FÓRUM LATINO-AMERICANO DE SMART GRID

SMART GRID

15ª EDIÇÃO

CENTRO DE CONVENÇÕES FREICANECA

11 E 12 DE SETEMBRO DE 2023
SÃO PAULO - SP

MEGGER

ASSETS MANAGEMENT AND MONITORING FOR IMPROVING RELIABILITY AND OPERATIONAL EFFICIENCY

Galo Teran
Latin America Business Manager

Agenda

Communication & Information management

Challenges on managing Overhead lines

Assets Management

Summary

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Past and Present

- Mexico 1970 World Cup
- For the first time, the tournament was broadcast on color television in slow motion for some networks that had this technology

- Qatar 2022 World Cup
- "Nearly 1.5 billion people" watched the final between Argentina and France
- 5 billion interactions" across all platforms and devices in the media universe

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Artificial Intelligence

- A combination of algorithms designed to create machines with the same capabilities as human beings.
- Technology that still seems distant and mysterious to us, but which for some years now has been part of our daily lives at all times.

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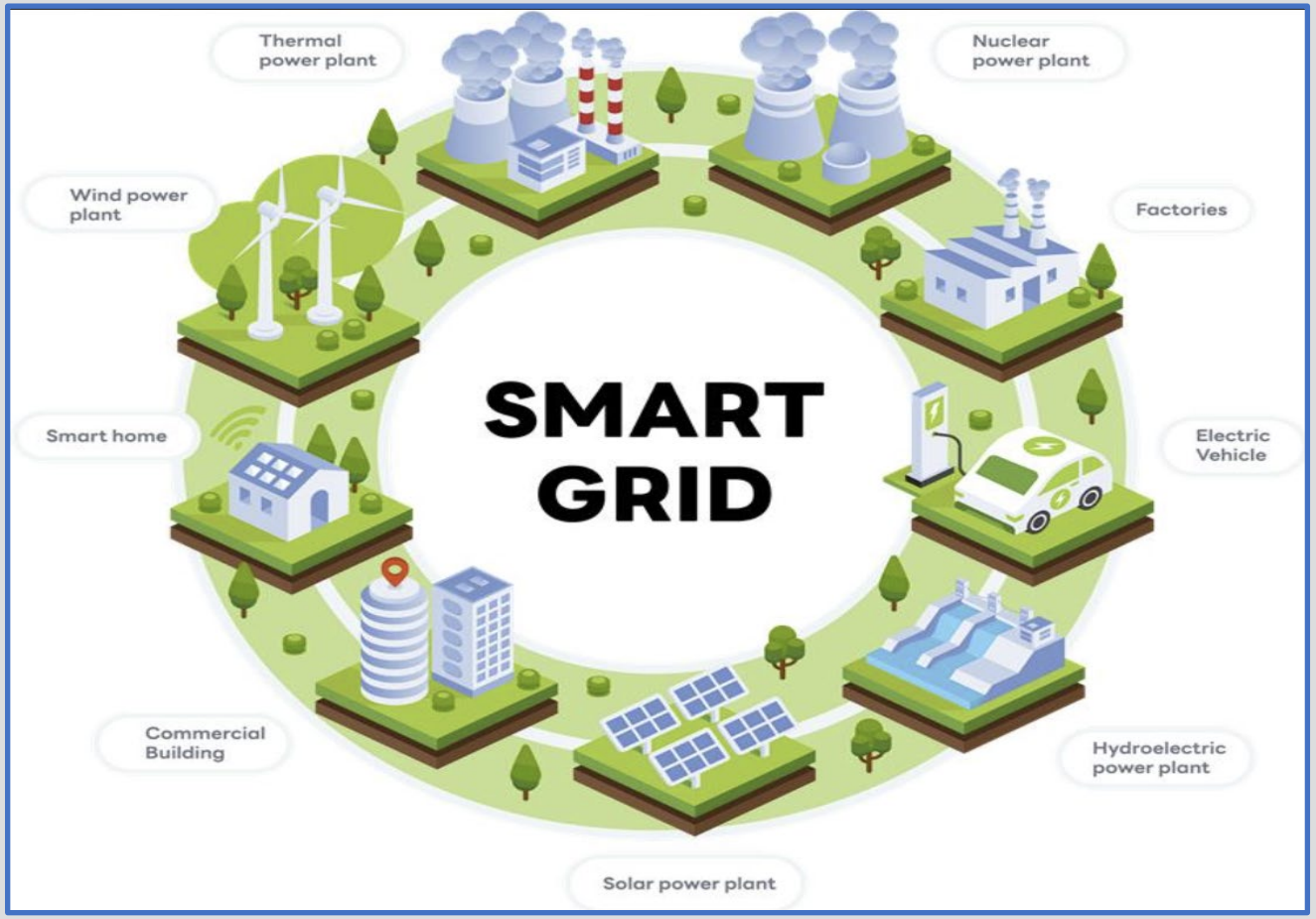
Smart Grid

- It is an electricity network that uses digital and other advanced technologies to **monitor and manage** the transport of electricity from all generation sources to meet the varying electricity demands of end users



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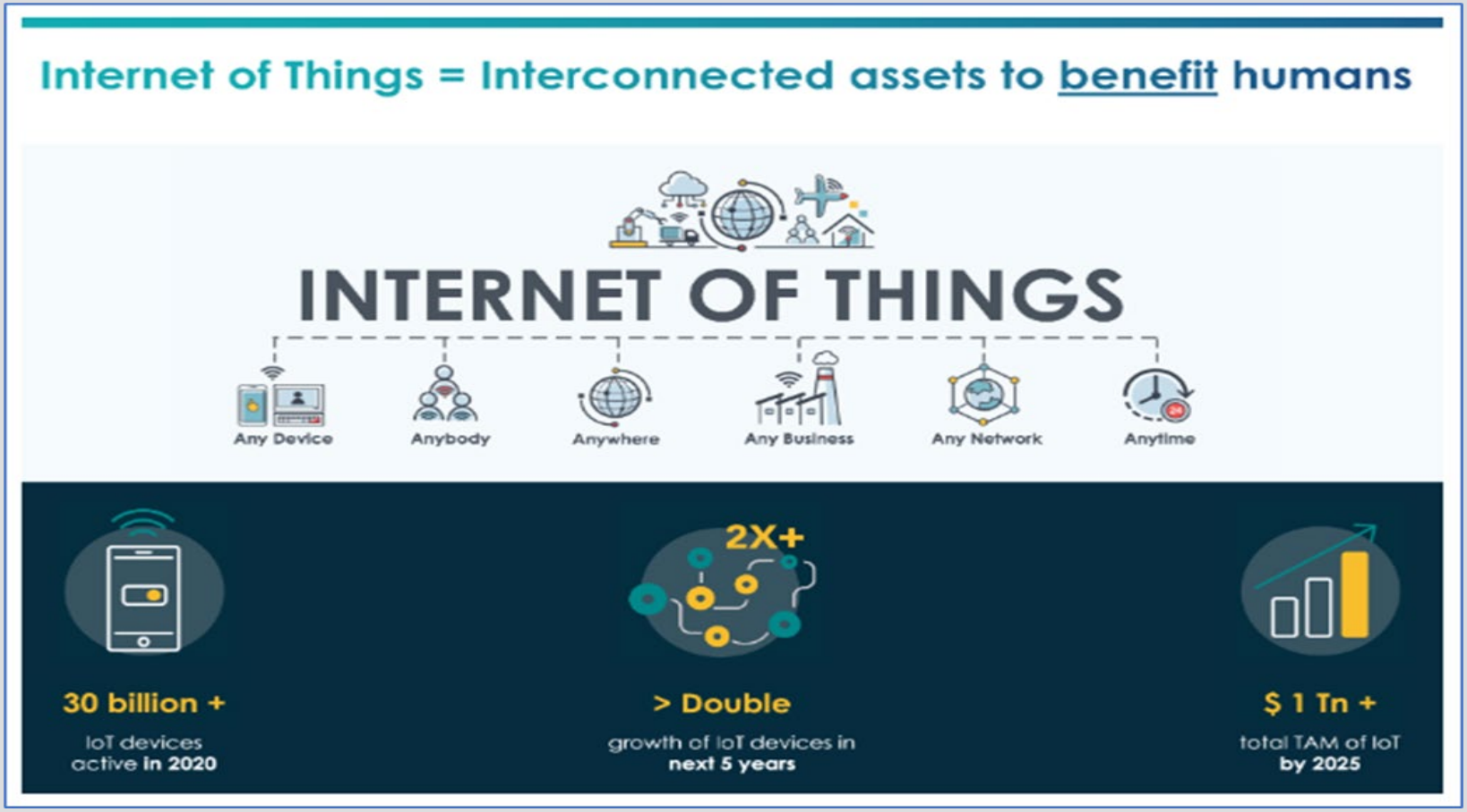
IoT



