Rural Digital Substation (RDS)

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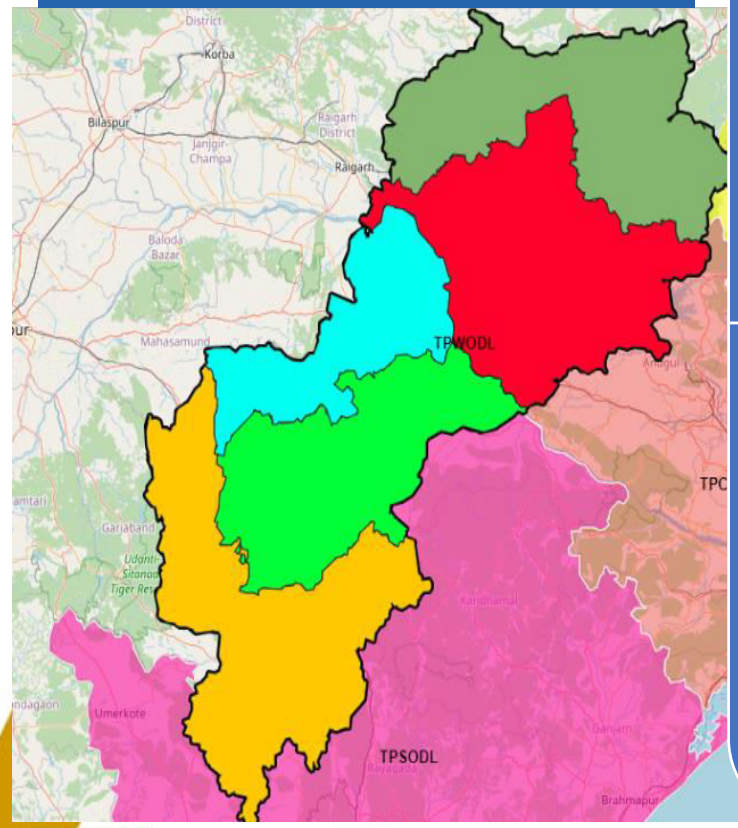
Introduction

TPWODL
TP WESTERN ODISHA DISTRIBUTION LIMITED
(A Tata Power and Odisha Government Joint Venture)



- 88 lakh Population Served
- 48373 Sq. Kms of Distribution Area
- 21.42 lakh Customer Base
- Reliability improvement: One of the key KPI

TPWODL – PPP between Tata Power & Govt. of Odisha

Context

Reliability improvement requires modernization of substations for better monitoring & control

Current condition of Primary Substation (PSS)

