

# New and Emerging Technologies and Trends

PQ Monitoring and Analysis for optimised Quality Power delivery  
By

Smt Vandana Singhal, Shri Rajen Mehta and Shri Manas Kundu

**Speaker : Manas Kundu,**  
*APQI India Co-Ordinator*  
*Advisor Energy Regulatory Affairs (ICA India)*

# INDEX

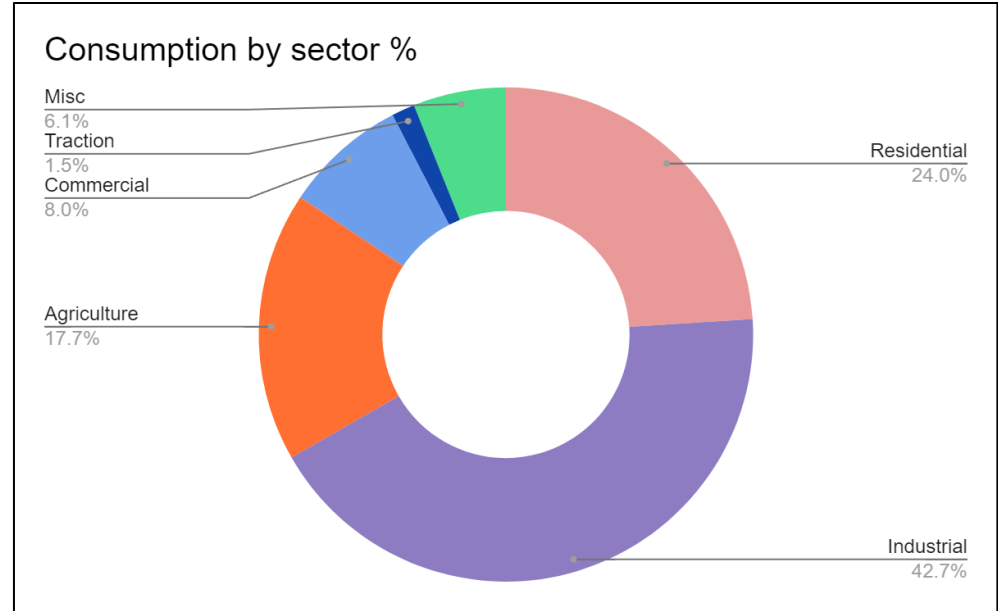
- Power Distribution - Today
- Effects of Digital Economy on PQ
- PQ Standards - Enablers for PQ Management
- Case Study - 1 (Industry)
- Case Study - 2 (Data Center)
- Summary
- PQ Management - A Path forward

