

# FOUNDATIONAL BLOCKS FOR SMART GRIDS

## DIGITALISATION OF POWER TRANSFORMER MONITORING SYSTEM

**Speaker :**

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*DISTRIBUTION ENGINEER (MAINS)*

*CESC LIMITED*

# Introduction

**Company name:** CESC Limited

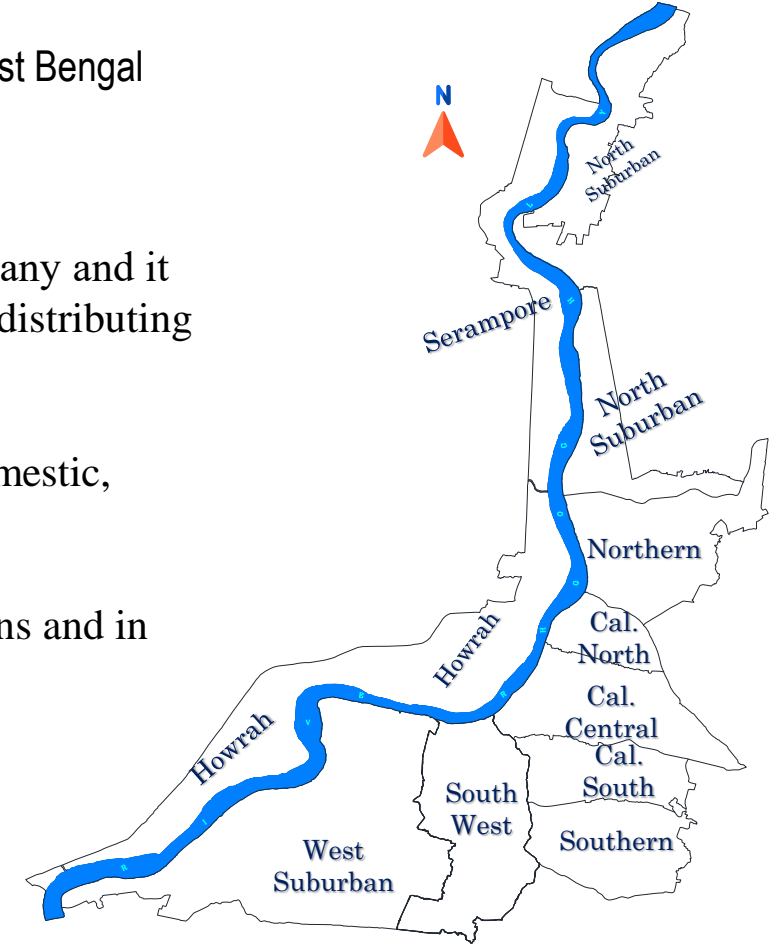
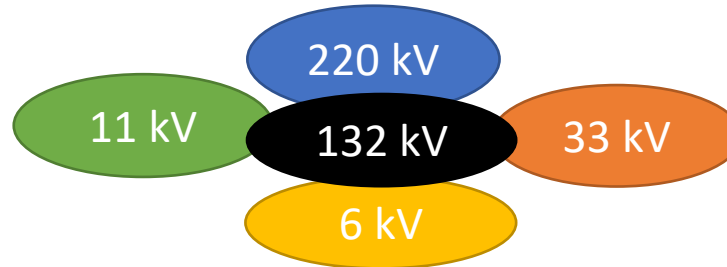
**Scope:** Generation & Distribution of electricity across 567 sq. km in Kolkata & Howrah in West Bengal