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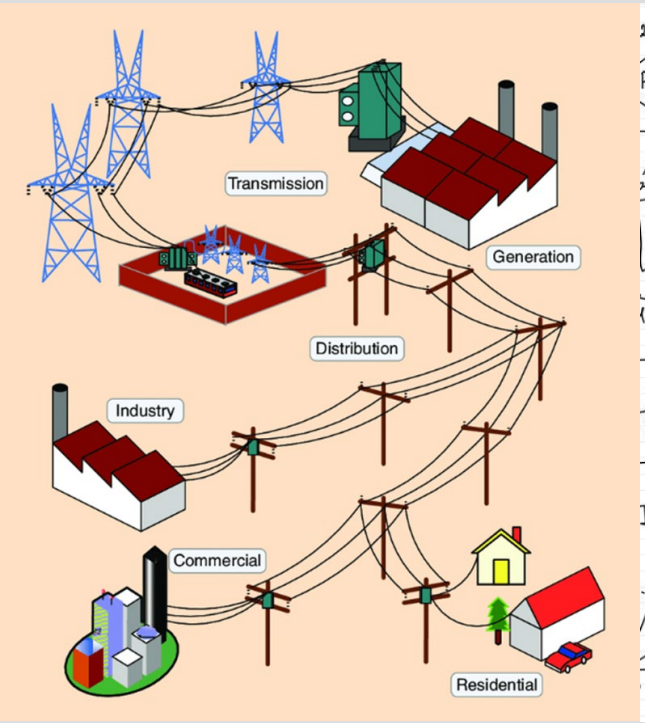
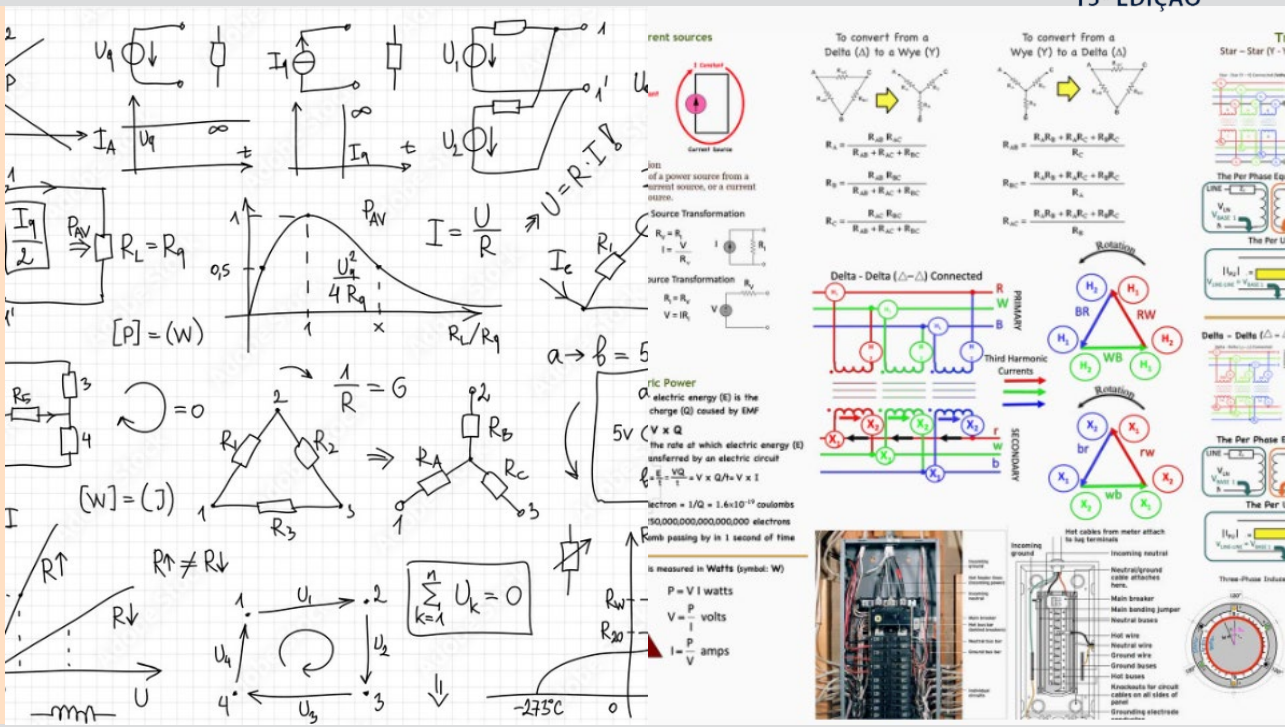
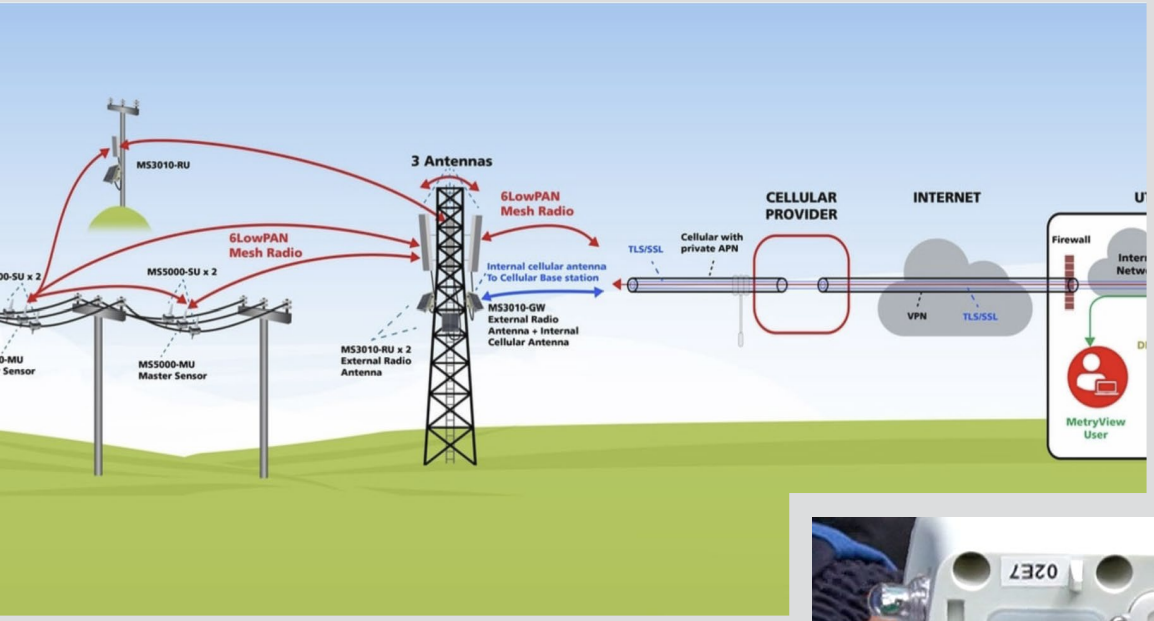
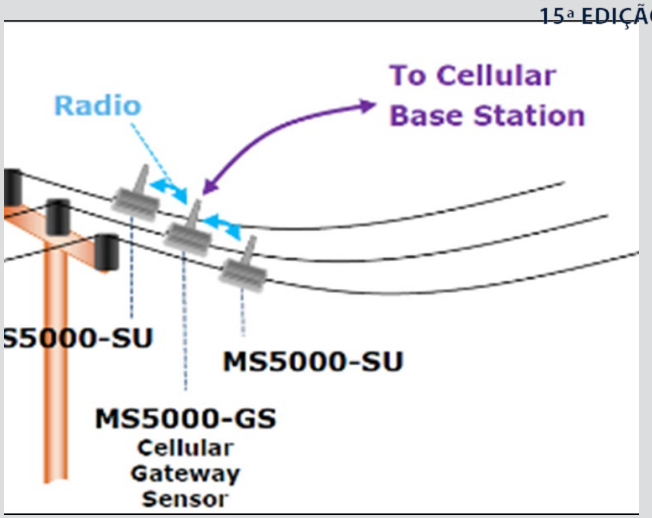




Challenges to get the right Information at the right time


MS3010-RU
3 Antennas
6LowPAN
Mesh Radio
6LowPAN
Mesh Radio
MS5000-SU x 2
MS5000-MU
Master Sensor
MS3010-RU x 2
External Radio
Antenna
Internal cellular antenna
To Cellular Base station
MS3010-GW
External Radio
Antenna + Internal
Cellular Antenna
TLS/SSL
Cellular with
private APN
CELLULAR
PROVIDER
INTERNET
VPN
TLS/SSL
Firewall
MetryView
User


Radio
To Cellular
Base Station
S5000-SU
MS5000-SU
MS5000-GS
Cellular
Gateway
Sensor

