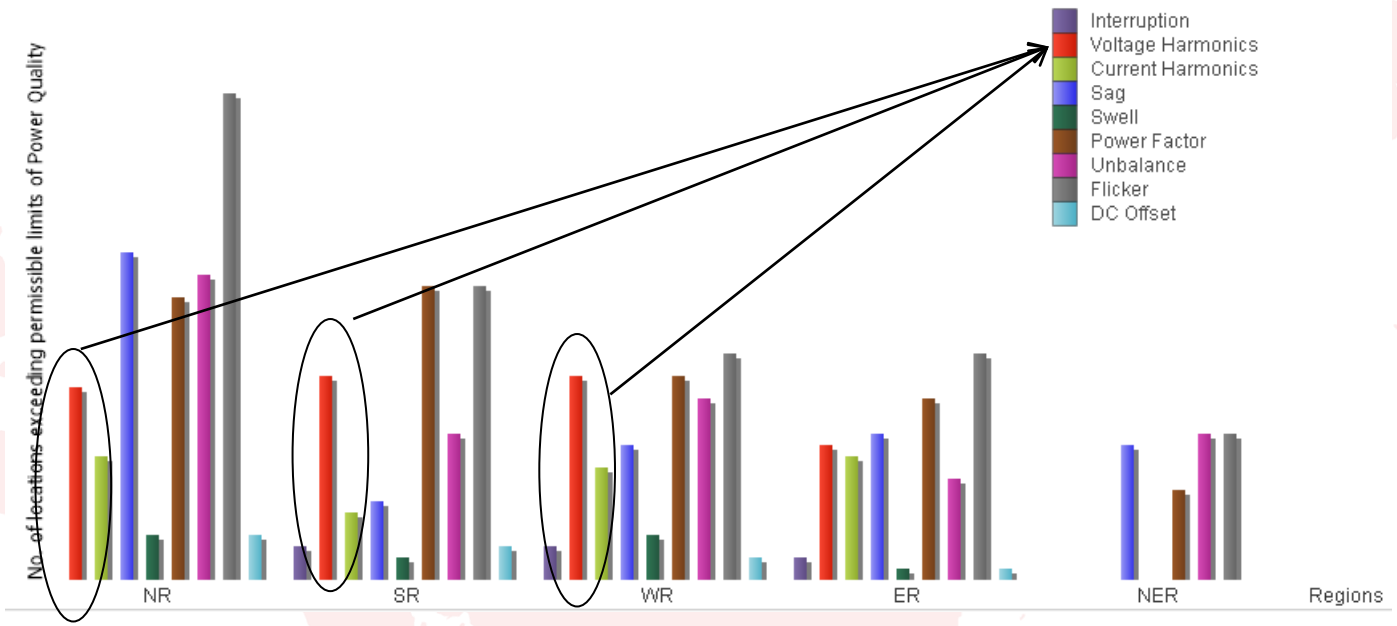
Modern Loads & Poor Power Quality Harmonics Issues

29/30 Nov' 2017

Distribution Utility Meet (DUM 2017)

Bangalore

India's Grid PQ – Nearing Cliff?

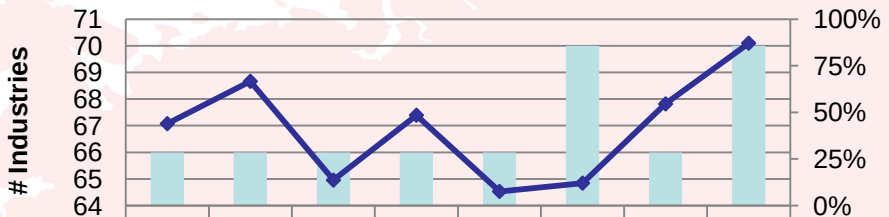


Region-wise Power Quality Parameters observed across the country

(Source: Swachh Power by Power Grid Corporation of India Ltd. | Year 2014)