# POWER DISTRIBUTION - TODAY

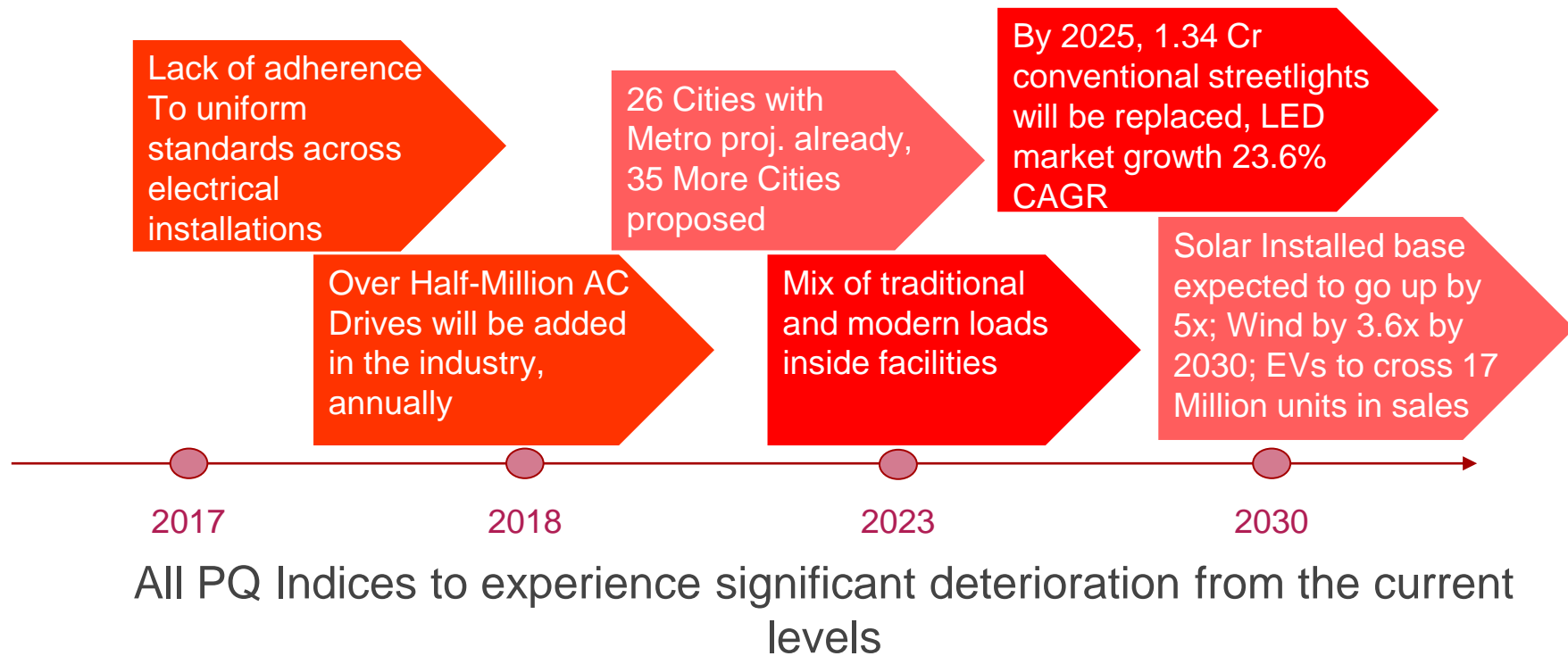


India is the third largest producer of electricity in the world.

Where Electricity Consumption by Industrial & Commercial sector is > 50%



# THE DRIVERS BEHIND THE DIGITAL ECONOMY



# EFFECTS OF POWER QUALITY - INDUSTRIES & UTILITIES



# ANALYSE



Do you have the tools to  
navigate the evolving PQ  
landscape ?

What you can't measure,  
can't be managed

## energyberg

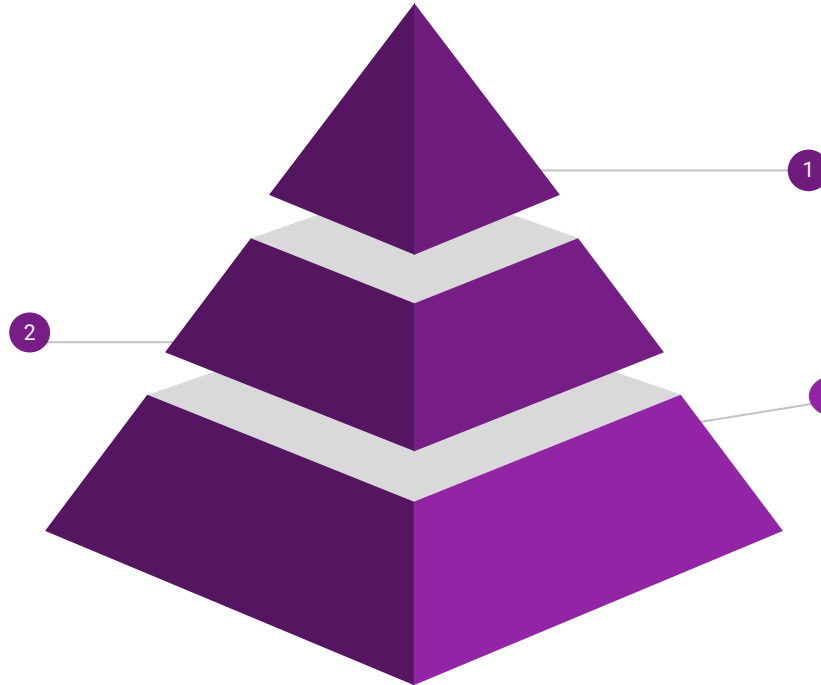
LOSS OF BRAND  
ENERGY SPIKES  
DOWNTIME  
MALFUNCTIONING

INEFFICIENT DEVICES  
POOR CONDITIONING  
FIRE HAZARDS  
EARTHING PROBLEMS  
COMPROMISED SAFETY  
BAD POWER QUALITY  
NON COMPLIANCE  
DATA LOSS  
SUB OPTIMAL DESIGNS