MGA SENSORS


027
MS5000-SU-9
MAC:001B C505 3022 02E
02F

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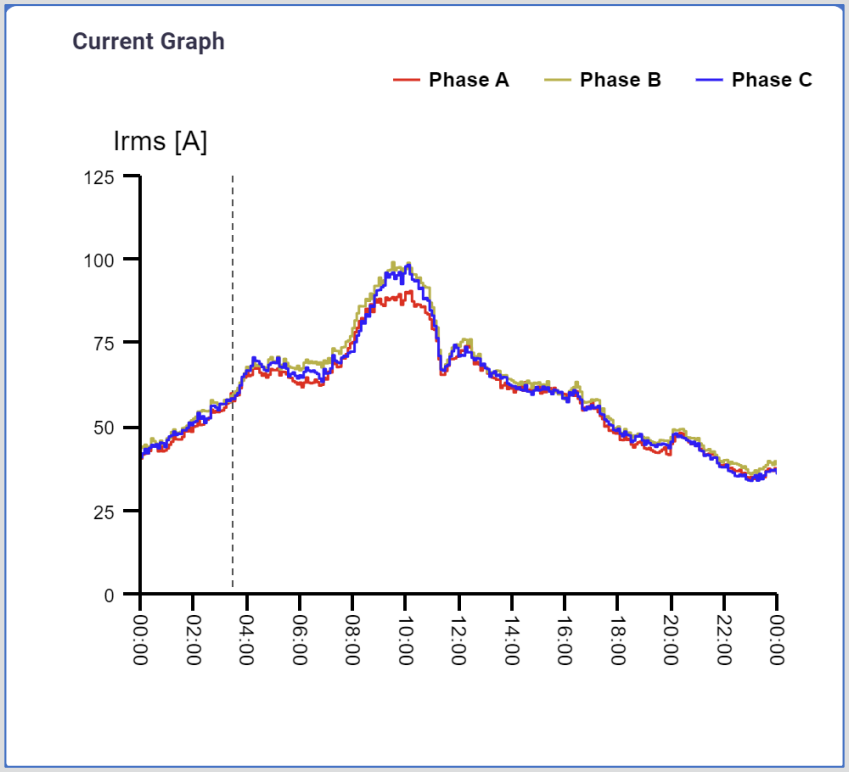
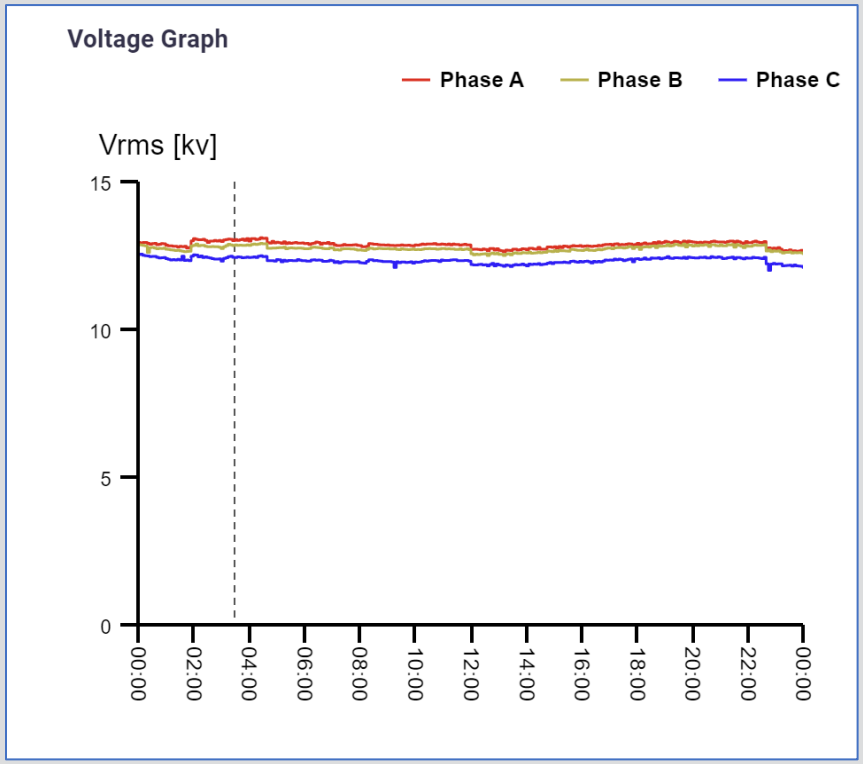
Per-Cycle Analysis - **Irms & Vrms**

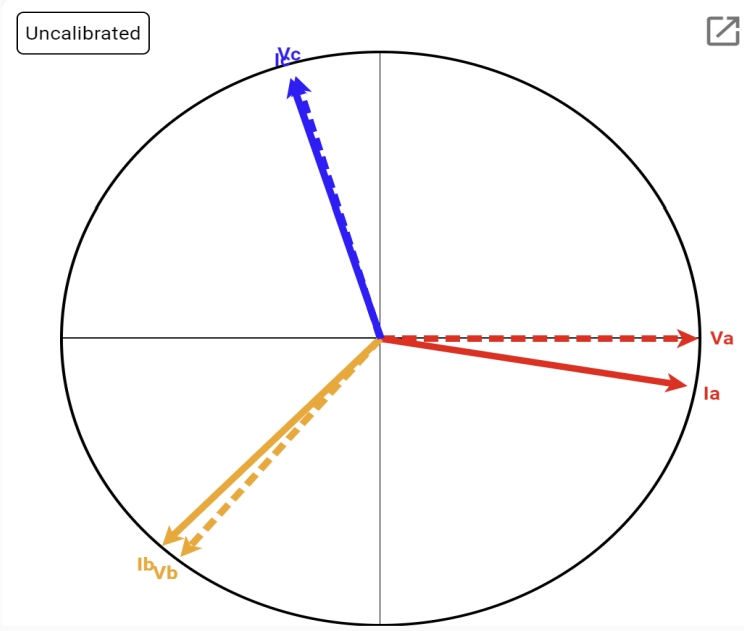




Vector Diagram

Per-Cycle Analysis

Vector Diagram



	Value	RMS	Angle
Va	12.986 kV	12.990 kV	-0.0°
Vb	12.863 kV	12.873 kV	-129.9°
Vc	12.438 kV	12.435 kV	105.6°
Ia	41.66 A	41.78 A	-10.1°
Ib	42.48 A	42.61 A	-133.8°
Ic	40.66 A	40.76 A	107.2°

	Value	PF	Active PWR	Reactive PWR
Ia/Va Angle	-10.1°	0.985	534.360 kW	94.906 kVAR
Ib/Vb Angle	-4.0°	0.998	547.212 kW	37.834 kVAR
Ic/Vc Angle	1.6°	1.000	506.647 kW	-14.363 kVAR
Total		0.994	1588.219 kW	118.377 kVAR

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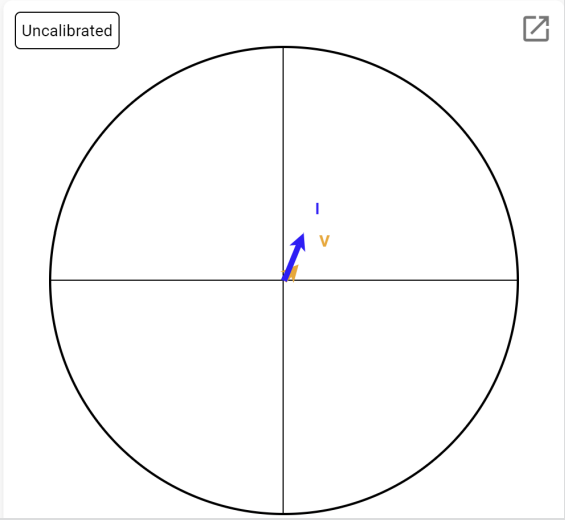
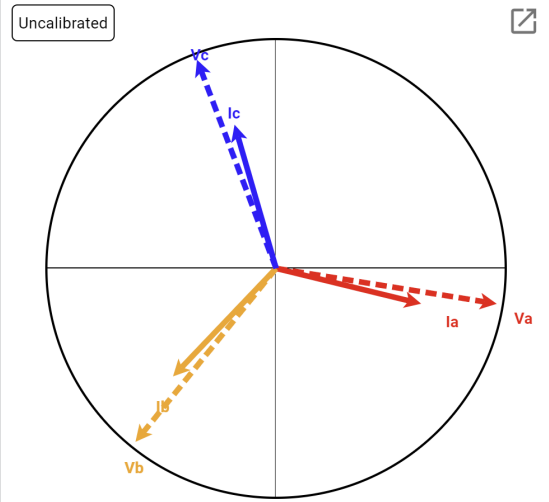
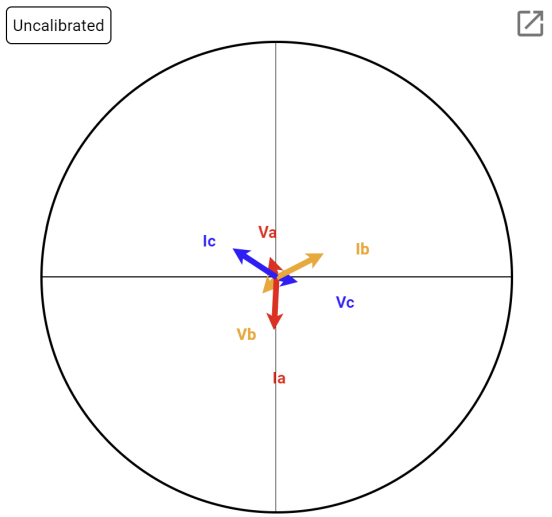
Zero Sequence



Positive Sequence



Negative Sequence



Symmetrical Components

	Value	Angle
V	12.692 kV	-8.0°
I	41.58 A	-12.2°
	Value	**PF**
I/V Angle	-4.2°	0.99727

	Value	Angle
V	0.885 kV	107.9°
I	2.64 A	-93.4°
	Value	**PF**
I/V Angle	-201.2°	-0.93210

