



Power Quality Audit

The Right Way to Ensure Power
System Performance

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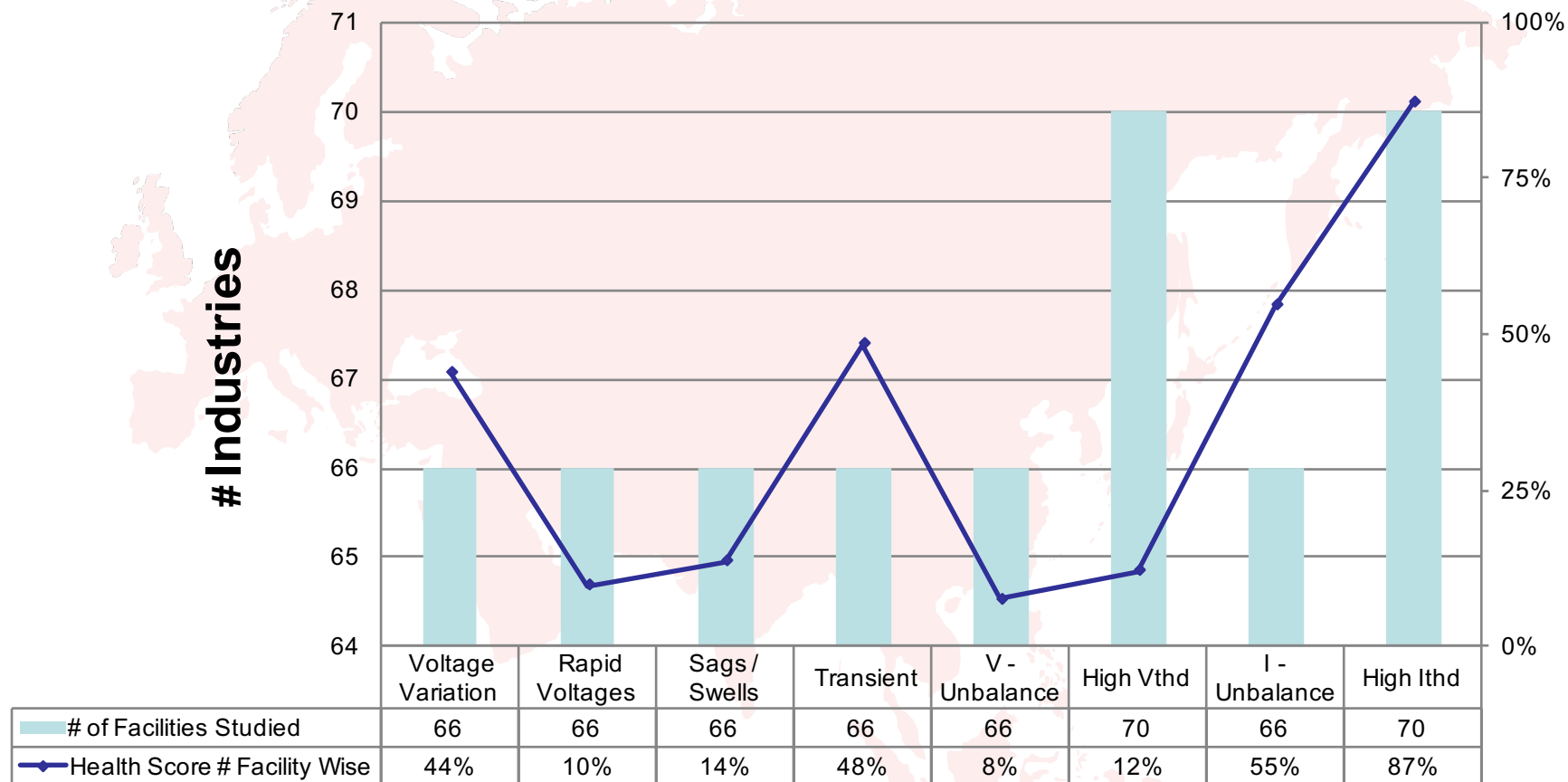
apqi ASIA
POWER
QUALITY
INITIATIVE