The Hidden Menace within

Survey on Power Quality in Industries/IT

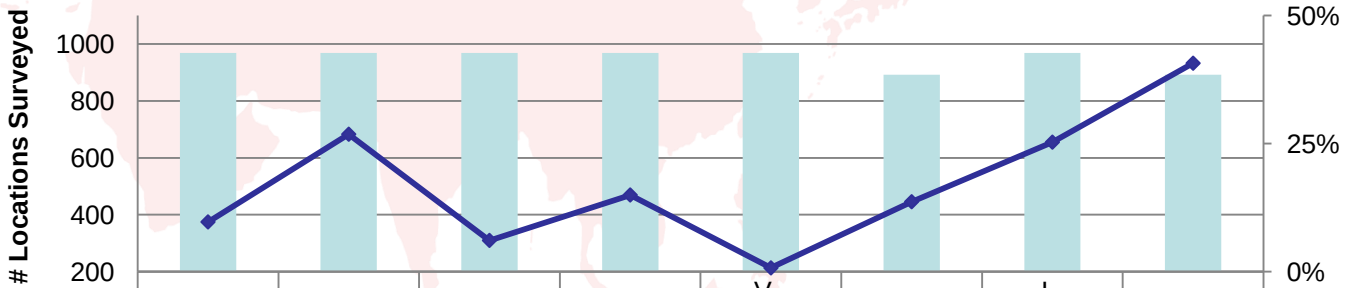


	Voltage Variation	Rapid Voltages	Sags / Swells	Transient	V - Unbalance	High Vthd	I - Unbalance	High Ithd
# of Facilities Studied	66	66	66	66	66	70	66	70
Health Score # Facility Wise	44%	67%	14%	48%	8%	12%	55%	87%

Clear Winner!!!

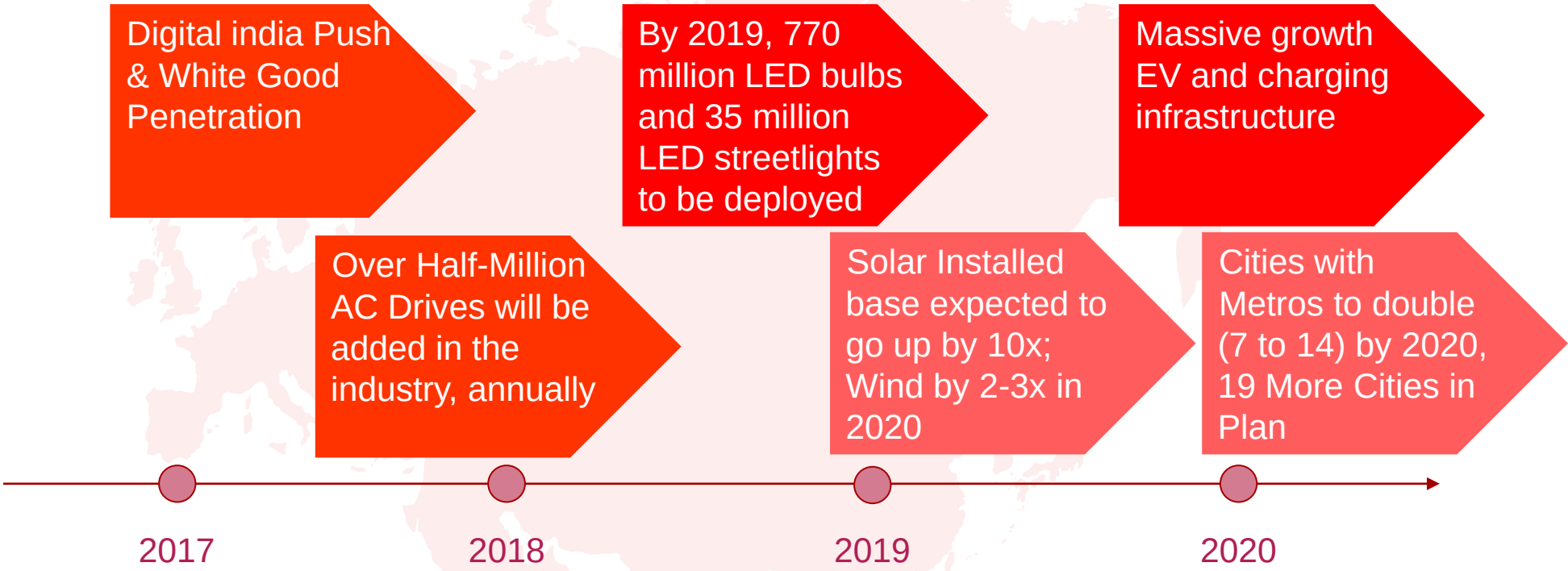
Source: Efficienergi survey

Survey on Power Quality in Industries/IT



	Voltage Variation	Rapid Voltages	Sags / Swells	Transient	V - Unbalance	High Vthd	I - Unbalance	High Ithd
# of Locations Surveyed	969	969	969	969	969	892	969	892
Health Score # Location Wise	10%	27%	6%	15%	1%	14%	25%	41%