**Registered Office:** CESC House, Chowringhee Square, Kolkata - 700001

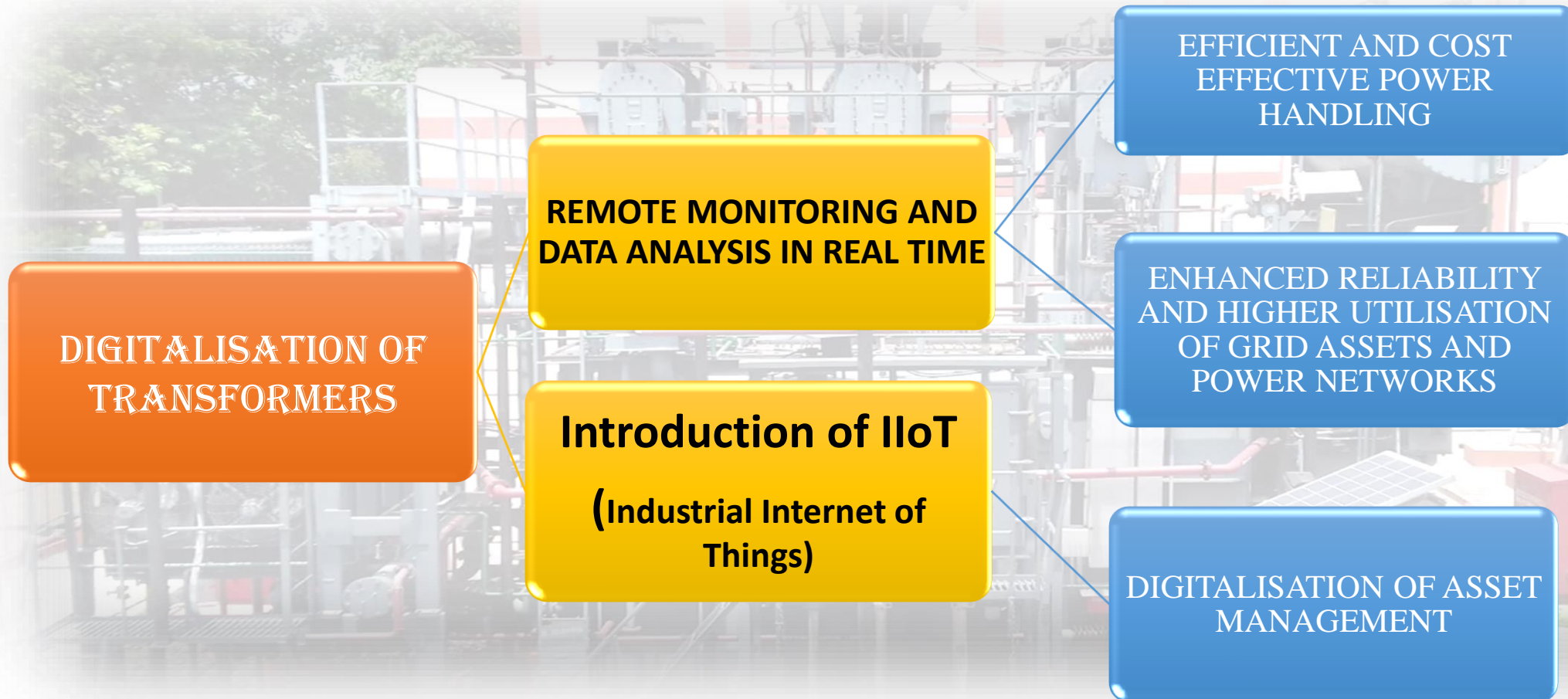


**CESC HOUSE** - Head Office of CESC Limited  
A heritage building built in 1933

- CESC is India's first fully integrated electrical utility company and it has been on an epic ride ever since 1899 in generating and distributing power
- **Consumer Base** : 3.4 million LT, 1700 HT -- including domestic, industrial and commercial users
- CESC has about **300 power transformers** in 18 Substations and in 122 Distribution stations



# Context



# Relevance

## Comprehensive

- Every device can be supported remotely
- Automatic updates and notifications

## Run time analysis

- Collection of statistics over time
- Monthly or yearly reports to detect trends
- Short time trend & Long time trends

## Greater efficiency

- More efficient than manned systems
- No error due to lack of consciousness

## Maintenance

- Allows remote analysis of data
- Reliable method of proactive maintenance-reduction in chance of sudden breakdown or failure
- Preventive maintenance of about 300 Power Transformers