Agenda

- PQ Audit – Understanding the need
- The Why, When, Where and What of PQ Audits
- Getting started with PQ Audit

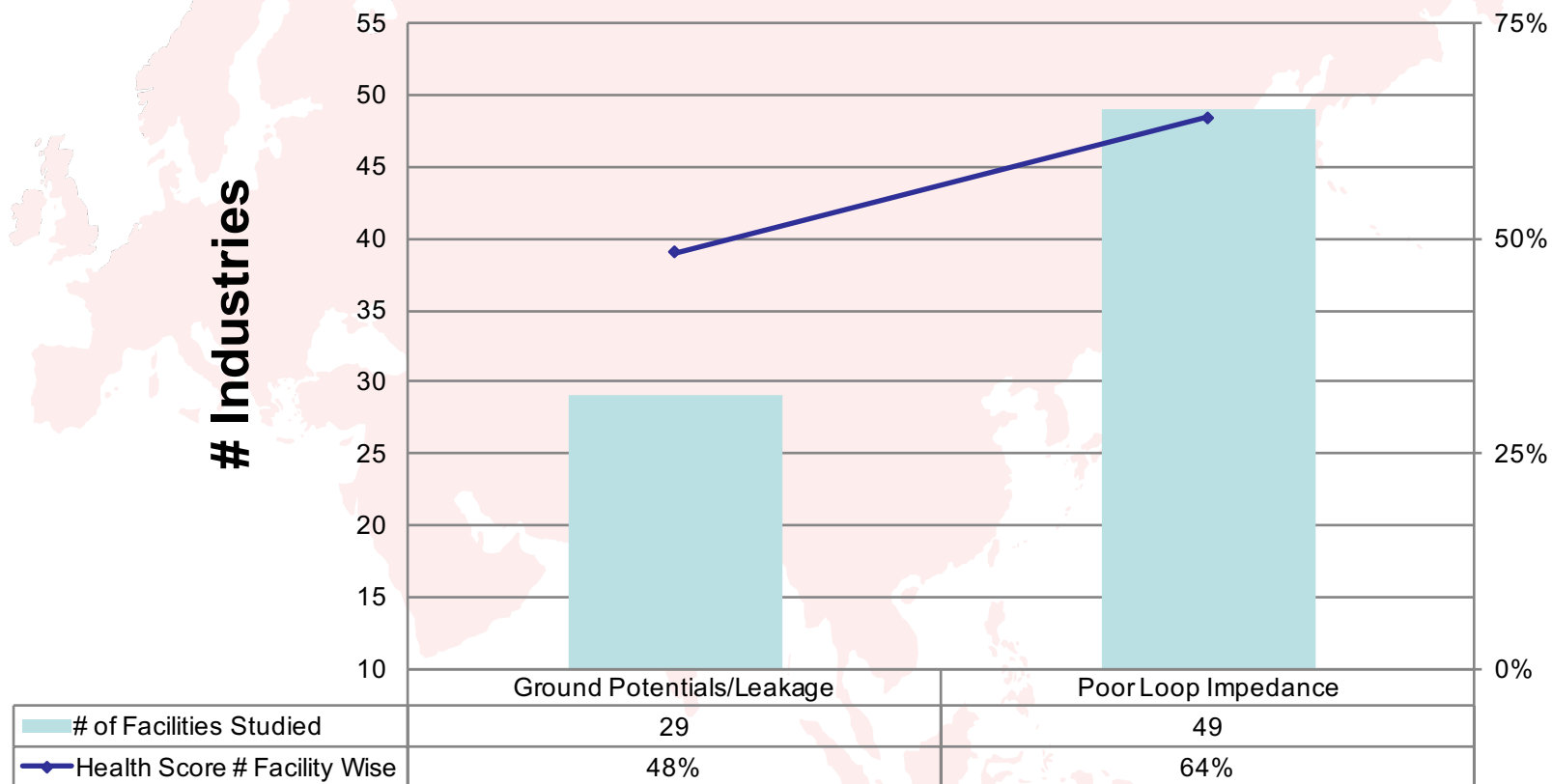
PQ – The Hidden Menace.