# PQ STANDARDS - ENABLERS FOR BETTER PQ MANAGEMENT

## IS 17036/SEMI 47 among others

Specifies the main characteristics of the voltage at network user's supply terminals in distribution system and provides voltage sag immunity levels



Upcoming

## PQ Measurement & Monitoring Methods

Provides standardised power quality measurement methods and frameworks for PQ monitoring implementation by key stakeholders

## FOR Model Regulations

Provides guidance to all stakeholders on a foundation for implementing Power Quality Measurements, Monitoring & overall Management

# CASE STUDY - 1

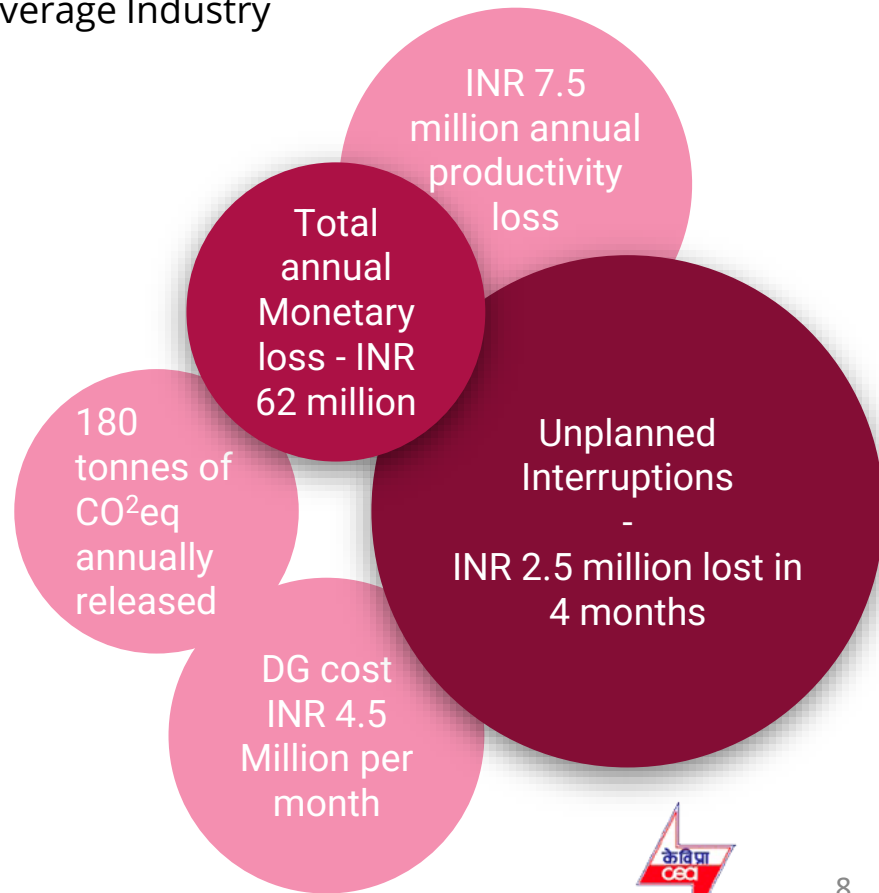
PQ Management - Food Beverage Industry

## Background

- One of the largest bottling facilities in CBO
- Manufacturing Capacity - 2400+ bpm, 6 lines
- Fed from 220 kV S/S 25 KMs away

## Issues

- **Frequent Voltage drops, unscheduled power cuts**
- **Further aggravated by a neighbouring traction load**
- **Stoppage of Production line - happening for years!**
- **Failure of Electronic cards**