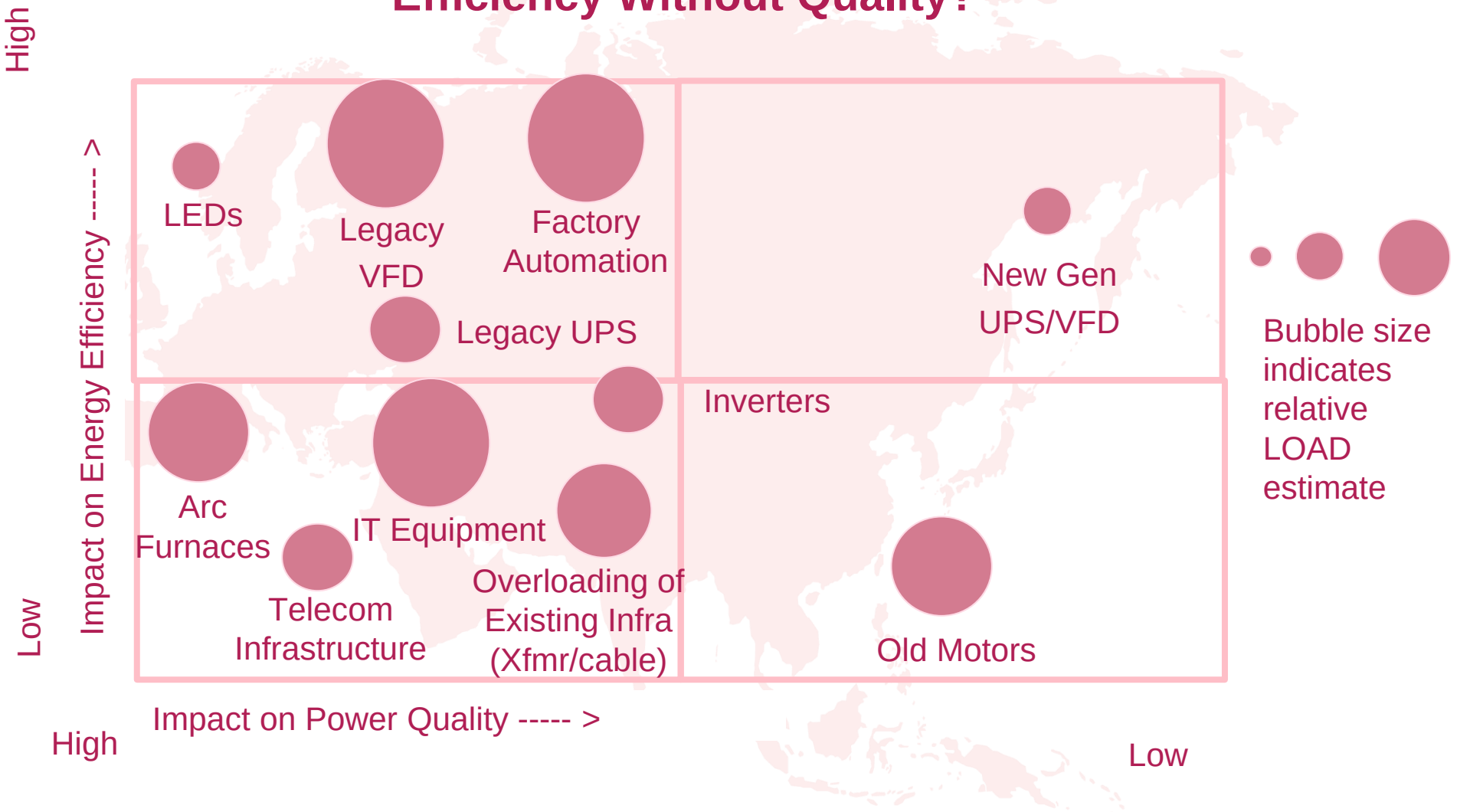
Expect Further PQ Deterioration



Harmonics to increase by ~ 50-60% by 2020, from the current levels with adverse effect on other PQ indices too.