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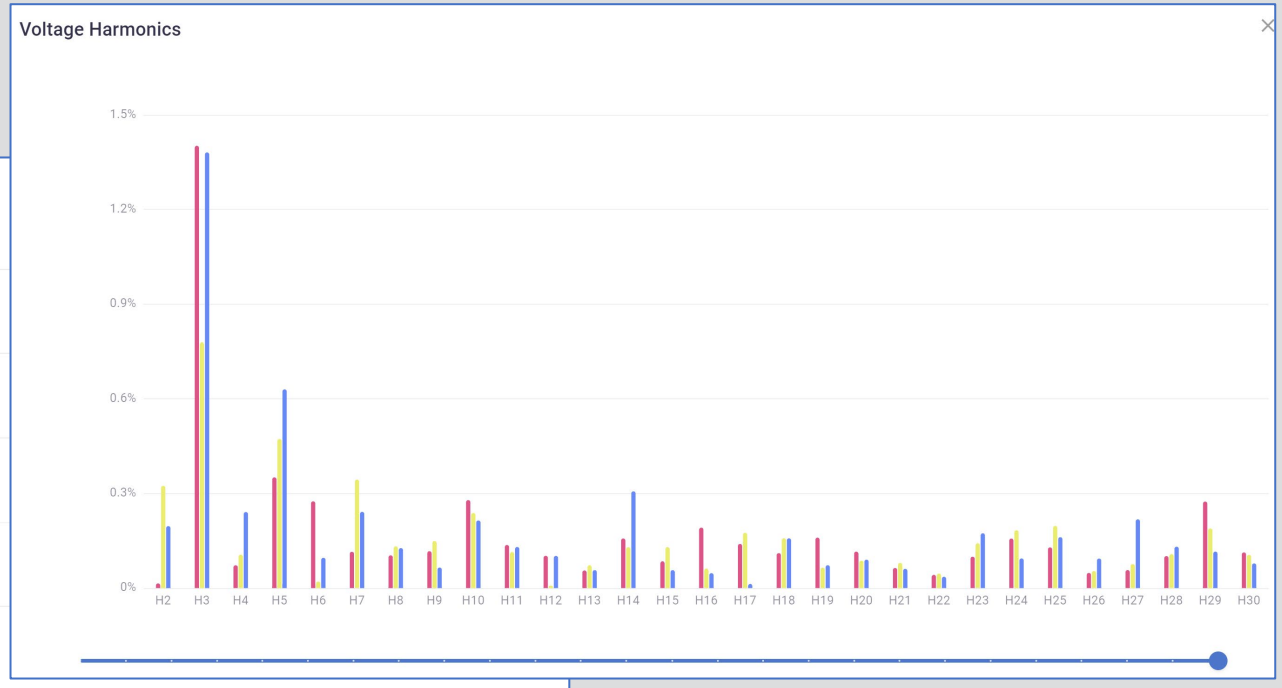
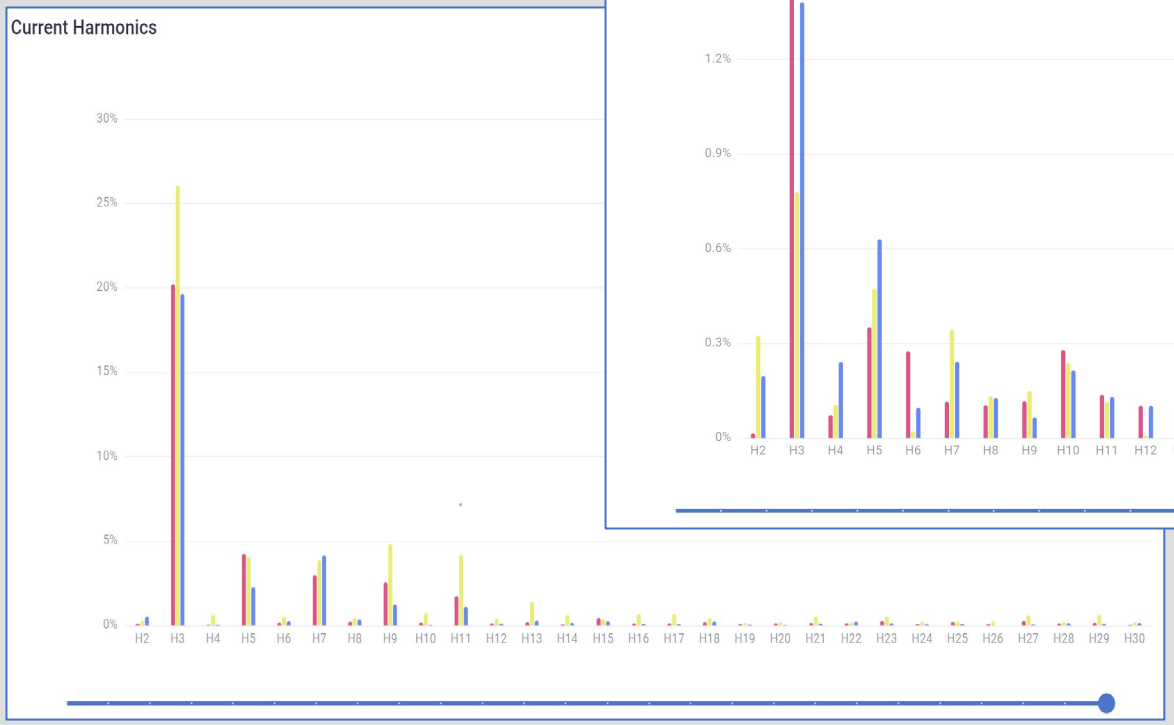
Current & Voltages Harmonics (30th)





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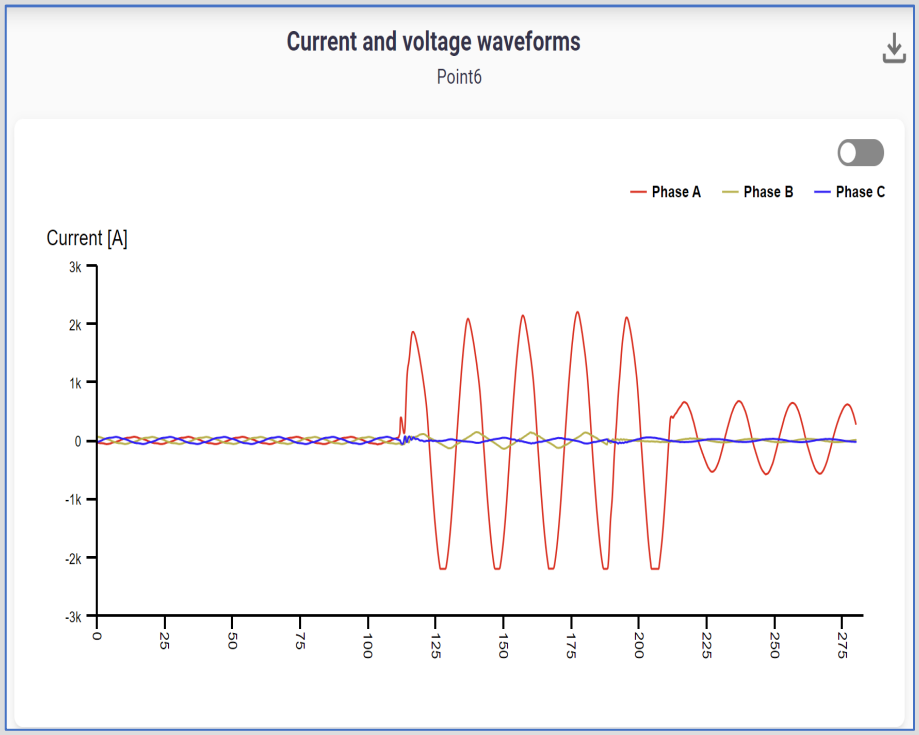
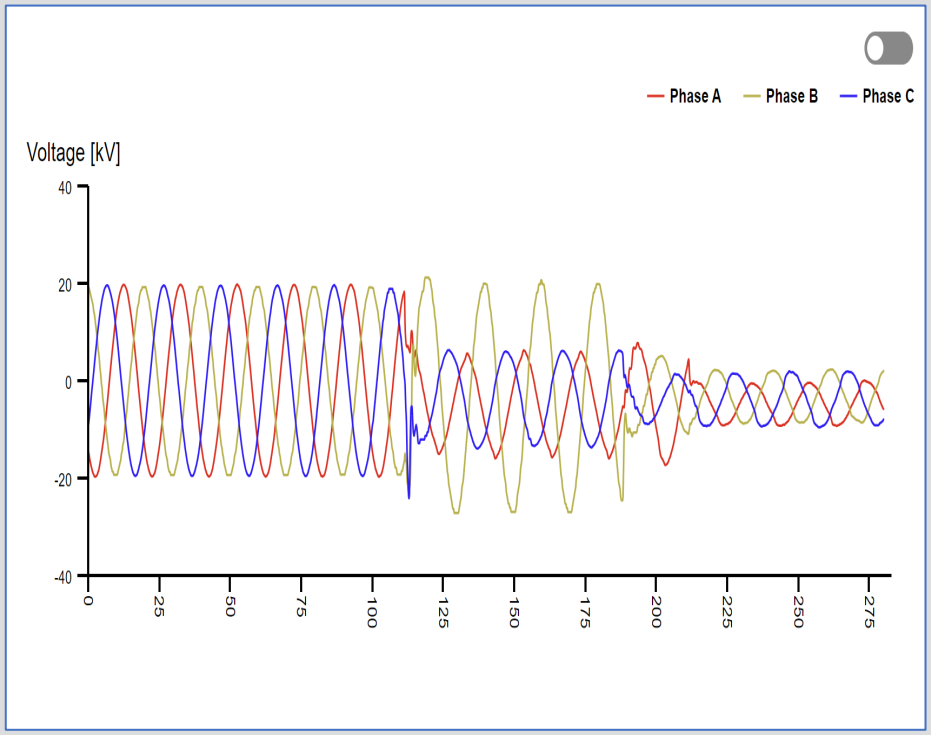
Current & Voltage Fault Waveforms





Asset Management

Fault Events Year until 12/31/2020

Date and Time		Classification
12.20.2020	11:26:36	Ground Fault Without Power Down
12.20.2020	11:14:11	Ground Fault Without Power Down
12.14.2020	02:50:20	Ground Fault Without Power Down
12.06.2020	05:06:31	Permanent Phase-to-Phase Fault (High Current)
11.27.2020	07:03:11	Transient Ground Fault (High current)
11.18.2020	23:32:34	Ground Fault Without Power Down
11.07.2020	03:17:42	Ground Fault Without Power Down
11.06.2020	04:23:04	Transient Ground Fault (High current)

