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DISTRIBUTION UTILITY MEET DUM 2023

Session 5

Disaster Management and Climate Readiness of Utilities

Presented By

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INTRODUCTION

Power Sector is one of the most important infrastructure of the country, as growth of this sector is directly correlated with the economic growth of the country. Any disruption in Power Sector due to Crisis / Disaster creates hardship to the human beings, as every aspect of human life is directly or indirectly associated with the electricity.

Odisha Scenario:

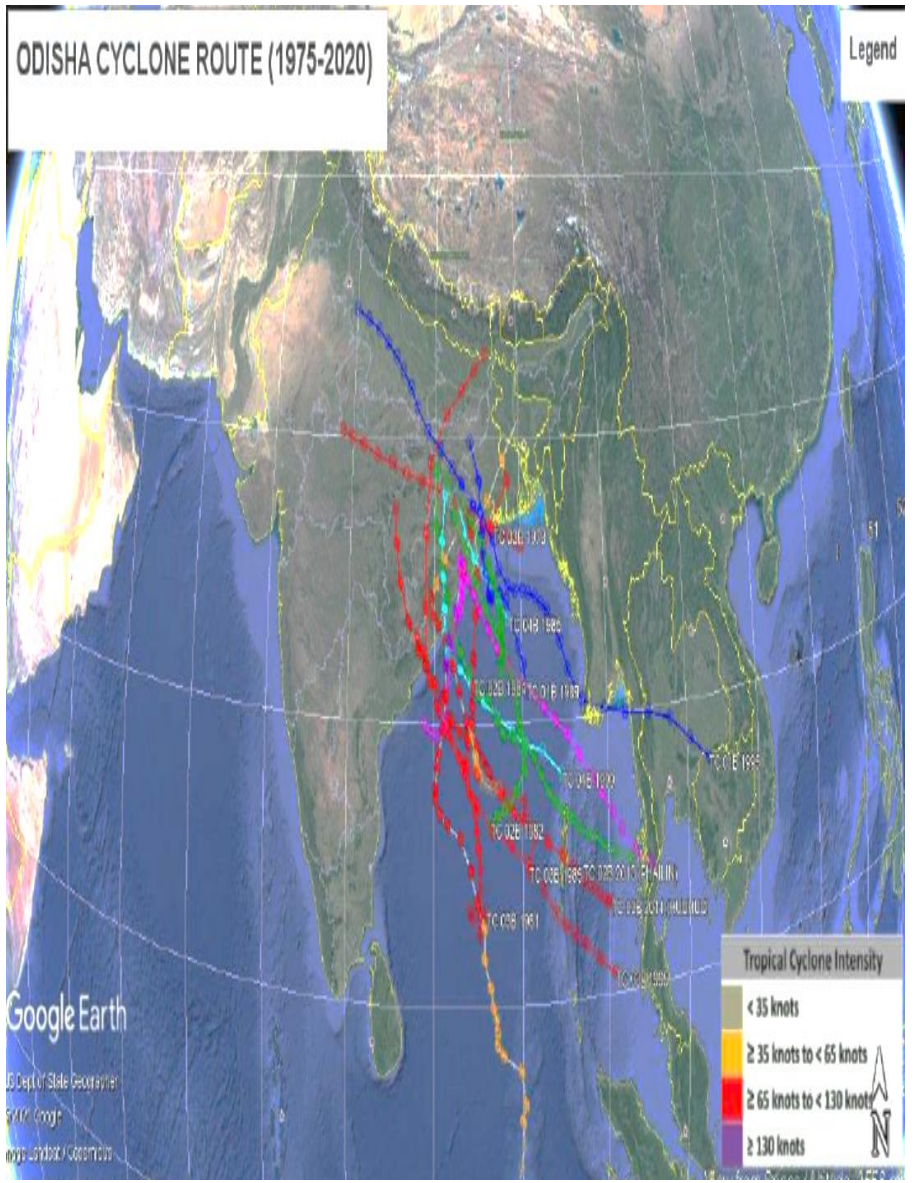
- The power distribution network is *dense in the coastal as well as Industrial Belts*
- It is evident that the costal infrastructure is prone to adverse weather conditions.
- The Lightening is prudent and results to failure of assets.

