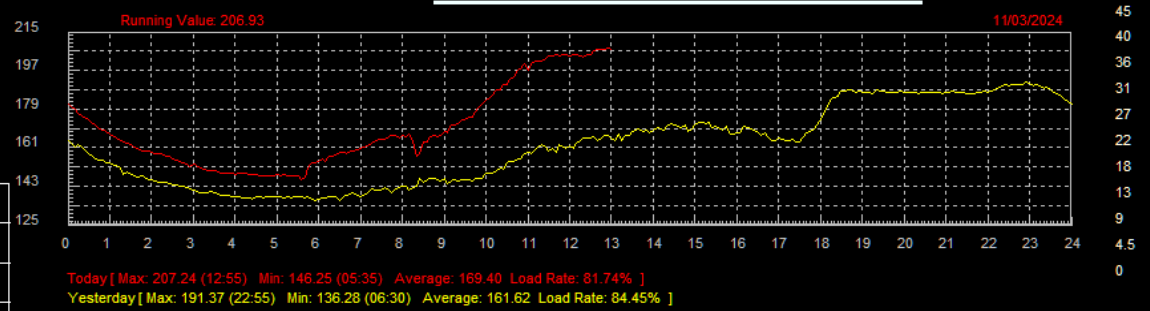
ISGF India Smart Grid Forum

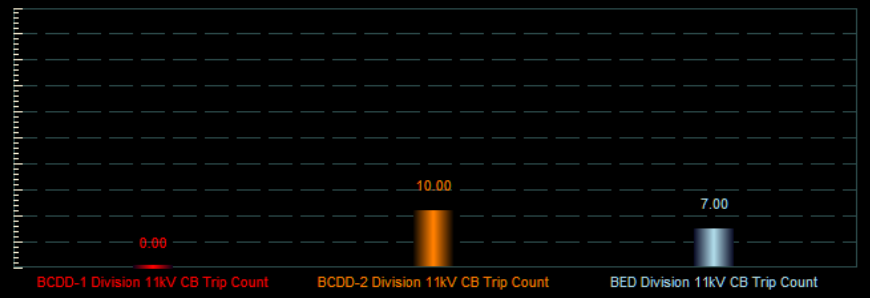
TPCODL
TP CENTRAL ODISHA DISTRIBUTION LIMITED
(A Tata Power and Odisha Government Joint Venture)

BBSR CITY OUTAGE DATA

TOTAL MW	206.93
TOTAL Mvar	51.27
FREQUENCY	50.09

Feeder	System	33kV	11kV
Count	583	222	361
CB Out of Service	62	38	24
CB IN Service	521	184	337





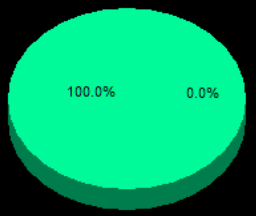
BCDD-1 Division

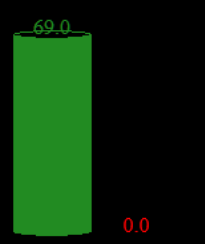
LOAD		Count	BCDD-1 TOTAL	33kV INC	33kV TRF	11kV INC	11kV FDR
Net MW	46.89	CB Out of Service	11	11	0	0	0
Net MVAr	8.10	CB IN Service	129	18	21	21	69

11kV FDR CB Out of Service Lists

Prev Page | Next Page | Objects(0)

	Description	Value





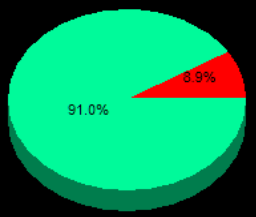
BCDD-2 Division

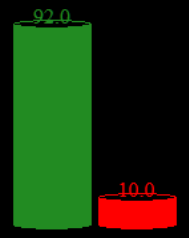
LOAD		Count	BCDD-2 TOTAL	33kV INC	33kV TRF	11kV INC	11kV FDR
Net MW	76.98	CB Out of Service	33	14	4	5	10
Net MVAr	20.50	CB IN Service	231	37	51	51	92

11kV FDR CB Out of Service Lists

Prev Page | Next Page | Objects(0)

	Description	Value
1	Dumduma 11kV HousingBoard CB	Open
2	Infocity 11kV Rajvatika CB	Open
3	Infocity 11kV Infocity CB	Open
4	Khandagiri 11kV JagmohanNagar CB	Open