Cable Trench

Control Room

Old CRP's

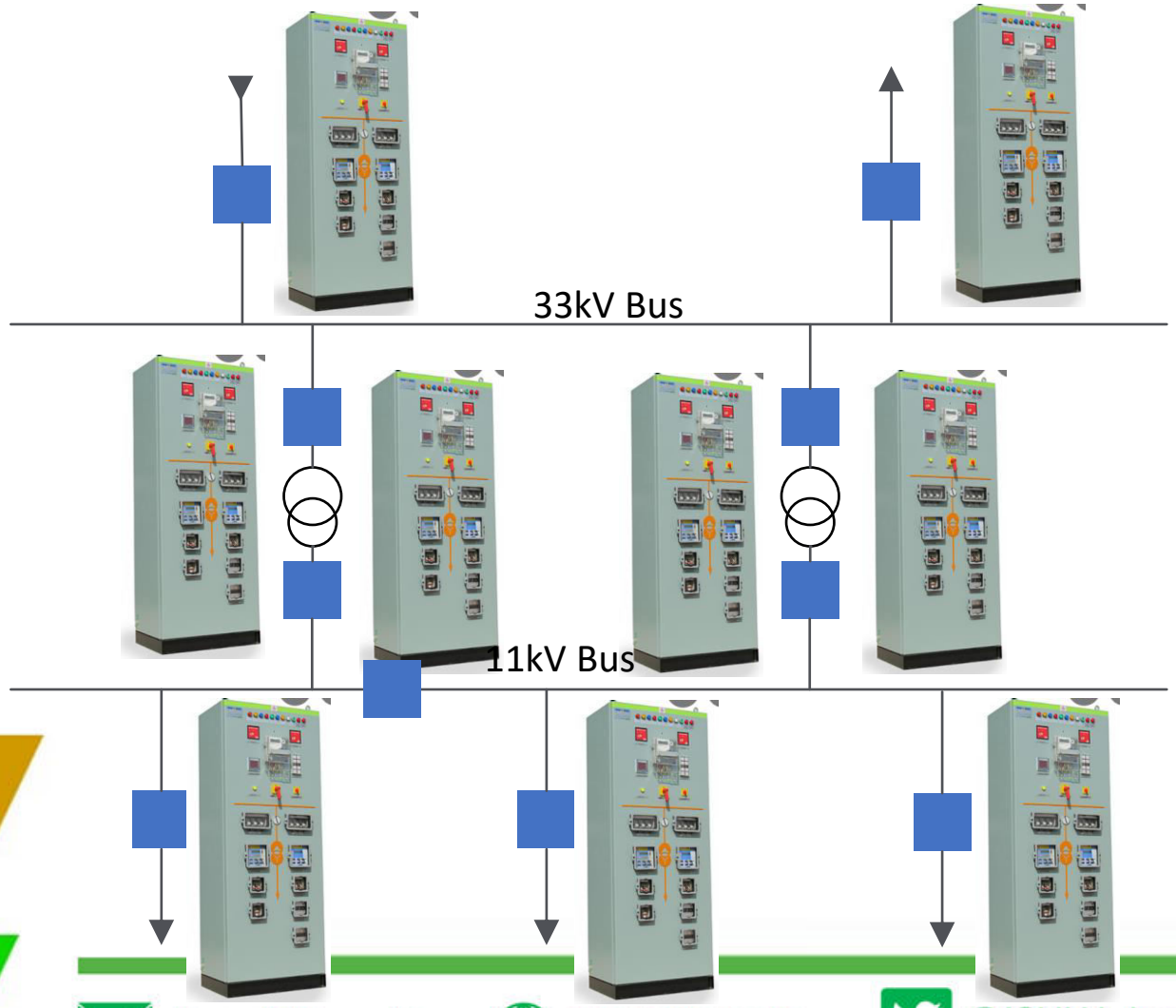
Cables Condition

Challenges in PSS modernization

- Substation Infrastructure is old
  - Control Cables
  - Protection System(Electro-mechanical Relays, etc.)
  - Civil Work (Trench, Control Room, etc.)
  - Space crunch in control room
- High turn around time to execute modification through regular RTU and Indoor Control Relay Panel (CRP) based automation
- Multiple outages of long durations & no data available for analysis at central location

Conventional CRP based SAS

33kV & 11kV Outdoor Breaker with Indoor CRP Panels



Control Room

Concept Rural Digital SS

CAT 6 cable laid in HDPE Pipe

Micro CRP will be installed on CB Structure

TRF-DIFF

TRF-DIFF

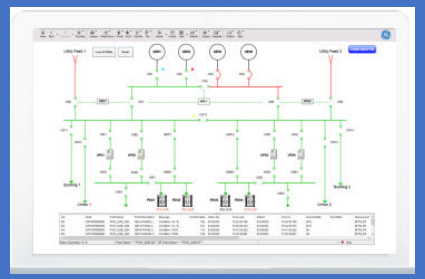
Dedicated Transformer Differential Protection relay

IEC 61850

Control Room

Remote Terminal Unit

HMI for operator



A **micro CRP Outdoor panel** with BCPU to Manage Feeder Monitoring, Control, Protection & Metering by **directly installing at FEEDER in SS**

Comparison Conventional Vs RDS

For calculation purpose, below parameter considered,

- 33kV/11kV PSS
- 2 Nos. 33kV line
- 2 Nos. 33kV HT breakers, 2 Nos. 11kV Incomer breakers
- 4 Nos. Outgoing feeders
- 2 Nos. Power Transformer (PTR)

- Total Time reduction in modernization: **1/10 of conventional approach**
- Total cost reduction in modernization: **62.8 % of conventional approach**