Lets have a look at ..how network is exposed to risk for any disaster, be it Cyclone, flood, lightening etc

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

CYCLONE's in Last decade

S. No	Name of Cyclone	Date	States Affected	Severity Class
1	Sitrang	October, 2022	Odisha, West Bengal	Tropical Storm
2	Asani	May, 2022	Andhra Pradesh, Odisha	Severe Cyclonic Storm
3	Jawad	December, 2021	Andhra Pradesh, Odisha and West Bengal	Cyclonic Storm
4	Gulab	September, 2021	Andhra Pradesh and Odisha	Severe Cyclone
5	Yaas	May, 2021	Odisha and West Bengal	Very Severe Cyclonic Storm
6	Nivar	November, 2020	Tamil Nadu, Andhra Pradesh & Puduchery	
7	Nisarga	June, 2020	Maharastra	Severe Cyclonic Storm
8	Amphan	May, 2020	Odisha, West Bengal & Andmans Island	Super Cyclonic Storm
9	Bulbul	November, 2019	Odisha & West Bengal	Very Severe Cyclonic Storm
10	Fani	May, 2019	Odisha & Andhra Pradesh	Extremely Severe Cyclonic Storm
11	Gaja	November, 2018	Tamil Nadu, Andhra Pradesh & Puduchery	Very Severe Cyclonic Storm
12	Titli	October, 2018	Odisha, Andhra Pradesh and West Bengal	Very Severe Cyclonic Storm
13	Phailin	October, 2014	Andhra pradesh, Orissa, West Bengal, Jharkhand, Chattisgarh	Extremely Severe Cyclonic Storm
14	Hudhud	October, 2013	Andhra Pradesh,Orissa & Andaman & Nicobar Islands	Extremely Severe Cyclonic Storm



Wind Speed Study

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, have been analyzed.
- The distance of the identified TPCODL divisions from the coast with respect to corresponding wind speed intensity, is considered the basis for the Wind zoning classification of the TPCODL distribution area.
- The TPCODL divisions will be classified into the following zones:

a) Very High Intensity wind zone (0 to 60 KM from Coast)

Wind speed 250 to 300kmph

b) High Intensity wind zone (60 to 100 KM from Coast)

Wind speed 200 to 250kmph

c) Moderate Intensity wind zone (100 to 150 KM from Coast)

Wind speed 140 to 200kmph

Distance from Coast Line (km)	Maximum Wind speed recorded in this zone or beyond this zone	Basic Wind Speed (V_b) m/s	Wind Parameters	Design Wind speed (V_d) as per IS 875 Part 3 2015 (kmph)	Remarks
Up-to 10	260	50	k_1=1.08 k_2=1.05 k_3=1.0 k_4=1.3	265.36	
10-20	260	50		265.36	
20-30	260	50	k_1=1.08 k_2=1.05 k_3=1.0 k_4=1.3	265.36	
30-50	260	50		265.36	
50-60	260	50		265.36	
60-70	260	50	k_1=1.08 k_2=1.05 k_3=1.0 k_4=1.0	204.12	V_d < Experienced wind speed
70-100	203	50		204.12	
70-100	203	44		179.63	
100-150	140	50		204.12	
100-150	140	44		179.63	
150-175	100	50		204.12	
150-175	100	44		179.63	
> 175	100	44		179.63	

Network Condition susceptible to Cyclones

TPCODL

Existing Electrical Network and its resiliency

- Existing Distribution Lines and Structures are not designed as per wind
  250 Km/hr.
- Substations are located at low laying areas in coastal region, hence floo
- DP mounted Distribution substations are not designed to withstand wind
- Due to lengthy span, conductor load couple with wind pressure becomes more on the supports
  bending or twisting due to heavy wind pressure.

Whether to go for Resilient and robust network with least damage

Allow damage to some extent and restore the system as early as Possible

Risk to Distribution Utilities

- Reconstruction / rectification of damaged power infra after cyclone is a challenging task.
- Huge funds requirement to bringing back to normal condition within very li
- During restoration period, it is difficult to maintain the quality of work.
- Due to power outage for long period, utilities incur huge revenue loss
- Huge Impact on the economic and emergency activities in addition to pub

Cost associated with each option will be different

Strategic Approach

Preventive and mitigation measures for minimizing the damage to Power Distribution Network:

- Measures to design Cyclone resilient network in all new future construction. Preferred in 1st 20 Km from Coast.
- Retrofitting of existing Distribution network infrastructure to increase their resiliency to Cyclone. Preferred in 20 – 60 Km to optimize the cost of making resilient network.

- In urban areas, 33 kV and 11kV overhead lines should be converted to underground cable system within 20km of coast line in order to provide reliable & uninterruptible power supply during cyclone

- Construction of **Indoor Substation** instead of Outdoor switchyard arrangement.

- Splitting of Larger network sections into the smaller section to ensure faster restoration.