e to Phase

Permanent

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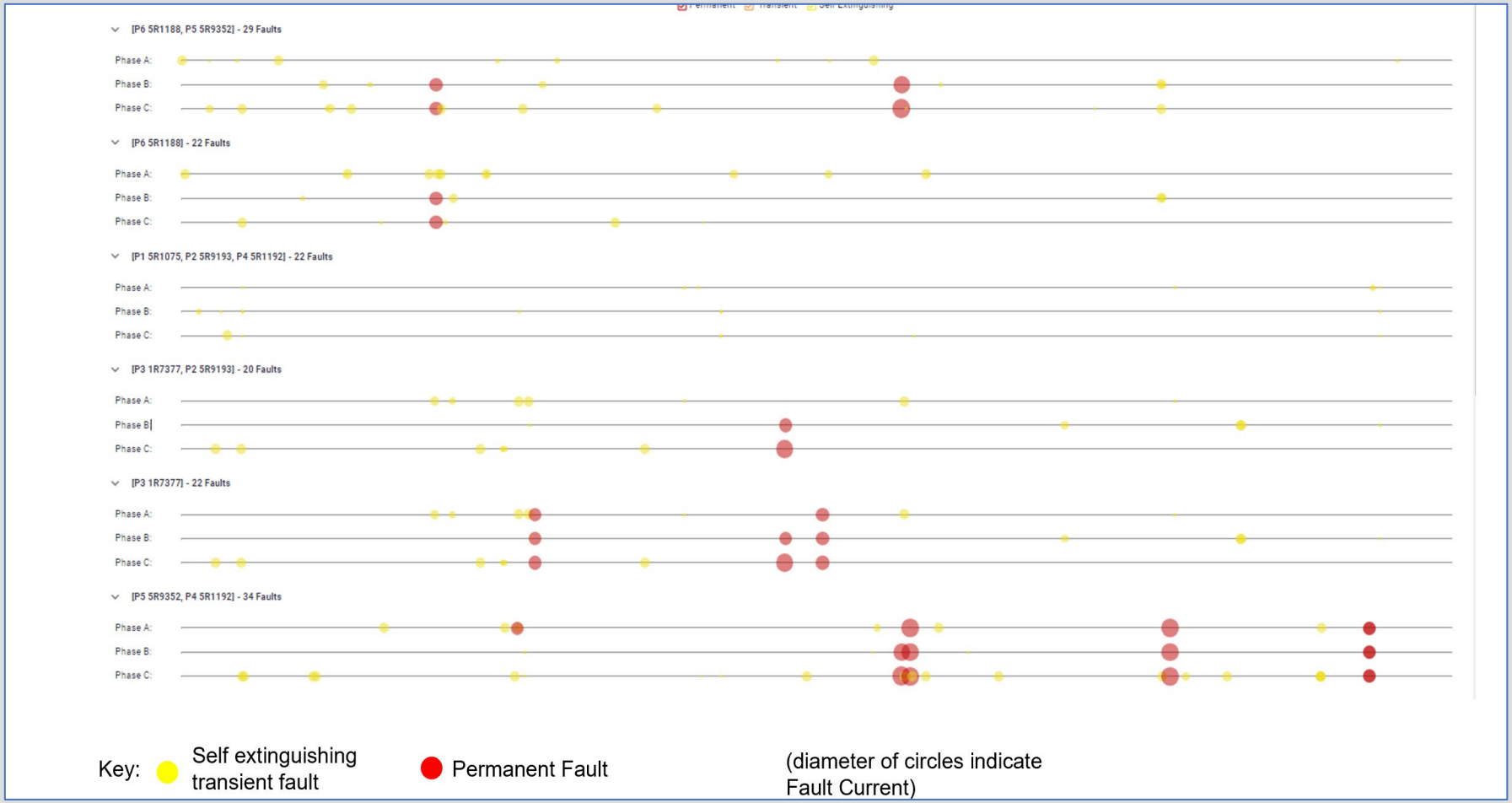
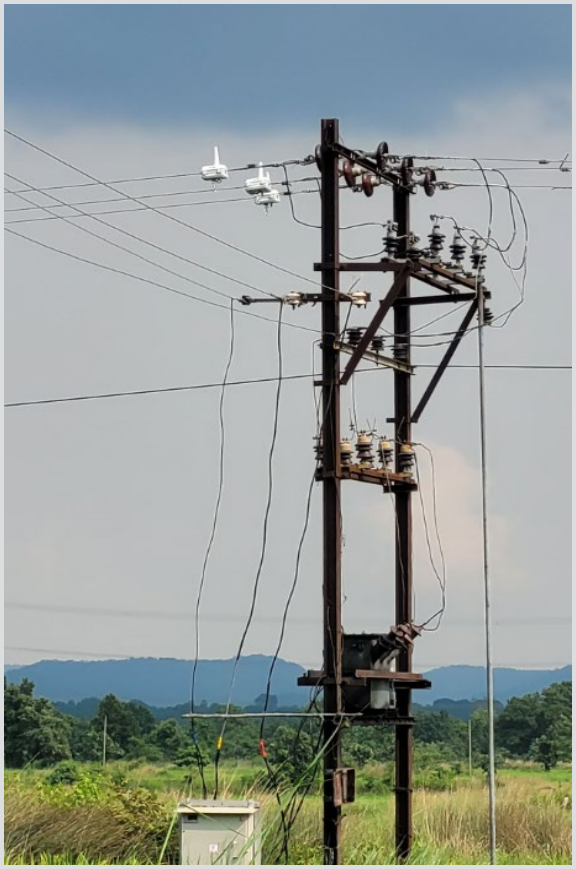
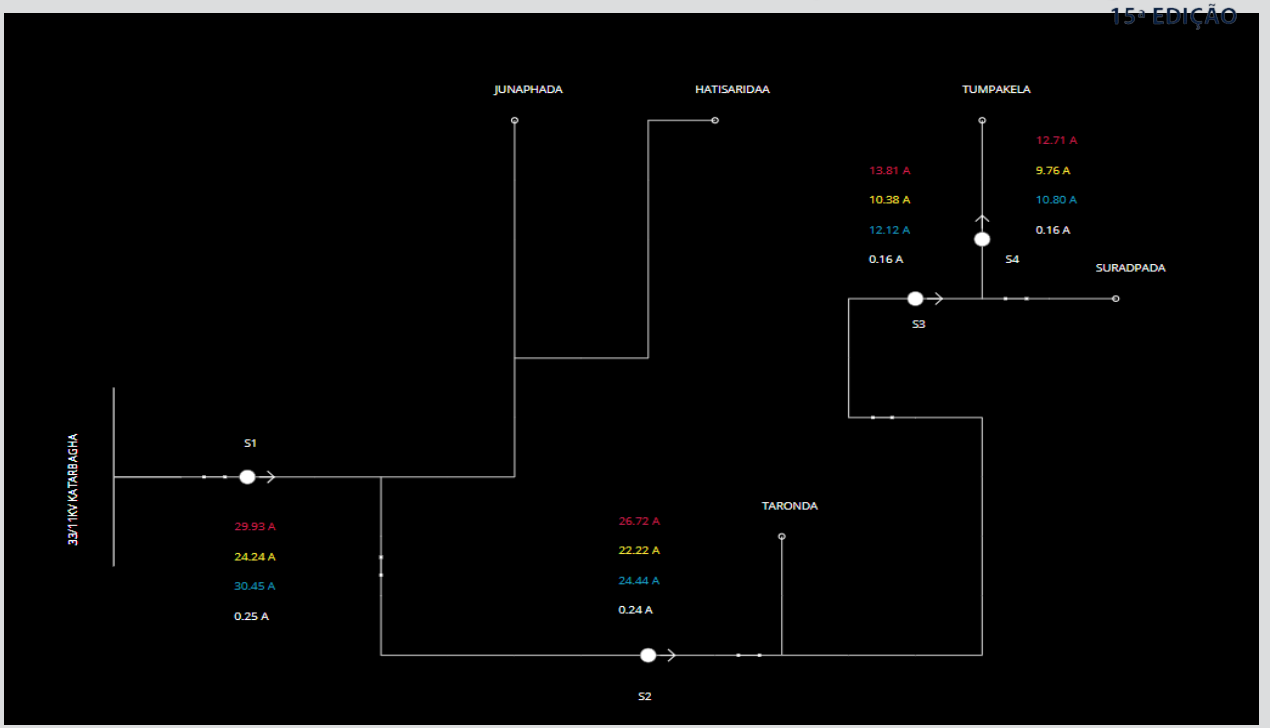
A year of Fault data can identify lines & phases with weak spots