Powering Tomorrow's India

Efficiency Without Quality?



Poor Power Quality From Harmonics

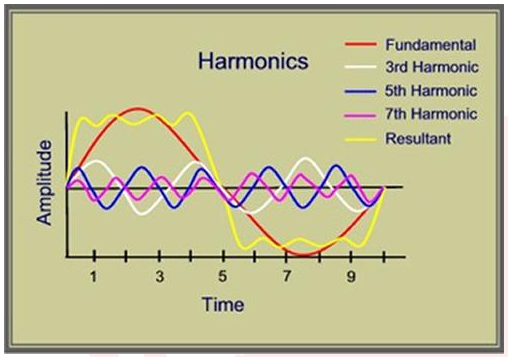


Figure A

These sinusoidal wave shapes contain many high frequency components called "Harmonics"

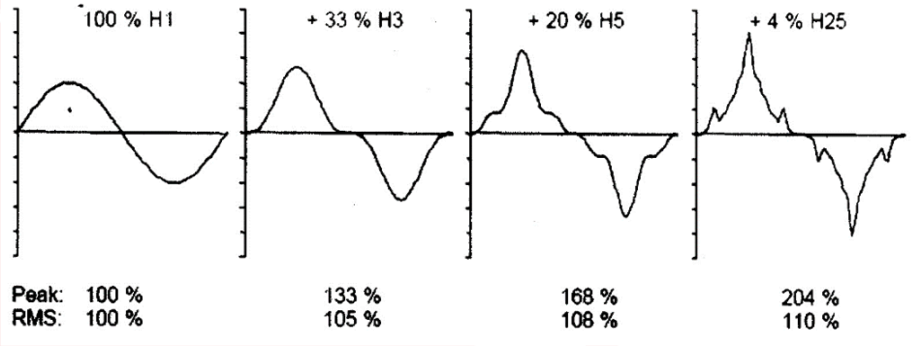


Figure B

Presence of harmonics increases RMS and peak current of the waveform. This increases over heating, relay malfunctioning and damage to insulation

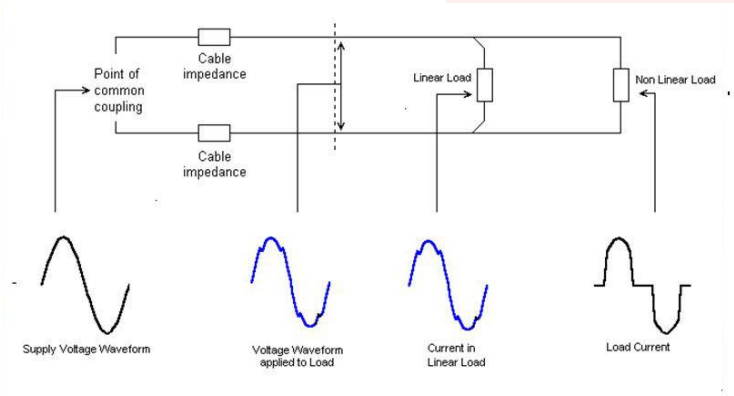


Figure C

Harmonic currents flowing through the impedance of a distribution network produce harmonic voltage drop, resulting in distorted voltage waveform.

How It Impacts You and Industry?

- Positive, negative and zero sequence harmonics can cause different effects, as noted in the table. Harmonic voltages and current can also cause the following problems

Sequence	Rotation	Effects
+	Forward	Heating
-	Reverse	Heating & motor problem
0	None	Heating i_n = sum of all i_{oh}