# CASE STUDY - 1

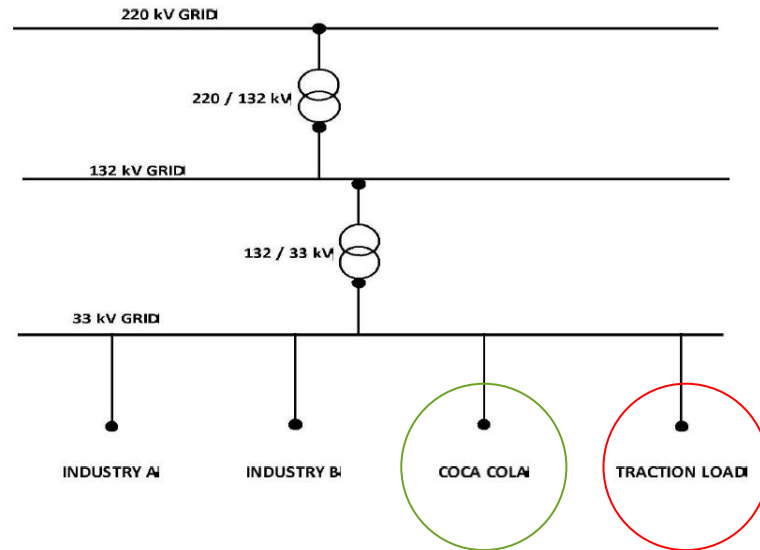
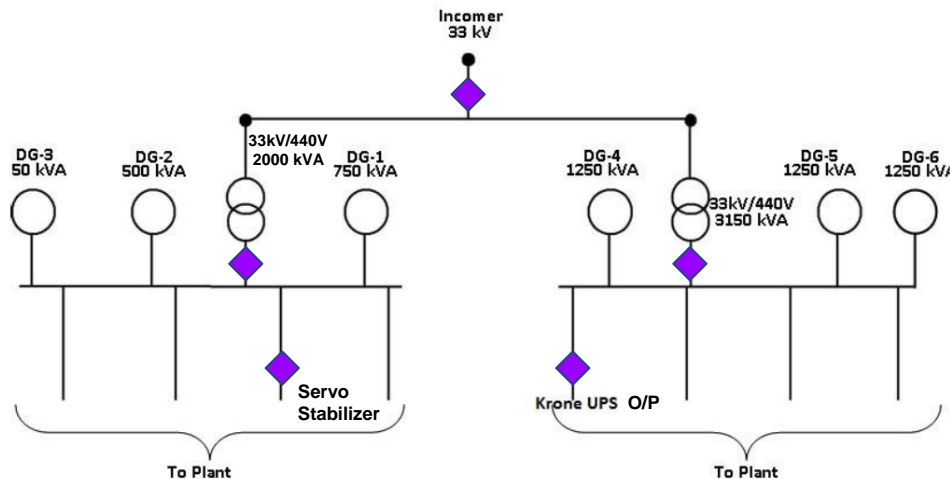
## PQ Management - Food Beverage Industry

IEC 61000-4-30

Draft PQ Std.

## Measurement Methodology

Locations monitored - ◆



Electrical Power Supply

## Voltage Profile

## CASE STUDY - 1

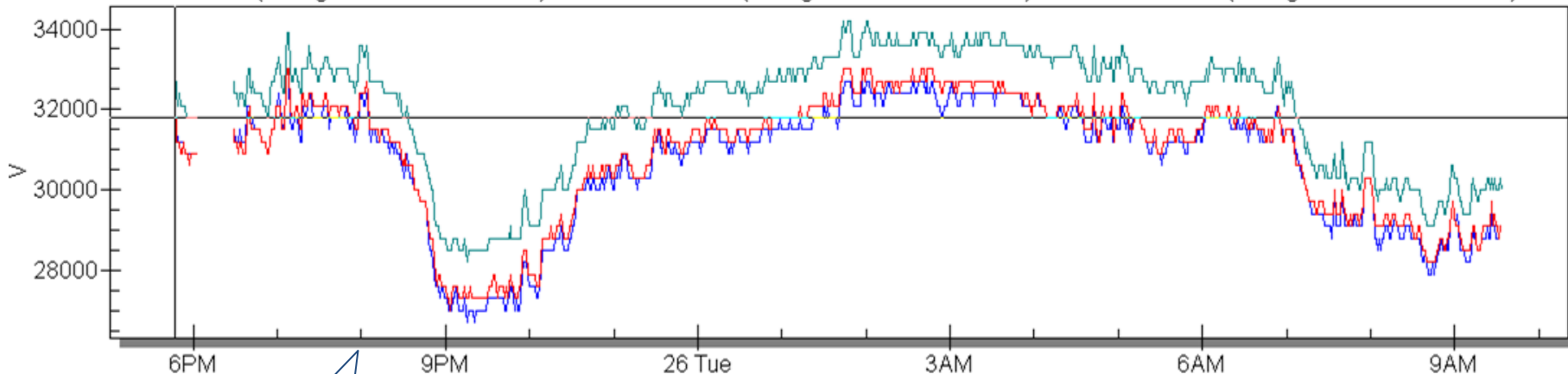
PQ Management - Food Beverage Industry

## 33 kV Main Incomer

MIC.STD (Voltage: Phase 1 - Phase 2)