CASE OF STUDY



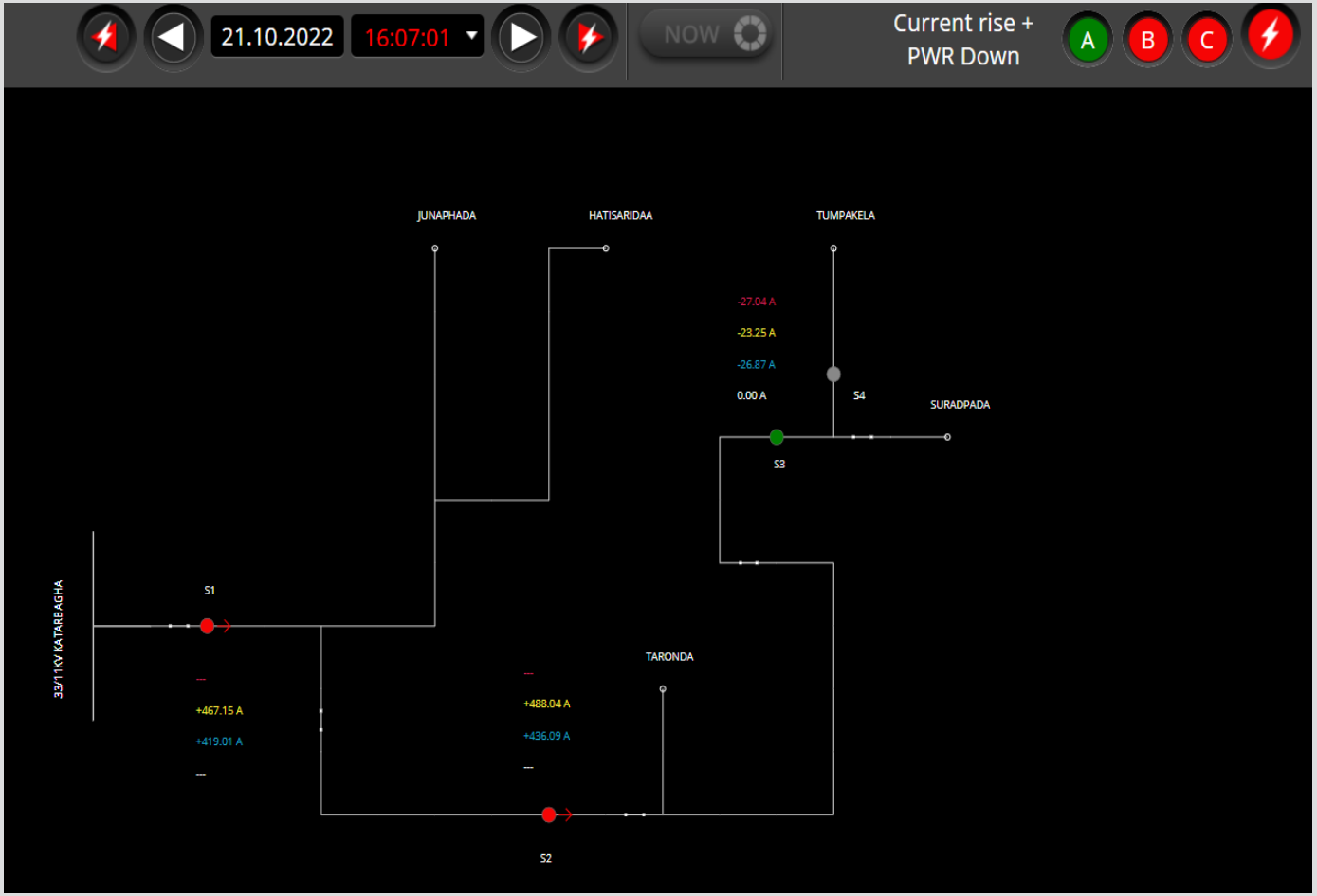


Katarbagha to Tamperkela 11 KV line

Line Diagram was designed in Metryview Software as per the sensor locations

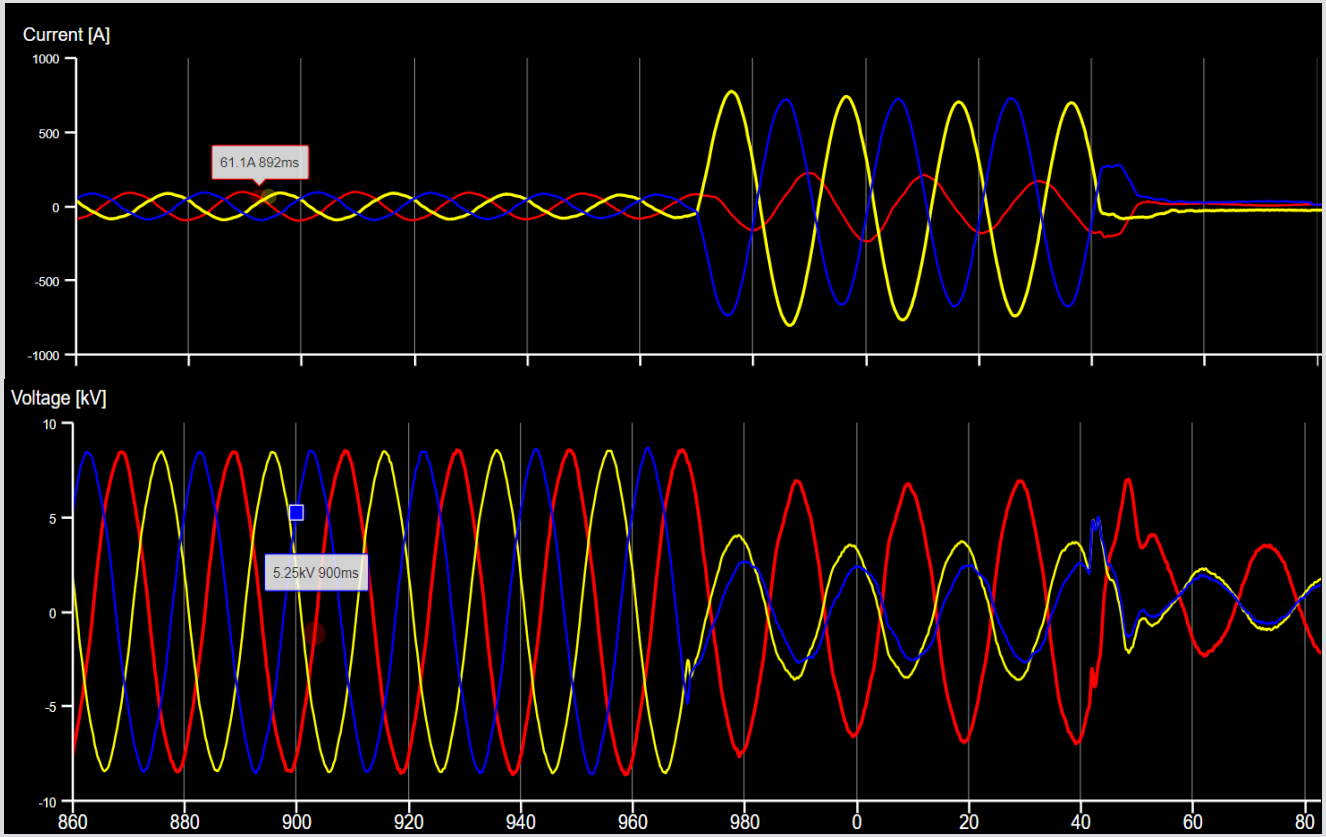
Permanent Fault occurred on 21-10-2022

- Phase to Phase Faults Occurred in B & C phases.
- Line was powered again in a few minutes to check it's a permanent faults
- Line got Trip again
- MGA Captured the Fault current & Waveforms



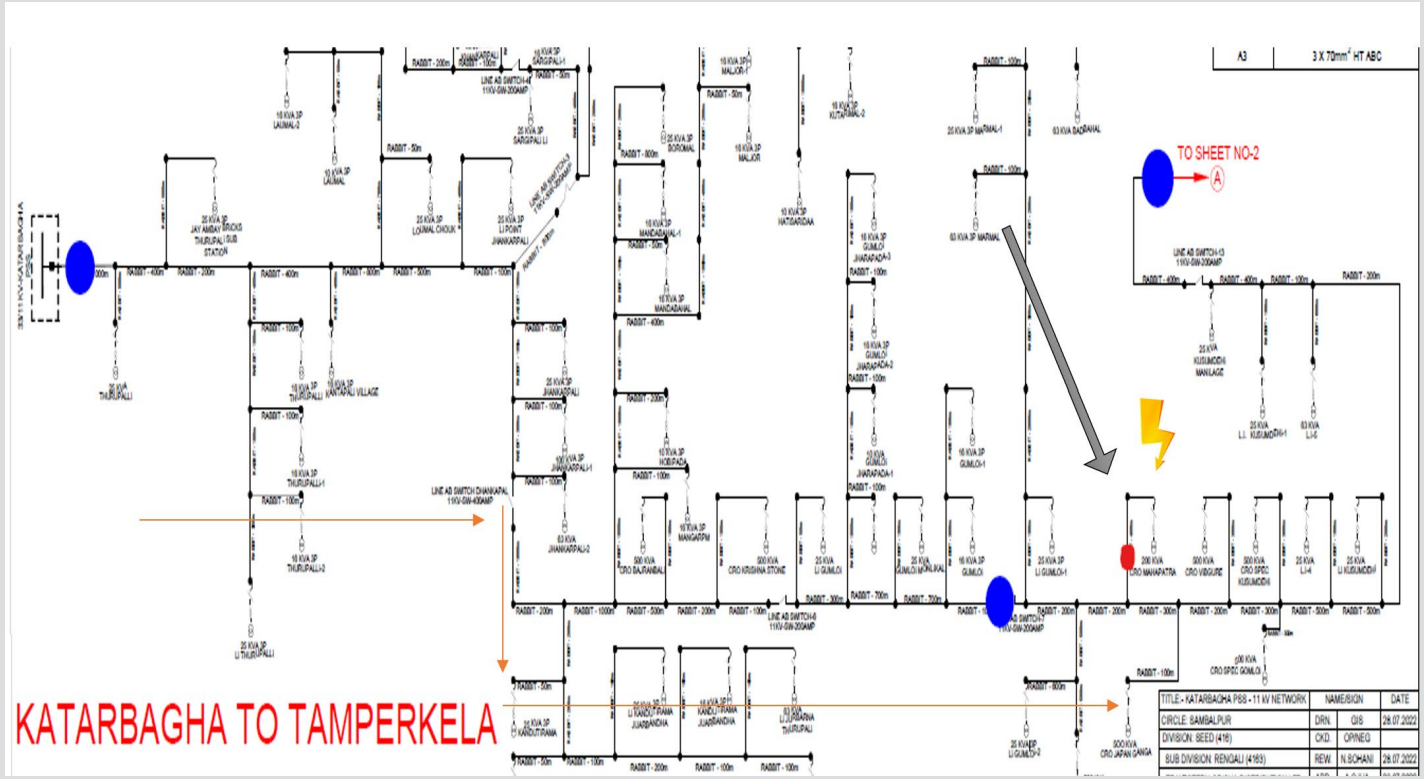
Permanent Fault occurred on 21-10-2022

- High Current Passed from Sensors 2
- Current Before Faults was 55 Amps & Fault Current was 488 Amps.
- Fault direction was forward
- Current & Voltage Waveforms
- Breaker tripped after 4 Cycles & time Taken was 80 ms



Permanent Fault occurred on 21-10-2022

- Customer' Team checks online the Fault location
- No Patrolling needed for 10Km on the main line.
- **Fault was Trace & Fixed in less than 60 minutes**
- **Normally time to Trace might take 3-6 Hrs. normally**