# Presentation on the Topic

## Step 1

## PARAMETER SELECTION AND COLLECTION OF DATA

Parameters(For power transformers)			
Already available		To be measured using sensors	
Parameter	Source	Parameter	Sensor type
Winding temperature	WTI repeater	Vibration level	Vibration sensor
Tap position	SCADA system	Conservator Oil level	VGA camera / Potentiometer
Voltage(LV & HV side)	SCADA system	Top tank temperature	Temperature sensor
Load(Amps)	SCADA system	Bottom tank temperature	Temperature sensor
Hydrogen level in oil	Online Hydrogen Sensors	Humidity inside breather	Humidity sensor
		Pressure inside breather	Pressure sensor
		OLTC motor current	Current transformer

## Step 2

## CODIFICATION OF DATA

### Classification

The data obtained are to be grouped in several classes depending on range of values

### Defining Colour Codes

Different color codes are defined for different classes for better understanding, representation

### Identify values to produce Notification

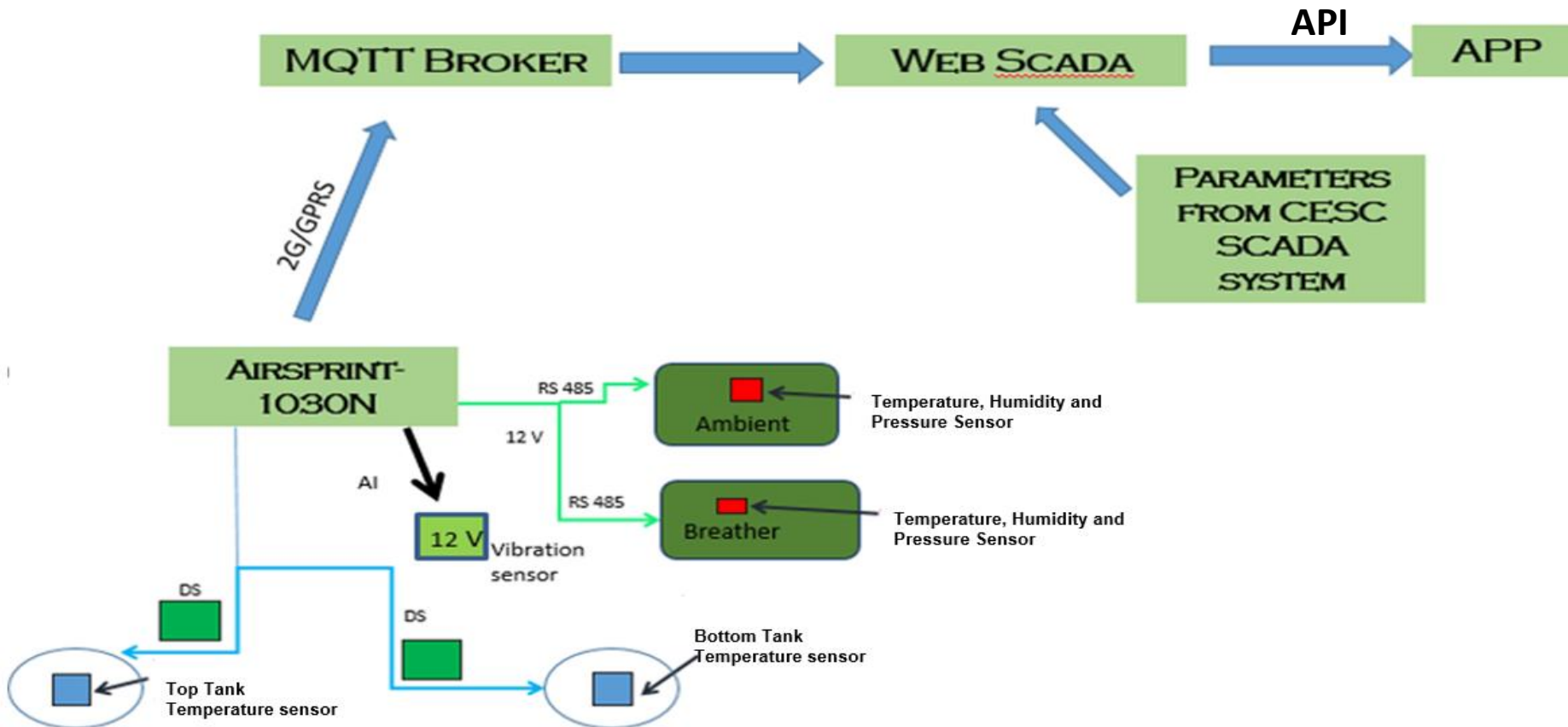
The maximum allowable value is determined