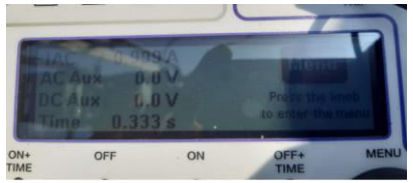
Attributes	Conventional Approach			Rurl Digital Substation (RDS)		
	Time in days	Approx. Cost (Lakhs)	Remarks	Time in days	Approx. Cost (Lakhs)	Remarks
Transportation of Panels from Store	3	1.5	Cost of transportation, services loading & unloading	2	1	Cost of transportation, services loading & unloading
ITC for 10 Panels	30	2.5	3 days per feeder and availability of outages	3	1	3 hours per feeder and availability of outages
Total Outages	3.3	4	4 hours per feeder	0.83	1	2 hours per feeder
CRP Feeder		21	CRP for 7 feeder protn.		10.5	CRP for 7 feeder protn.
CRP TRAFO.		10	CRP for 2 Trafo. protn.		6	CRP for 2 Trafo. protn.
Copper cables	5	14.4	60 meter distance from bay to CRP for CT, PT, Control, AC, DC cables	1	5.1	60 meter distance from bay to Control room for AC, DC, CAT6 cables 10 meter for control cable from CB, CT, PT to CRP
Size: Control room	90	30	3000 Sqft construction	30	10	1000 Sqft construction
Cable Trench	45	15	600 mt. per PSS	2	2	170 mt. HDPE Pipe/PSS
Vermin Proofing	2	0.05	For complete PSS	0	0	For complete PSS
Total (if control room is ready)	**Max 30 days**	**98.45**		**Max 3 days**	**36.6**	

* This data is caluculated based on current conditions and skills of TPWODL, this may vary utility to utility

Execution at 33/11kV Attabira PSS

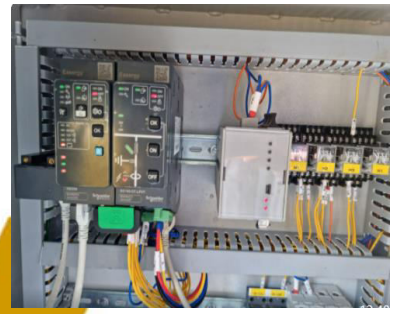
Following activities have been carried out while working on Feeder SITC