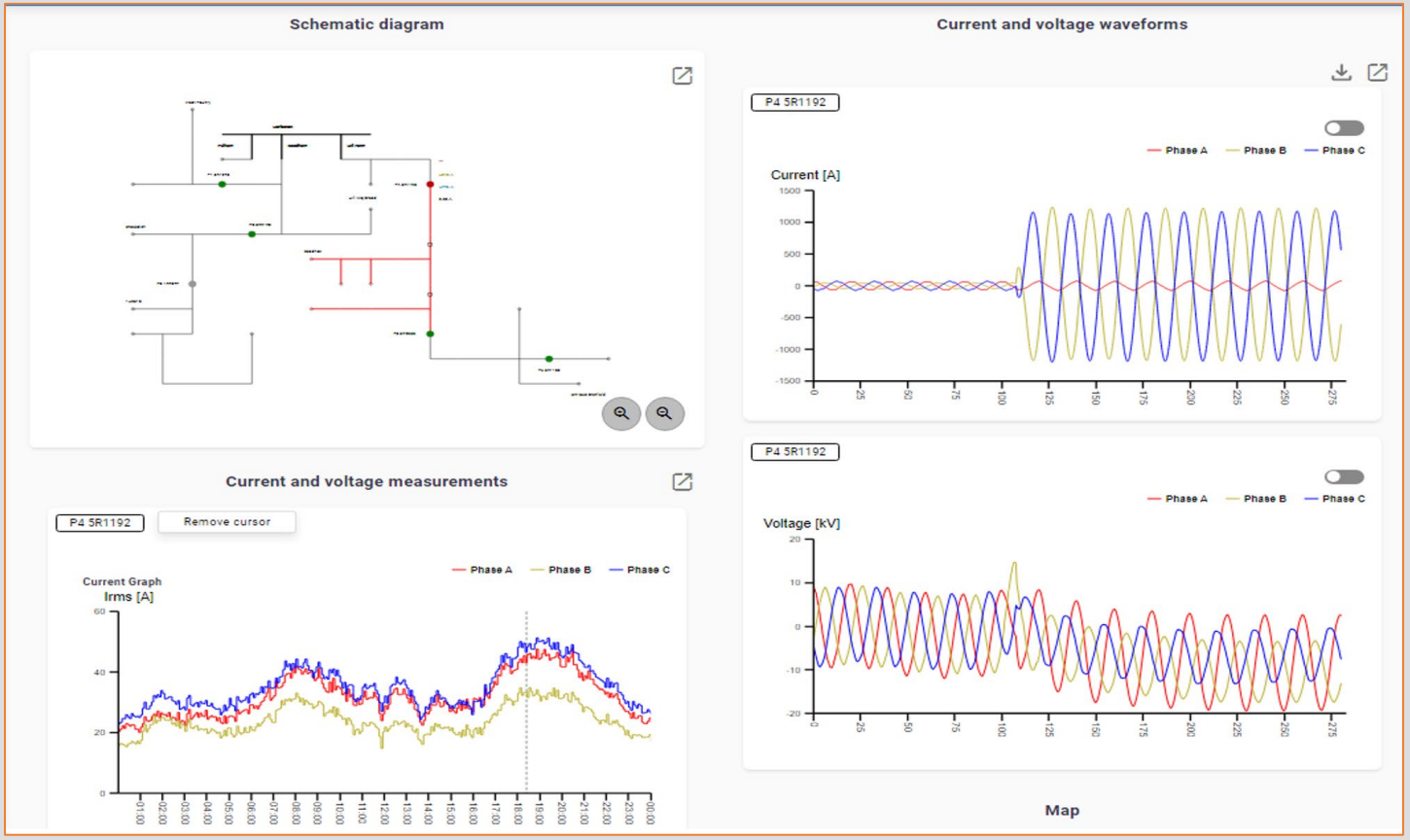
Root Cause of the Permanent Fault

- Tree branch was hanging on 11 kV line

- Local people were cutting the trees & During cutting the Branch was fallen on an 11 kV line Permanent Fault Occurred.

Also,…Ph/Ph Faults during heavy rain May 2023 at Harleston UK

- Heavy rain contributed to a series of Ph/Ph faults
- Faults automatically cleared by breaker operation



Note: All waveforms are from a Petersen Coil earthed network

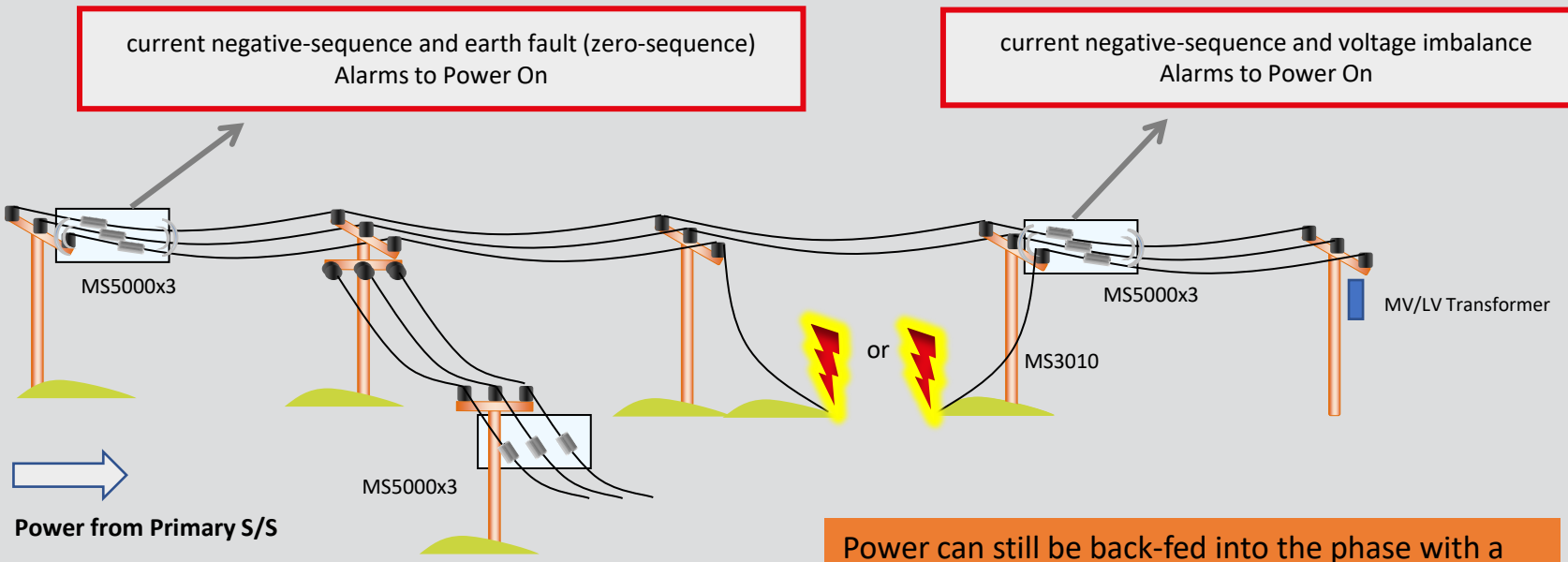
Detection of broken conductor with an earth fault

- SEF on solid earthed networks may not protect the whole feeder and Primary Substation Protection may not operate
- MS5000 sensors distributed around the network can produce the following alarms for detecting the fallen conductor:

(1) Negative-Sequence current before and after the broken wire

(2) Voltage imbalance downstream of the broken wire

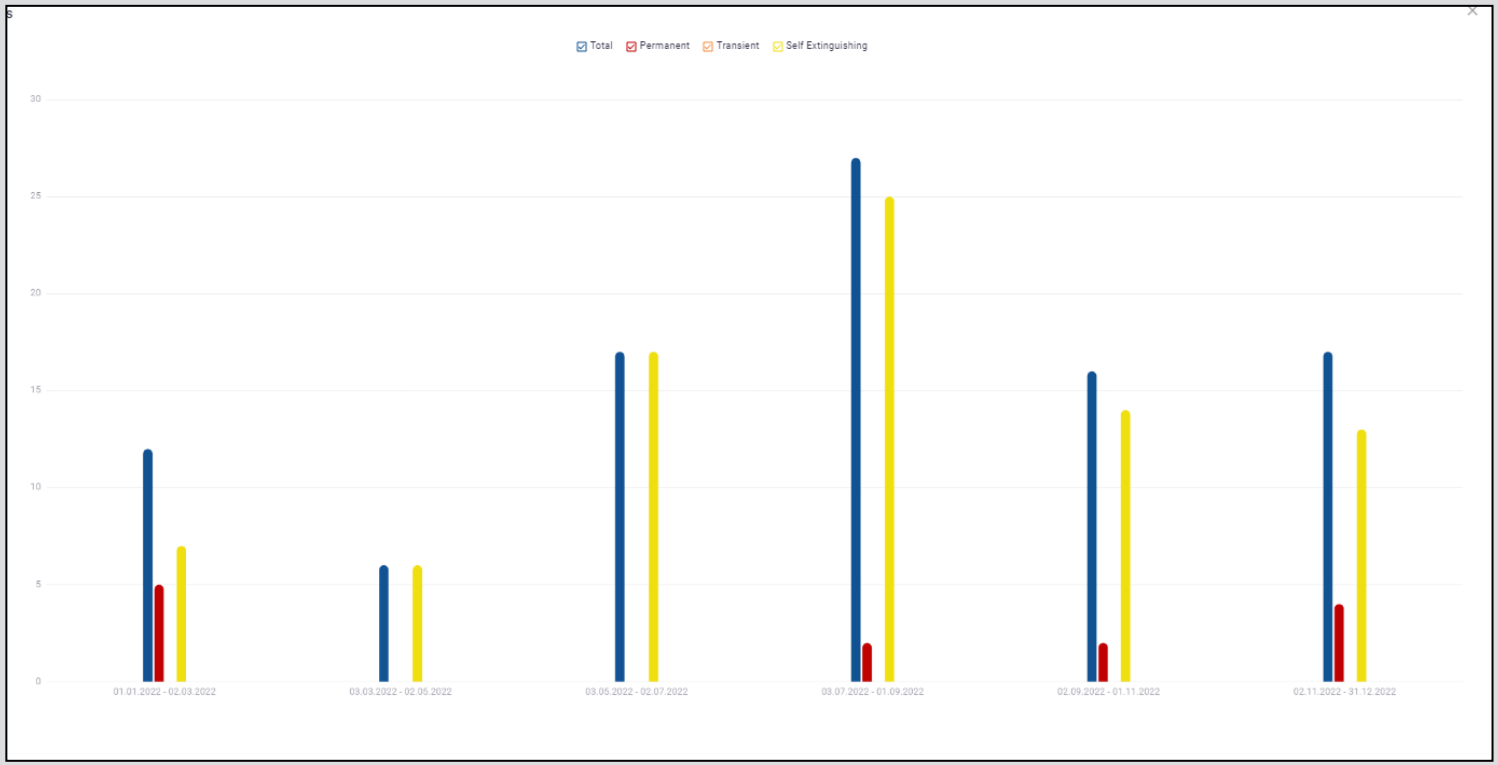
(3) High impedance Earth Faults (detected by sensors located before the broken wire analysing zero-seq. transients)