### SAMPLE COLOR CODING TOP OIL (TANK) TEMPERATURE

<u>Parameter</u>	<u>Color code</u>		<u>Notification</u>
	Temperature range(°C)	Color code	
Top oil (tank) temperature	<= 60	Light green	When temperature exceeds 70°C
	60-70	Orange	
	>70	Red	

## Step 3

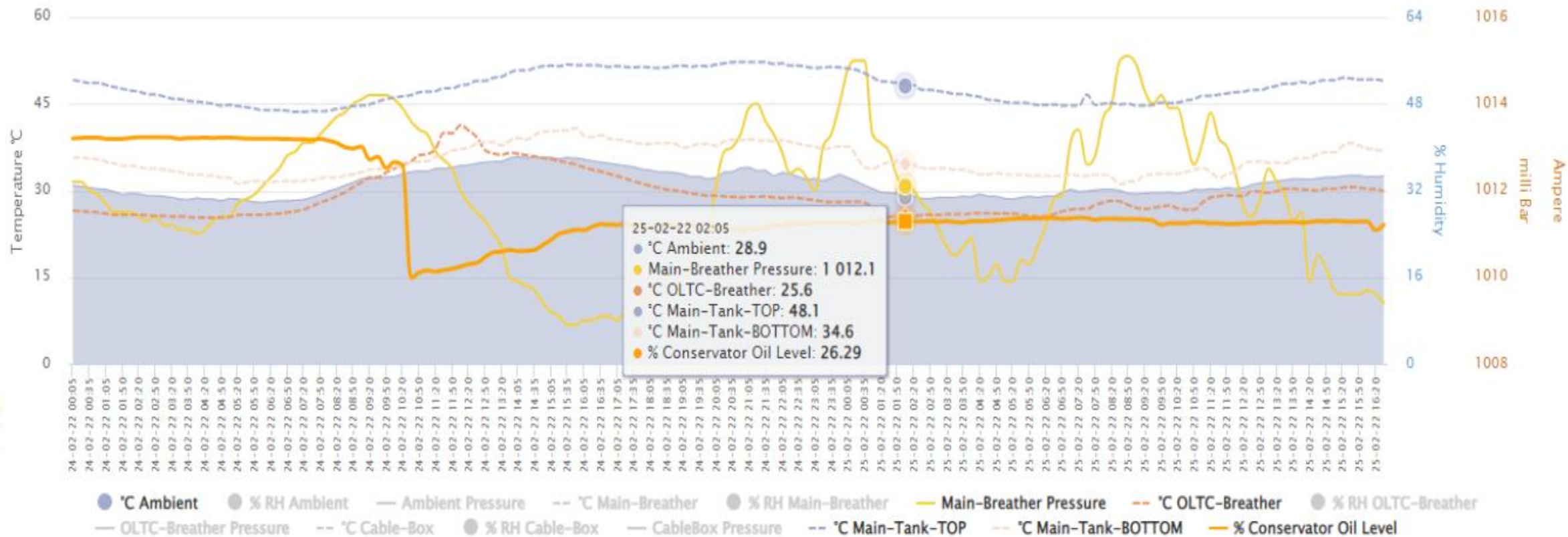
## DATA TRANSMISSION & STORAGE SYSTEM



# Use Case/Case Study

## VARIATION OF TOP & BOTTOM TANK TEMPERATURE AND CONSERVATOR OIL LEVEL

PTR IoT Interval Read Profile : B.T.ROAD S/S T2 - SA00012AT2\_132

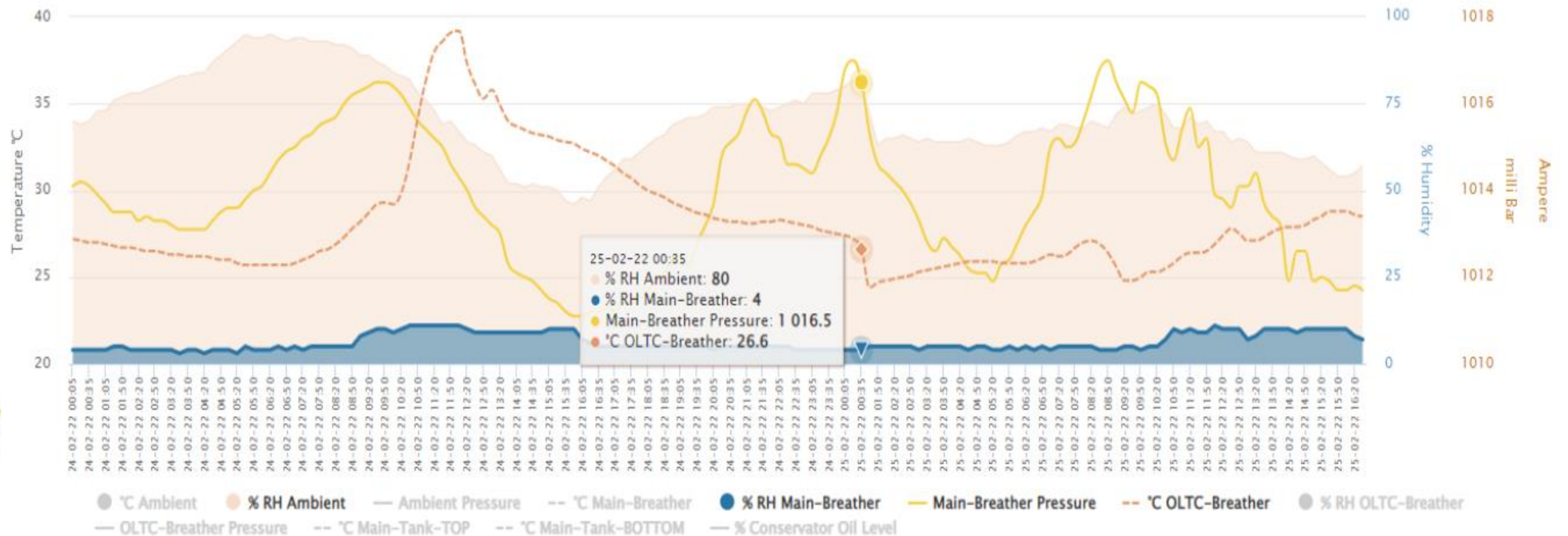




# Use Case/Case Study

## VARIATION OF TEMPERATURE, PRESSURE AND RELATIVE HUMIDITY INSIDE BREATHER

PTR IoT Interval Read Profile : PRINCEP STREET S/S T1 - SA00014AT1\_220



## ❖ PATH FORWARD :

- **Standard reference values** may be set for each parameter at different times of the year which may be used for comparison.
- Analysis of physical condition of the power transformers alongside loading data will eventually lead us to **even distribution of load** among various transformers that will reduce stress on a single transformer
- **Abnormal values** may be archived for further analysis and to find cause of discrepancies
- Improvement of **performance** and **extension of life and reduction in maintenance cost**

# Thank You

## ➤ References::

1. **Australian Journal of Basic and Applied Sciences**,5(11): 984-990, 2011; ISSN 1991-8178
2. **“Transmission of vibration of a power transformer from the internal structures to the tank”** by Ming Jin, Jie Pan, Hai Huang and Jianping Zhou; Australian Acoustical Society.
3. **“Remote Monitoring System for Transformer Substations”** by Timo T. Vekara, Seppo Pettissalo and N. Rajkumar
4. **Indian electricity Grid Code, CERC, 2010**