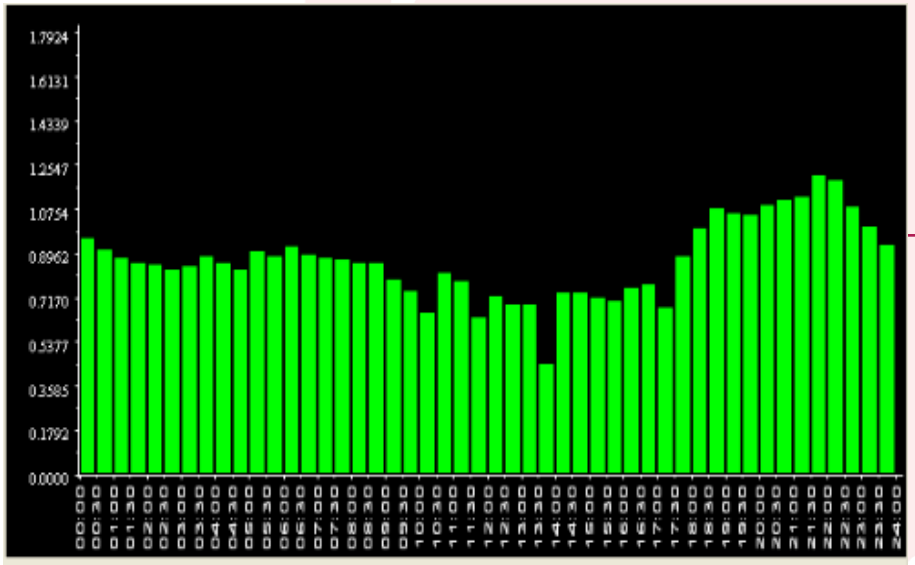
- Telephone Interference
- PLC & Computer Failures
- Misoperation of SCR Drives
- Frequent Tripping of Circuit Breakers
- Overheating
- Interference
- Resonance
- Insulation Failures
- Capacitor Failures
- Machine Vibration
- Frequent Fuse Blowing
- Burning Out Small Auxiliary Equipment
- Supply Distribution System Distortion
- Malfunctioning of Electronic Equipment
- Severe Lamp & Computer Screen Flicker

The PQ Challenge

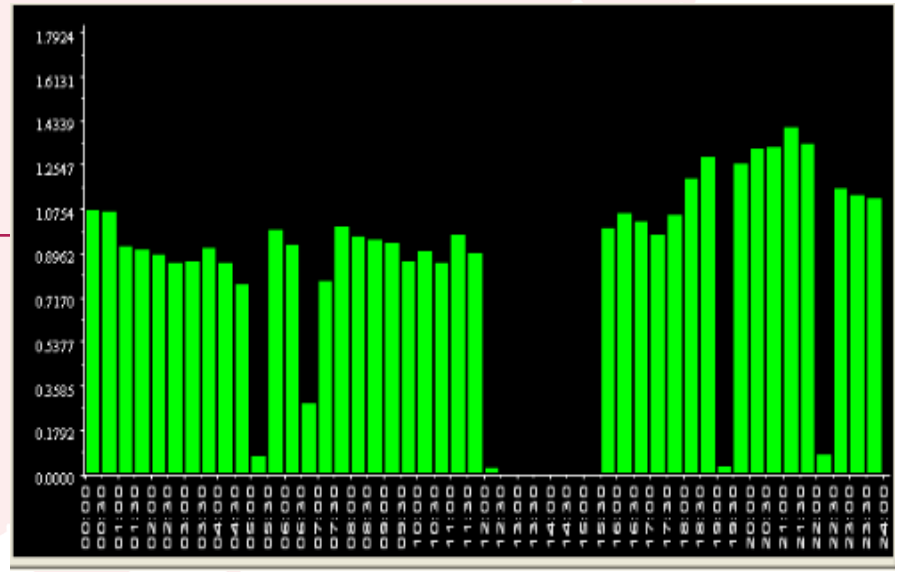
- ABSENCE *of unified standards and regulations akin to PF Improvement*
- UTILITIES *can ill-afford to ignore diverse impacts of PQ in such a dynamic scenario*
- STRIKING *lack of investments in attempts to measure, assess, learn, analyse and improve electrical power quality issues among stakeholders*