Survey on Voltage Quality



PQ – The Hidden Menace.

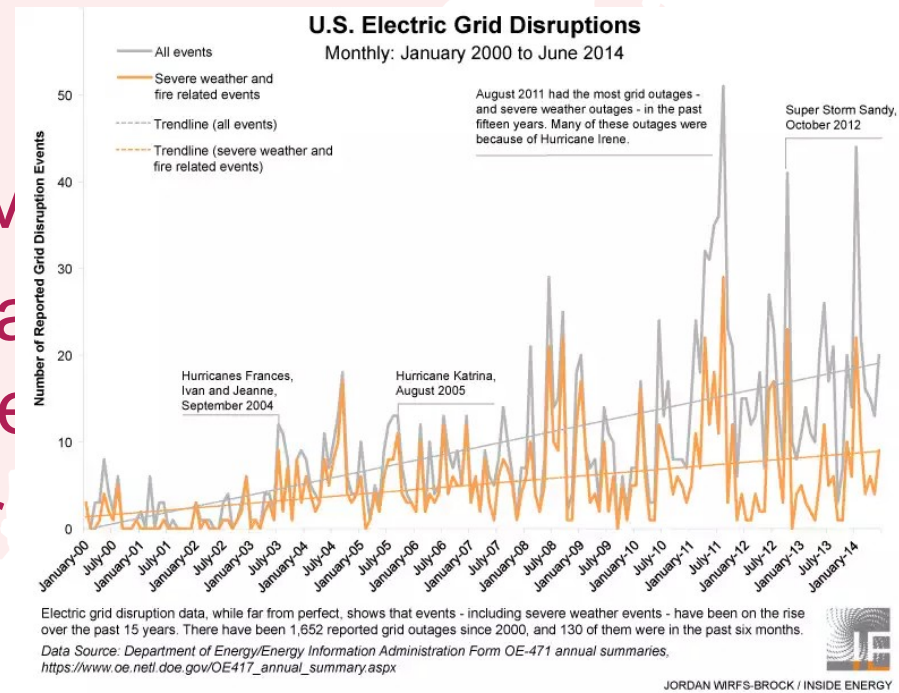
Survey on Earthing Quality



PQ is the new *Availability*.

PQ Gaining importance with

- Greater complexity and interconnectivity of power networks
- Higher sensitivity of Electronics, IIoT driv
- Availability and Relia affected by PQ issues
- Rising costs of poor