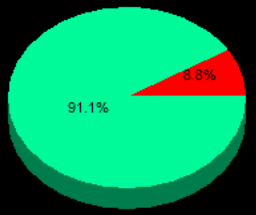
BED Division

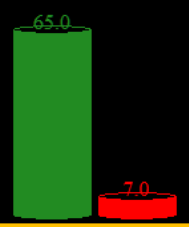
LOAD		Count	BCDD-2 TOTAL	33kV INC	33kV TRF	11kV INC	11kV FDR
Net MW	83.06	CB Out of Service	18	8	1	2	7
Net MVAr	22.67	CB IN Service	161	21	36	39	65

11kV FDR CB Out of Service Lists

Prev Page | Next Page | Objects(0)

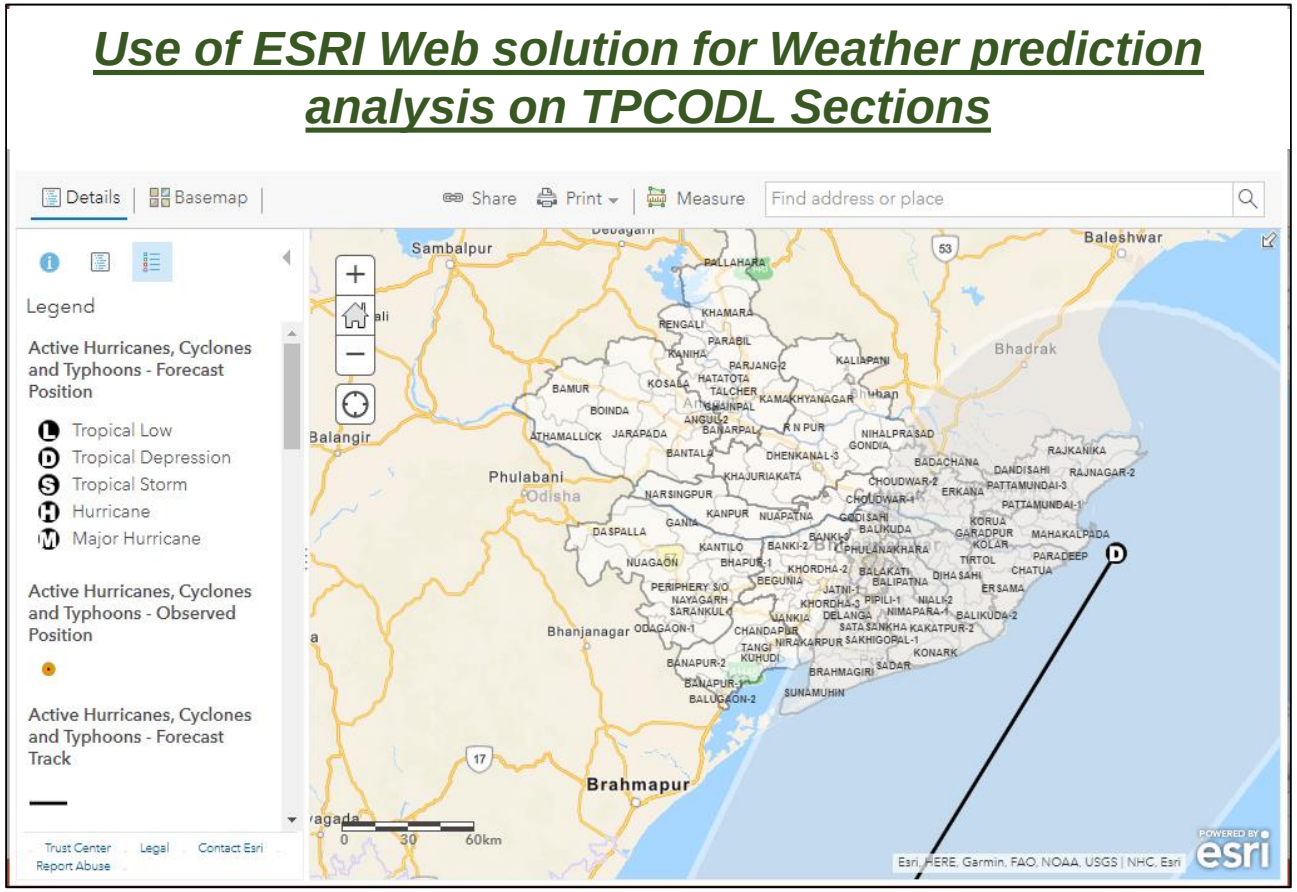
	Description	Value
1	Laxmi 11kV RMU 16 CB	Open
2	Laxmi 11kV RMU 14Kalpana1 CB	Open
3	Laxmi 11kV RMU 6 CB	Open
4	LINGIPUR 11kV KUAKHAI CB	Open