Power can still be back-fed into the phase with a broken conductor through Tx MV/LV windings

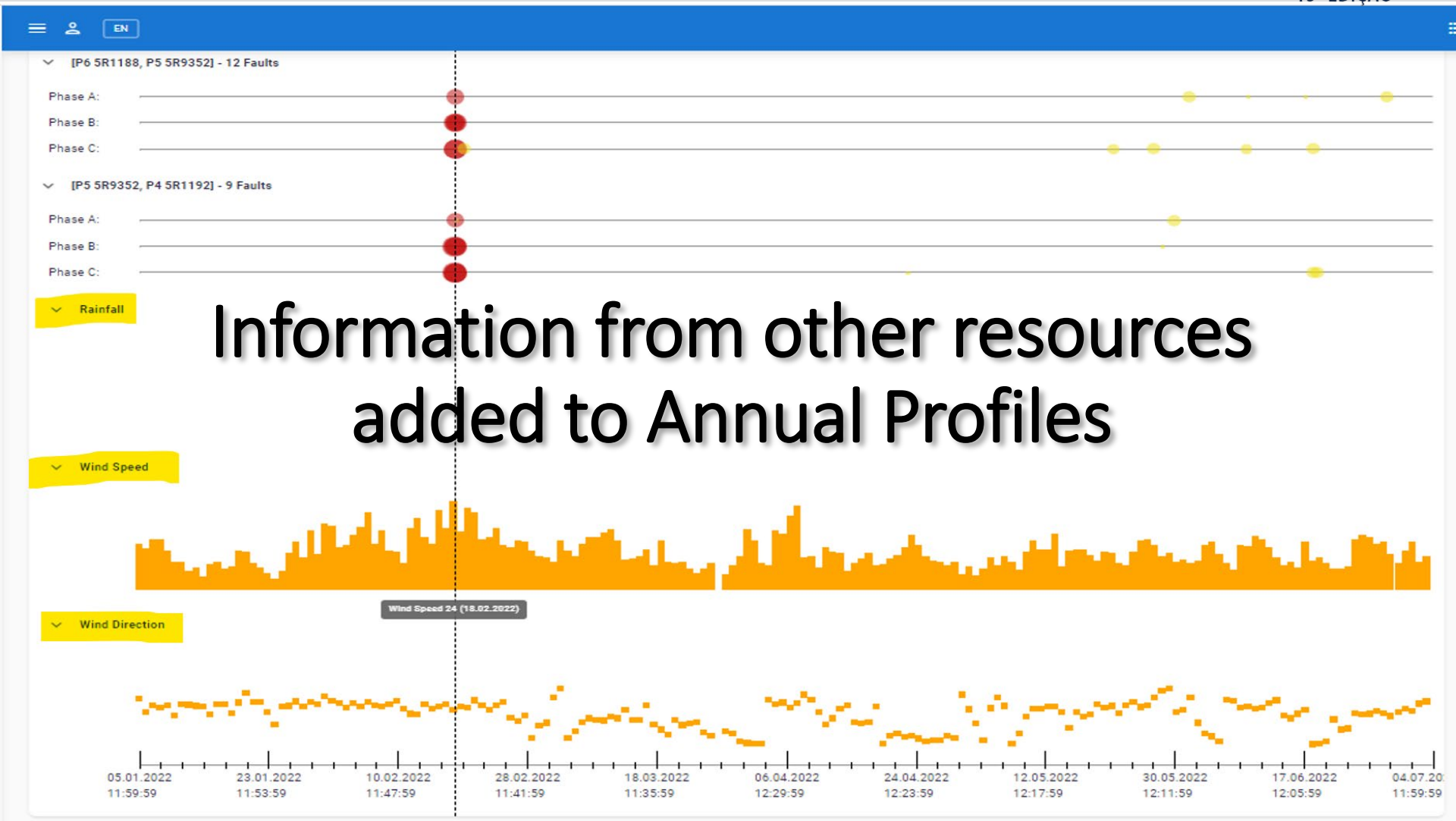
Summary

Annual profiles can identify feeders with Vegetation Issues



Total Faults | Permanent Faults with power down | Transient Faults

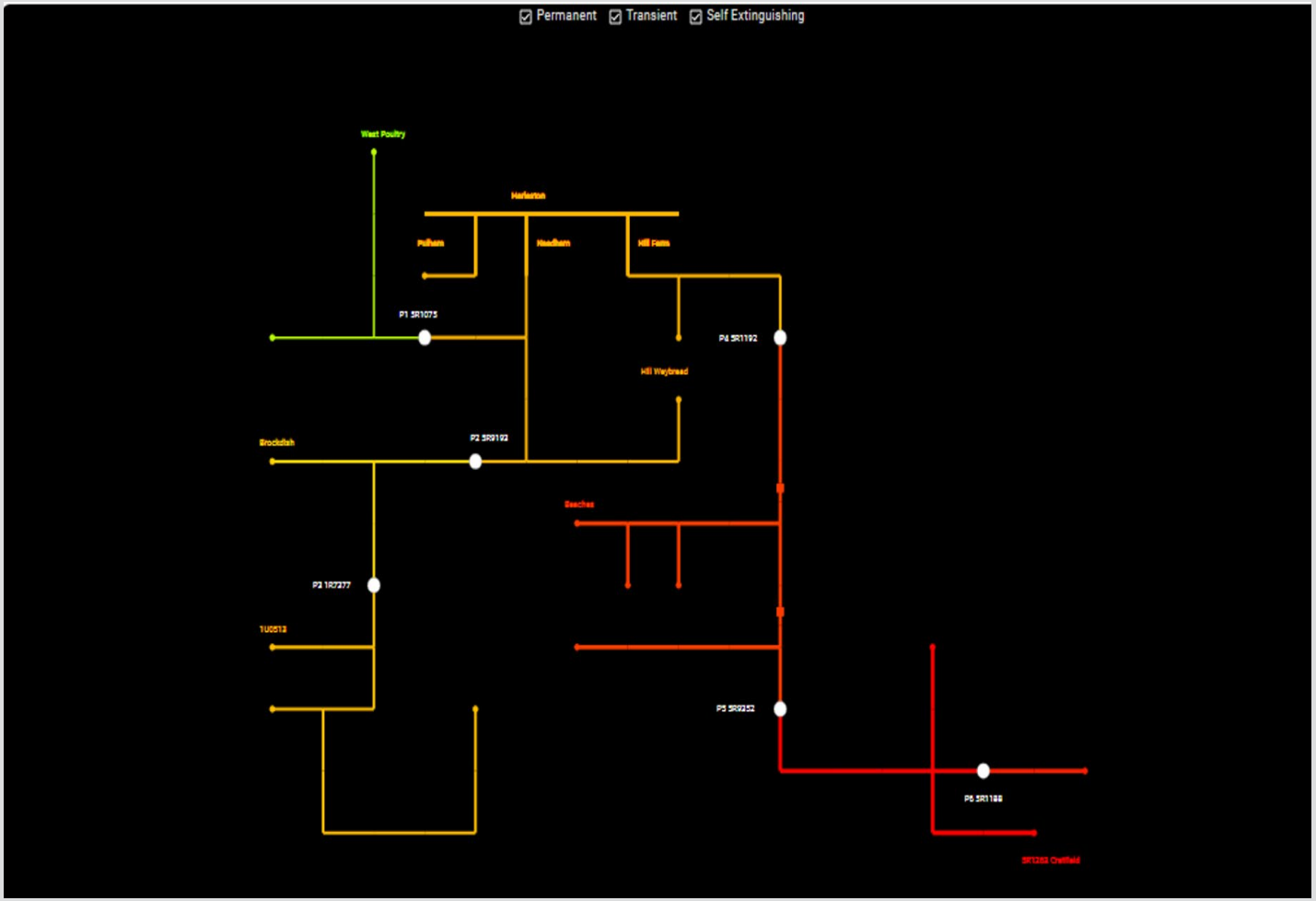
- High levels of transient Faults in the highest growth season compared with Permanent Faults can indicate feeders with Vegetation problems



Information from other resources added to Annual Profiles

Heat Maps can be used to identify Weak-Spots in Networks

- Smart Grid Sensors can identify Weak-Spots in Networks
- Fault data for typically period of a year can be used to create ‘Heat Maps’
- Pareto principles can be applied to improve reliability
- Vegetation issues, Insulation problems, Extreme weather weak-points)

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de Distribuição até 138 kV
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