- **Refurbishment of existing lines by use of rail poles / joist / Spun Poles** and introduction of additional poles in between span to strengthening the existing line should be taken up.

- Sufficient Stock of **Mobile Substations** to restore the Power supply in case of massive damage

Flood – Preparedness and Response

The river system of Odisha comprises of nine major river systems and their tributaries and distributaries. Monsoon season witnessed spates of heavy to very heavy rainfall in different parts of the Odisha State. Heavy rainfall in the upstream catchment area and in downstream area of river caused flood in Odisha state.

Design Approach

- All electrical equipment to be installed at place higher than the HFL.
- Distribution Transformers to be installed on elevated plinth
- Substation to be constructed above the road level and with proper drainage system.
- Appropriate grade of concreting to be used for construction of Pole and / or tower foundations.

Rebar Lacing Pole - Cyclone Resilient

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.

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

RLP Design: RLP design is very simple. It 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.

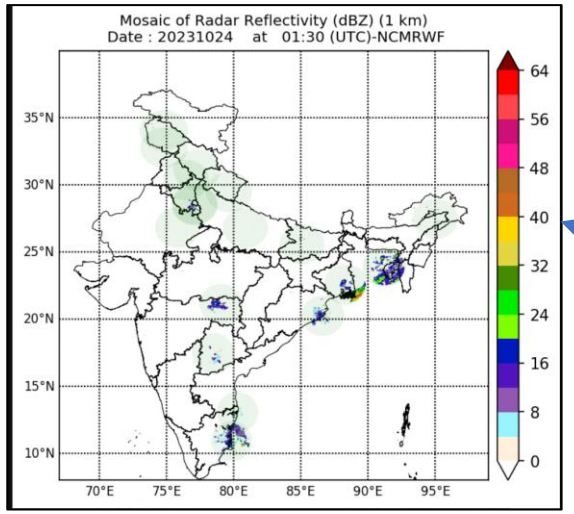
RLP Foundation: Foundation design can be selected based on soil condition. A prefab STUB embedded in foundation & The RLP has detachable bolted connection with the STUB.

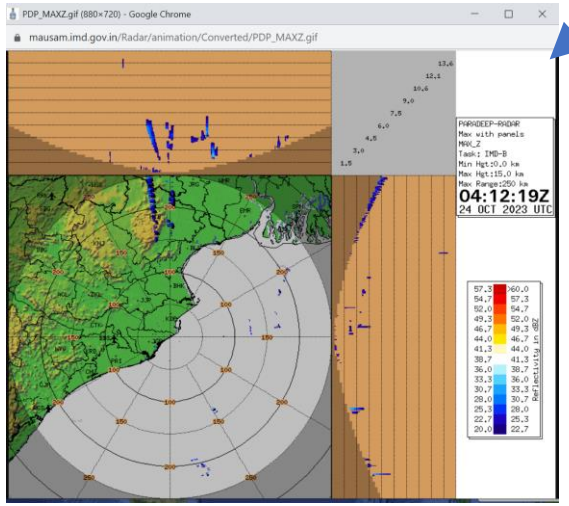
Pilot project near Konark Beach : 1 CKM 11KV Line constructed to test the real field performance in cyclonic conditions.

RLP with CICA : TPCODL has developed low cost Composite Insulated Cross Arm which has been used on RLP & to improve the overall reliability to very high level.