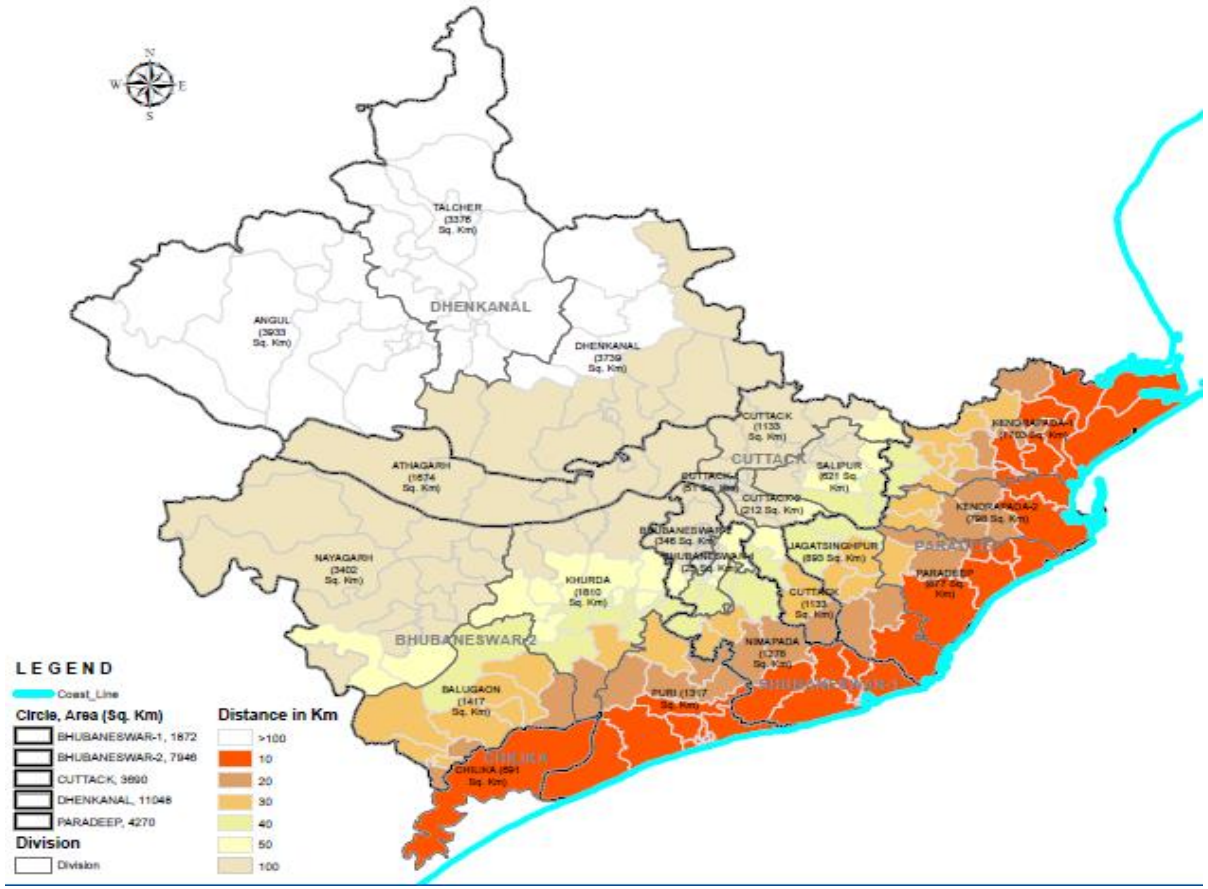




Emergency Plans-Men & Material Deployment using GIS

Use of ESRI Web solution for Weather prediction analysis on TPCODL Sections





Leveraging web based solution for likely to be affected sections on GIS platform for better Men & Material Deployment.

1. Basis on the alert and trajectory shared on the weather web plugin, highlight the likely to be affected sections.
2. Using the distance of the section from the coast line and estimated wind speed, plot the severity of the impact on the GIS
3. Deploy the Men & Material as per the severity of the impact in the identified sections.

Investment in Emergency Equipment and Reserves

Rs. 135 Cr

All 4 Discoms

For maintaining inventory for materials for restoration of distribution network during natural disasters

Inventory to be located

TPWODL

Plan for cyclical stock build up at strategic location – Due to Low incidences of Cyclones at TPWODL

THANK YOU

For discussions/suggestions/queries email: ***isuw@isuw.in***

visit: www.isuw.in

Links/References (If any)