MIC.STD (Voltage: Phase 2 - Phase 3)

MIC.STD (Voltage: Phase 3 - Phase 1)

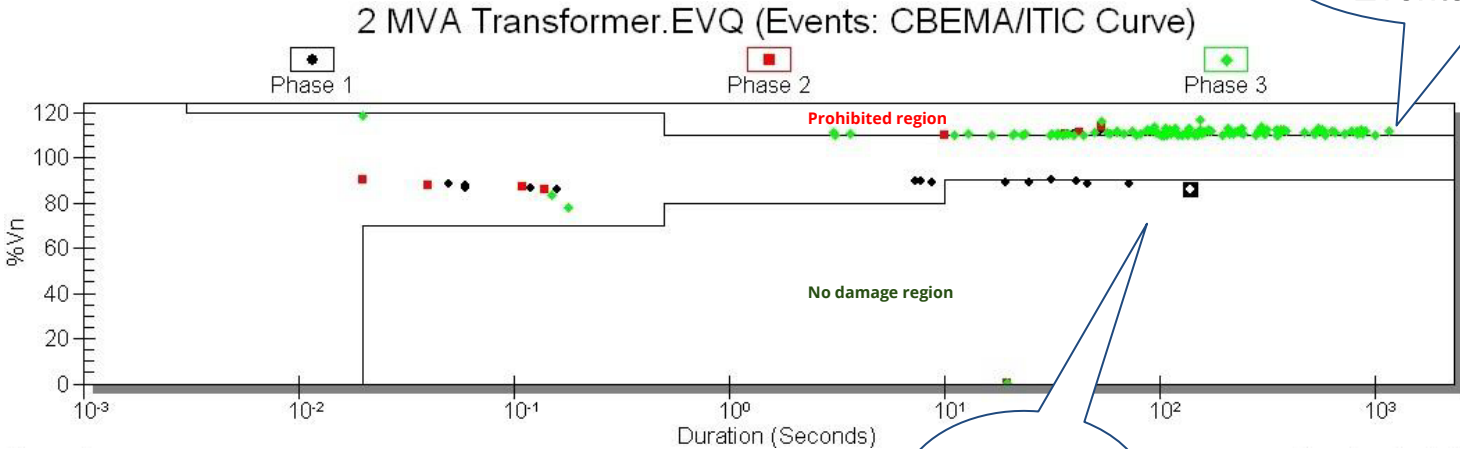


# CASE STUDY - 1

PQ Management - Food Beverage Industry

## ITIC Curve

### Event Analysis

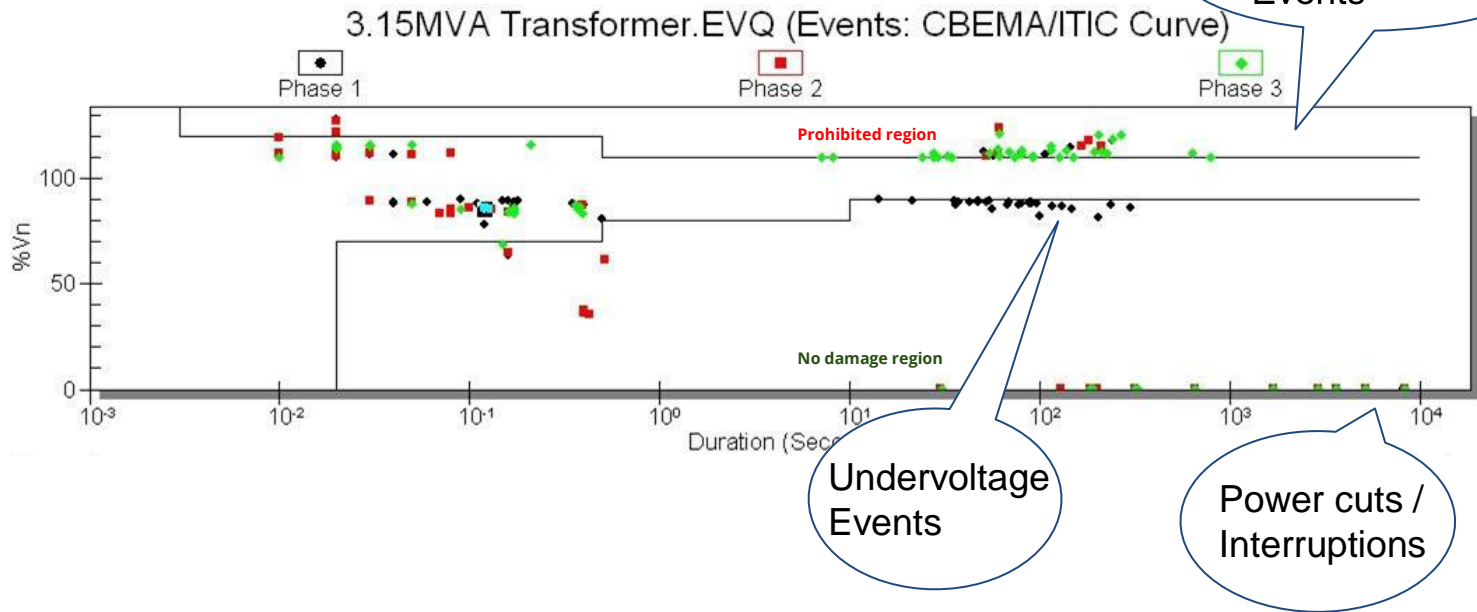


## ITIC Curve

# CASE STUDY - 1

PQ Management - Food Beverage Industry

## Event Analysis

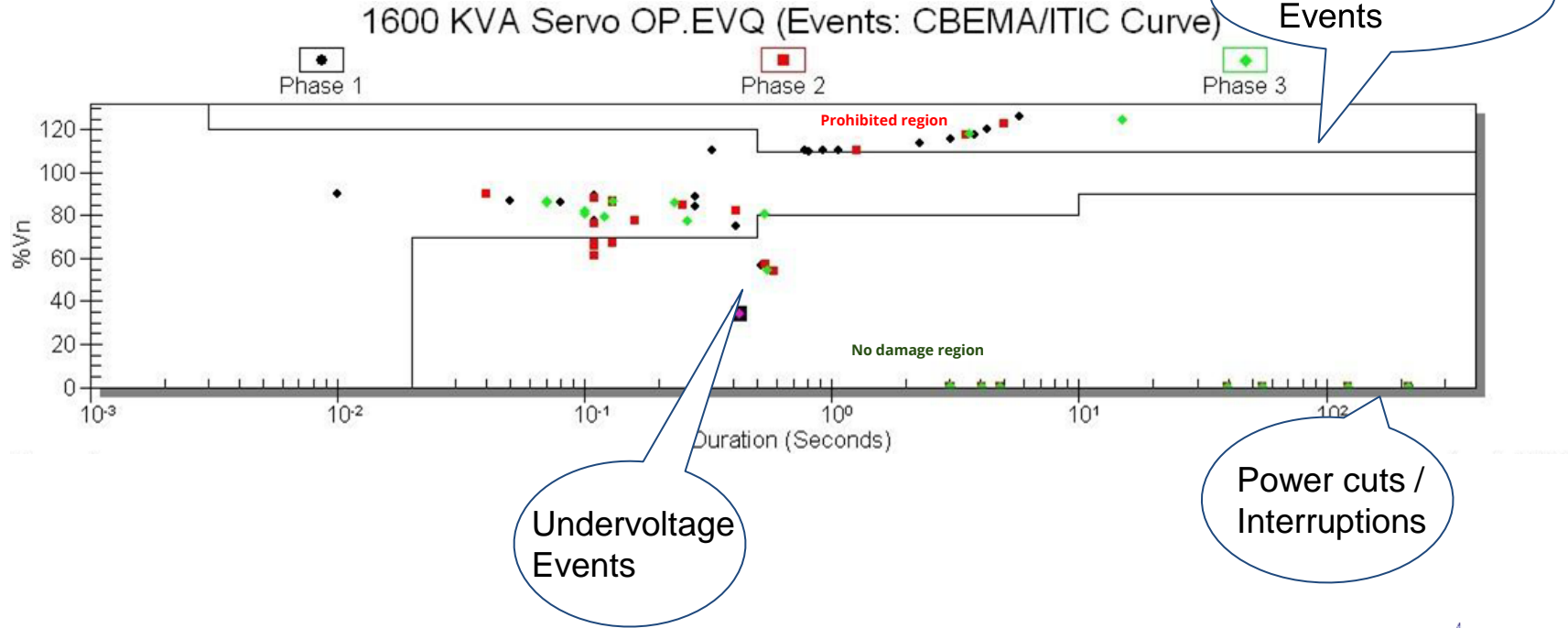


# CASE STUDY - 1

PQ Management - Food Beverage Industry

## ITIC Curve

### Event Analysis



# CASE STUDY - 1

## PQ Management - Food Beverage Industry

### Results & Recommendations

01	Voltage fluctuations, over voltages, and sags are causing critical equipment failures	<ul style="list-style-type: none"> <li>Install 2 no. of UPS each of 600 kVA at critical locations (Immediate)</li> </ul>
02	Huge variations in load by trains operating on 33 KV industrial feeder	<ul style="list-style-type: none"> <li>DISCOM needs to separate the Traction feeder from all Industrial feeders</li> </ul>
03	Severe voltage dips discovered in SCADA caused tripping	<ul style="list-style-type: none"> <li>Protection settings should be adjusted</li> <li>Further investigation required for 2ms voltage dips</li> </ul>
04	Traction load introducing 2nd 3rd and 5th harmonics causing Voltage Amplification	<ul style="list-style-type: none"> <li>An SVC with 'Load balancing control' can balance out the voltage supply</li> </ul>