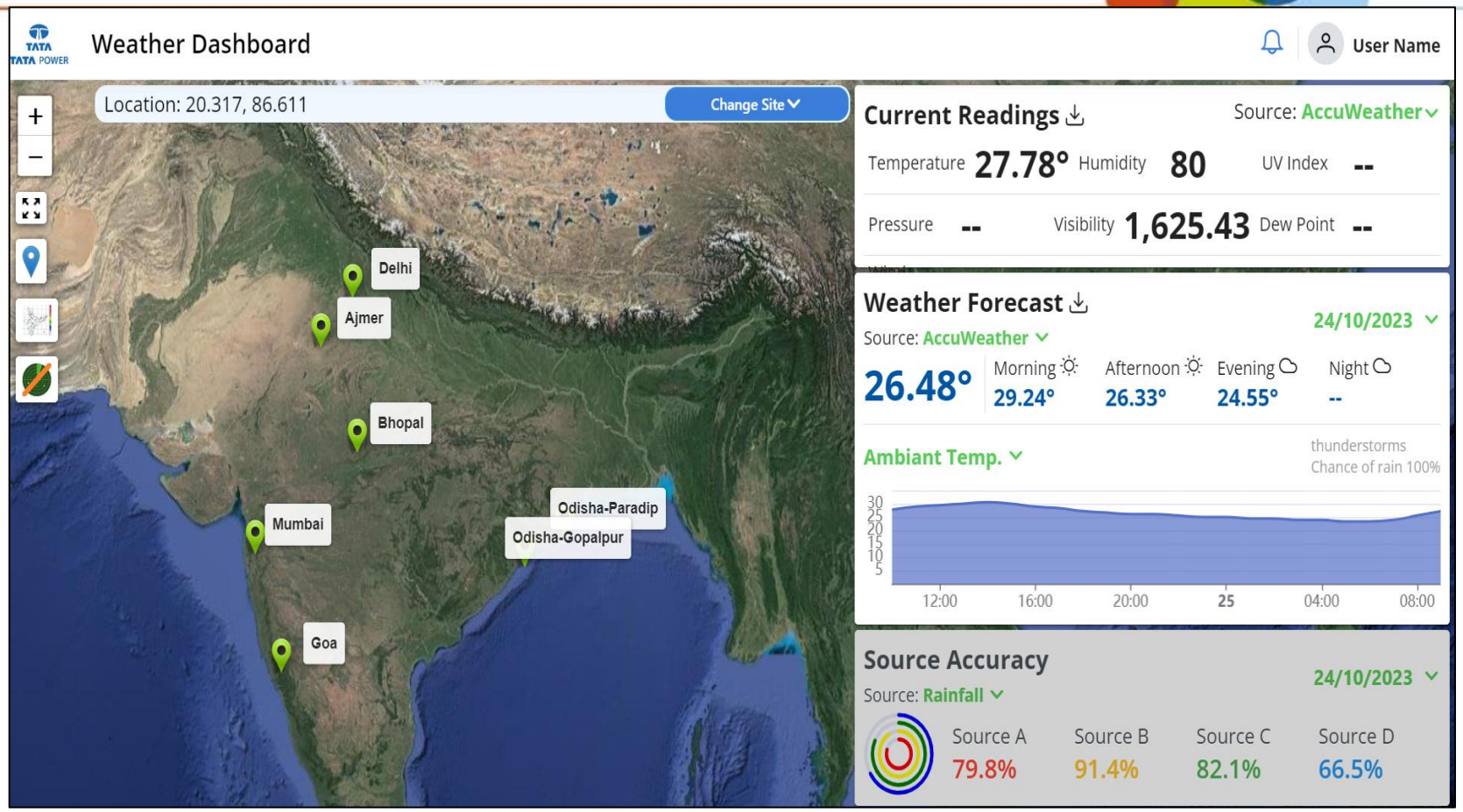
In-house Weather Dashboard

PAN India Live Weather Changes RADAR





Specific Radar which would cover 200-350 KM radius and allow us 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 the weather data can be stored is ultimately envisage

Collaboration & Resource Sharing

- ✓ Composite Centralized & Decentralized Approach with three layered approach of Corporate ,Central & Field over a vast geography of 30 ,000 Sq. km .
- ✓ Formal Structure for Pre ,During & Post Disaster Mgmt. .i.e.. Core Assessment Cell ,Disaster Mgmt. Cell , Emergency Mgmt. Team ,Emergency Support Team ,Central Emergency Control Centre ,Circle Emergency Control Centre which works in close coordination.
- ✓ Well defined Information Flow for Internal & External Stakeholders
- ✓ Emergency Restoration System on Standby
- ✓ Emergency Locational Stores
- ✓ Early Warning Systems in terms of Weather Stations integrated to SCADA , IMD Forecast streaming
- ✓ Satellite Phones at Critical Locations
- ✓ Detailed Action Plan with responsibilities as per the Level of Disaster for all types of Natural / Other Calamities

KEY TAKEAWAYS / RECOMMENDATIONS

Based on the analysis and failure assessment, it can be concluded that distribution network near the coastline are presently not fully cyclone resilient across the country and it require major upgradation to become disaster resilient.

- The zone of first 20 km from coastline is most vulnerable to cyclone damages and should be prioritized for upgradation.
- For the second zone i.e., 20-70 km from coastline we may consider both retrofit/strengthening and new design solutions based on residual life assessment
- For Flood prone areas, Structures to be kept above HFL in the area.
- For urban and semi-urban areas, under-ground cables should be adopted wherever techno-commercially feasible.
- Detailed climate studies and simulation studies can be taken-up in collaboration with government agencies as a long-term risk analysis strategy.

THANK YOU

For discussions/suggestions/queries email: ***dum@indiasmartgrid.org***

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Links/References (If any)