Comparison of LS Graph

Without Interruption

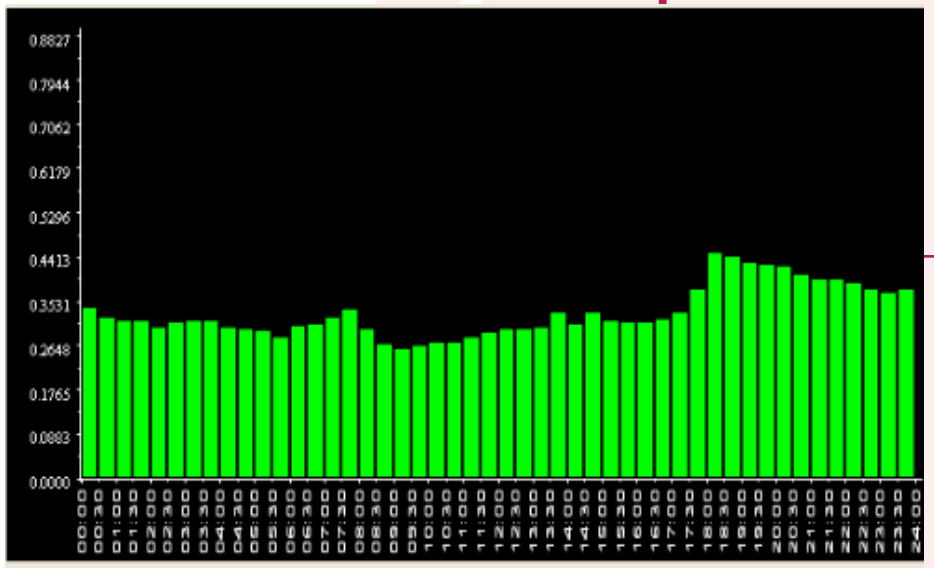


With Interruption

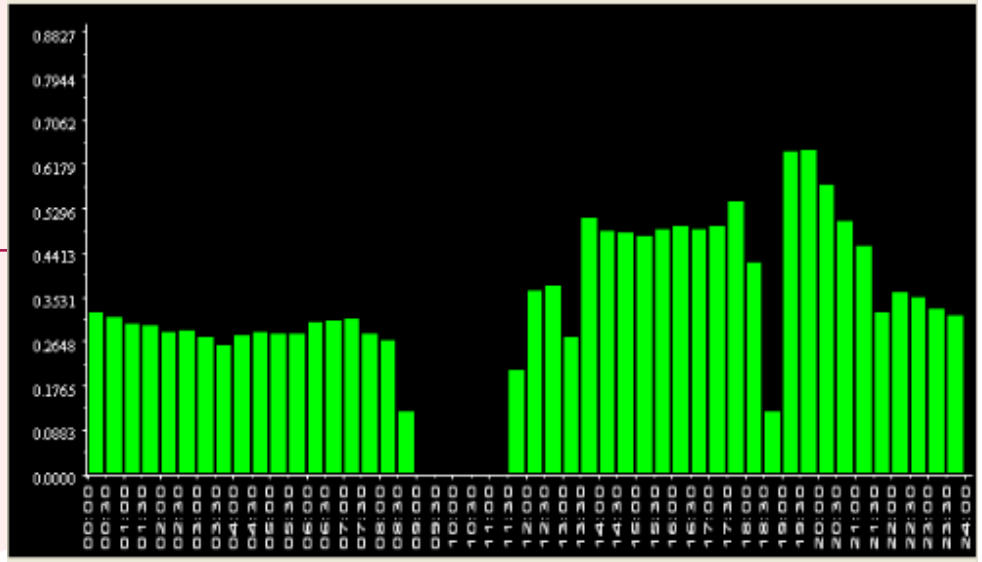


Comparison of LS Graph

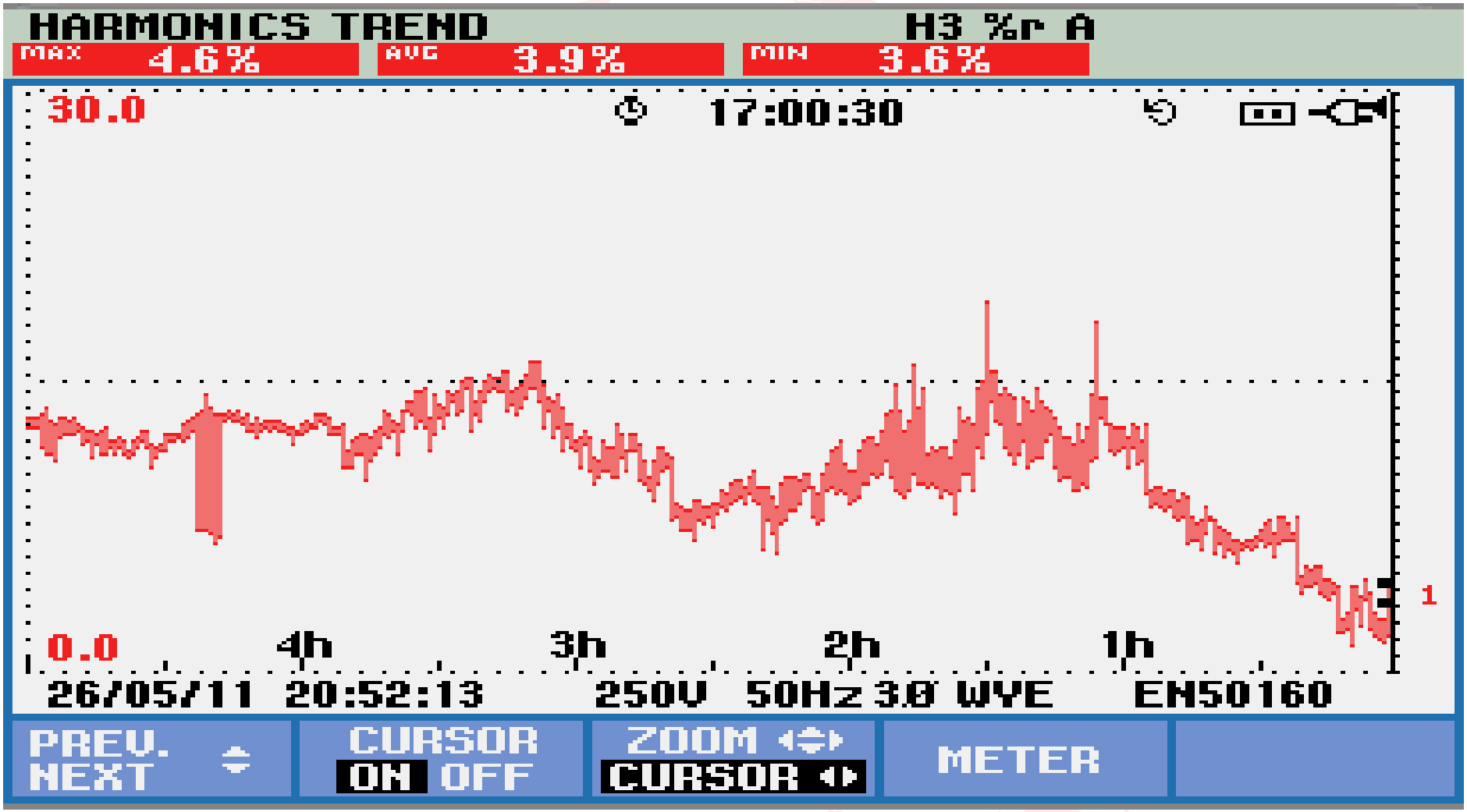
Without Interruption



With Interruption



Harmonic Trend in Domestic Complex



- The load survey graph taken in a distribution transformer with exclusive domestic loads.
- The first and second slide shows the difference between load curve on different days. Left curve is the day without load shedding and load curve is balanced. The right hand side load curve with load sheddings shows increase load after resumption of power supply.

Vision

To propagate a common Platform to monitor, measure and ensure harmonics & power quality compliance assurance

- Industry's first!
- Technology Neutral
- Benefits all Stakeholders

The Platform

UNIFIED software tool to improve compliance assurance of power quality parameters

Instantaneous Assurance

- Data Capture
- Self-evaluation

Free (Version 1)

Periodic Assurance

- Data storage for historic analysis
- Data driven Decisions

Restricted Access (Version 2)

Real-time Assurance

- Data Correlations for trends
- Advanced Control

Restricted Access (Version 3)

Inviting Evangelists & Associates

Financial Grant for Platform

Lead/Support Partner for stakeholder consortium

Resources to propagate platform (People, Infrastructure etc.)

Knowledge to structure and scale up Platform

Drive user empanelment, especially SMEs

Thank You

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