05	Voltage Interruptions are alarmingly high - max 60 in a month!	<ul style="list-style-type: none"> <li>Auto changeover of supply through RMU fed by two reliable HV feeders</li> </ul>

# CASE STUDY - 1

## PQ Management - Food Beverage Industry

Before PQ Monitoring and Analysis	After PQ Monitoring and Analysis
<ol style="list-style-type: none"> <li>1. Tremendous Financial Losses to the consumer</li> <li>2. More than half the time DG power required</li> <li>3. Utility held directly responsible for poor PQ</li> <li>4. Local workers at risk of unemployment</li> </ol>	<ol style="list-style-type: none"> <li>1. Retention of investment in the state</li> <li>2. Actual source of the issue discovered</li> <li>3. Actions taken by the Utility to separate traction load</li> <li>4. Much smoother and compatible input voltage supply</li> <li>5. Plant was able to remain operational</li> <li>6. Faith regained in the Utility's capabilities</li> </ol>

# CASE STUDY - 2

## PQ Management - Data Center / Steel Plant

Before PQ Monitoring and Analysis	After PQ Monitoring and Analysis
<ol style="list-style-type: none"><li>1. Investment in a 50MW data center needs assurance w.r.t power availability and reliability</li><li>2. Concrete actionable recommendations not available to mitigate issues if any</li></ol>	<ol style="list-style-type: none"><li>1. Timely discovery of Power Quality non-compliances due to neighbouring steel plant</li><li>2. Grid level mitigation actions now clear to utility</li><li>3. DC can take proactive actions at their end knowing the intensity and frequency of PQ trends and events.</li></ol>