Installation of micro CRP panel below outdoor Circuit Breaker

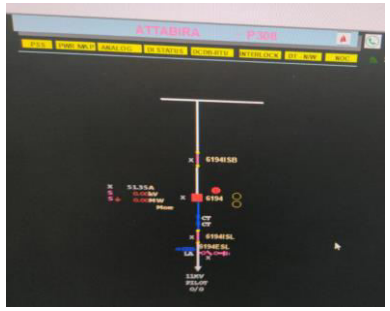


Testing of Protection functionalities

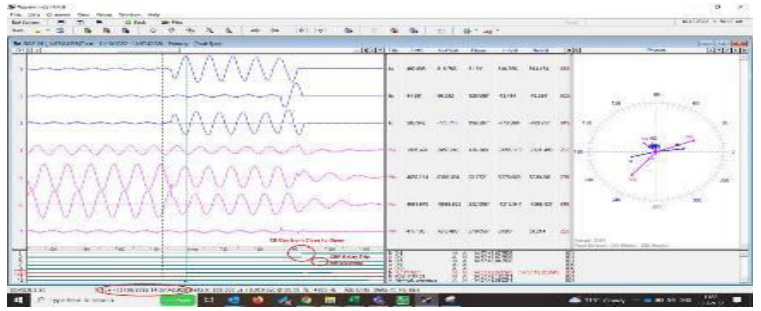
SCADA Event List



Termination of control signals, Aux Supply, CT and PT cables

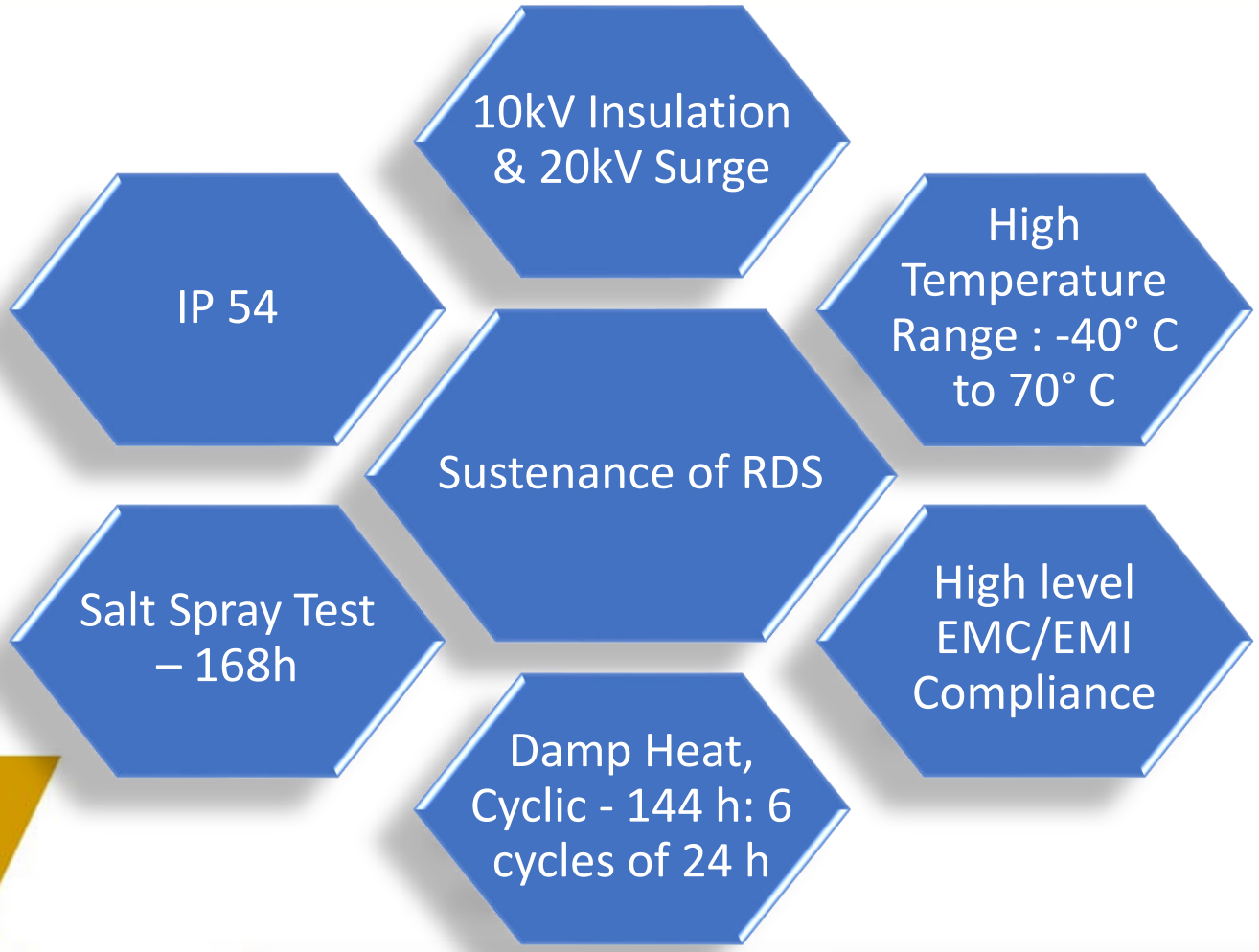


Point to Point testing with SCADA



Disturbance Record

Sustenance & Way ahead



Way Ahead

Idea 1: Digital Breaker
Fixing micro CRP adjacent to CB mechanism

Idea 2: Micro CRP using Fiber reinforced polymers (FRP) material
Use of Fiber reinforced polymers (FRP) box to avoid all environmental challenges

Benefits & Recommendations

To consumers

To utility:

To nation

To environment

Appreciation mail from OEM on Idea

From: Sachin Subhash PATIL <sachin.patil@se.com>
Sent: Friday, February 10, 2023 3:50:04 PM
To: Ganesh Mane <ganesh.mane@tpwesternodisha.com>
Cc: Ruchir Somani <ruchir.somani@se.com>
Subject: Rural Distribution Substation Support

Dear Ganeshji,

We thank you for your whole hearted support to make this project in reality.

We have received valuable inputs from you which helped us to fulfil requirement & optimise the solution.

These products are with us from three to four years , but the ideas which you poured helped us to use these solution for overall benefits of both the organisation.

These ideas are benefited in large extend to reduce cables , faster execution etc..

Looking forward for your guidance always to create a new solutions and reduce the pain points at site.

Regards,

Sachin

18:33

Synopsis got accepted in CIGRE-23

Scalability:

From: cigre2023@jtb.com <cigre2023@jtb.com>
Sent: 13 January 2023 13:35
To: Ganesh Mane <ganesh.mane@tpwesternodisha.com>
Subject: (Sendai Colloquium 2023) Notification of peer review results

Thank you for your contribution. We accept your synopsis.

Please prepare the full paper referring to the full paper template and instructions, which will be published on the Sendai Colloquium Web site around January 20th, and upload it to AMARYS by May 26th.

The reviewers' comments on your synopsis can be viewed on the My Page of your account.

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Thank You

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

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Links/References (If any)