# SUMMARY

Industry	Problem	PQ issue	Actual Cause	Standards used for analysis
Food and Beverage Industry (Existing)	Extremely poor voltage quality, Huge financial losses	Voltage Sags, Swells and Interruptions	Neighbouring load - traction	IS 17036 ITIC Curve New Draft Standard
Data Center (New Consumer)	Incoming Supply feeder has non-compliant Power Quality for DCs	Flickers, Harmonics, Voltage Sags, Swells and RVCs	Neighbouring load - Steel Plant	IS 17036 SEMI F47 IEEE 519-2014 New Draft Standard

# PQ MANAGEMENT – A TORCH IN THE DARKNESS!



## How PQ management with IT Integration helps?

- Automated compliance to Standards & real time reports
- Causal Analysis on hard to trace failures/malfunctions
- Actionable recommendations for the Pollutant
- Improve Asset life and capex reduction by timely actions
- Use of AI/ML for Predictive insights to prevent future failures
- Real time Identification and situational intelligence of the electrical network



Enhancing PQ Management through IT means better customer service and in turn profitable utilities!!!!

# CONCLUSION & WAY FORWARD

- PQ Monitoring & Analysis = Revenue
- PQ Analytics = Insights into asset health
- Smart meters without PQ = Opportunity Lost
- Adherence to PQ Standards = Reliable Grid