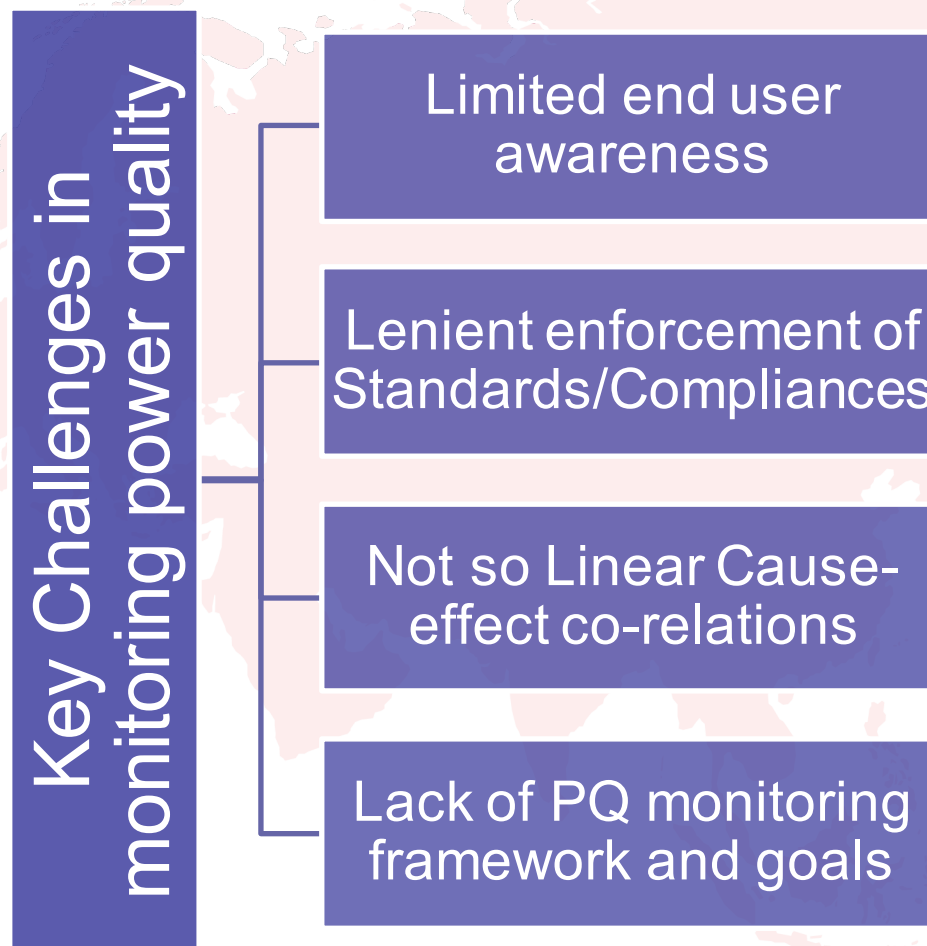


Availability is binary.

POWER QUALITY is not.

- PQ is multi-thronged and dynamic
- Good PQ is relatively difficult to define
- PQ improvement is specific to the systems being reviewed
- End user Vs. Utility Vs. OEM responsibility?
- Financial and life-cycle benefits of good PQ may not be upfront or obvious
- Improving PQ is an ongoing process that calls for investments of time, effort and money

Managing PQ - Challenges exist at various levels



PQ = Lot's of Myths.

PQ myths that need corrections

- PQ \neq (just) PF correction
 - Harmonics \neq Always harmful
 - Oversized System \neq Better PQ
 - UPS/SVR/Harmonic Filter \neq “The” solution for PQ
 - PV/Wind Generation \neq No PQ issues
 - Additional earthing stns \neq protection of sensitive equipment
- ...and many more

Improving PQ – Whose job is it anyway?

Projects and Consultants

- PQ compliant Equipment, PQ Standards
- PQ Monitoring, Performance obligations on OEMs

Utilities

- Awareness building regards PQ contractual obligations

EPC and Contractors

- Pre/Post Installation/Commissioning PQ checks, Sensitization of all project stakeholders

End Use and Maintenance

- PQ Data Monitoring frameworks

OEMs

- Publish PQ Compliance/Standards, Align to meet PQ goals for the electrical network

Poor PQ reflects a broken chain

Result - PQ responses continue to be reactive.

- Reactive costs you much more than you actually can think

Shutdown of costly studio equipment at a leading Radio Station

Delay of 2-3 months in launch of a flagship, highly advanced AV facility

Revenue loss as a critical equipment at hospital breaks down

Breakdowns due to non-linear loads induced by VFDs at a paint manufacturer

Downtime due to PQ disturbances at a Server room catering to a pan India audience

Loss of Reputation due to Elevator malfunctioning at a hospitality chain

Getting the best from PQ Audit – Why? When? Where? What?

- Why PQ Audit?
- When to conduct?
- Where to focus?
- What to expect?

Why PQ Audit? – Few Thoughts.

- **Compliance** requirements by Grid owners, end users, OEMs – harmonics, voltage quality, ground potentials
- **IST** (Integrated System Testing) / Pre-Post Commissioning Tests
- **Contractual** obligations
- Performance monitoring & verification of installed systems /equipment
- For **Justifying CAPEX** proposals
- **Root Cause & Failure Analysis**
- **Benchmarking** Studies – Mainly Grid Level
- **“Fixing the blame Audit”** (expecting Pre-conceived Outcomes)

Why PQ Audit?

Calculating your ROI

PQ Audit as an Insurance

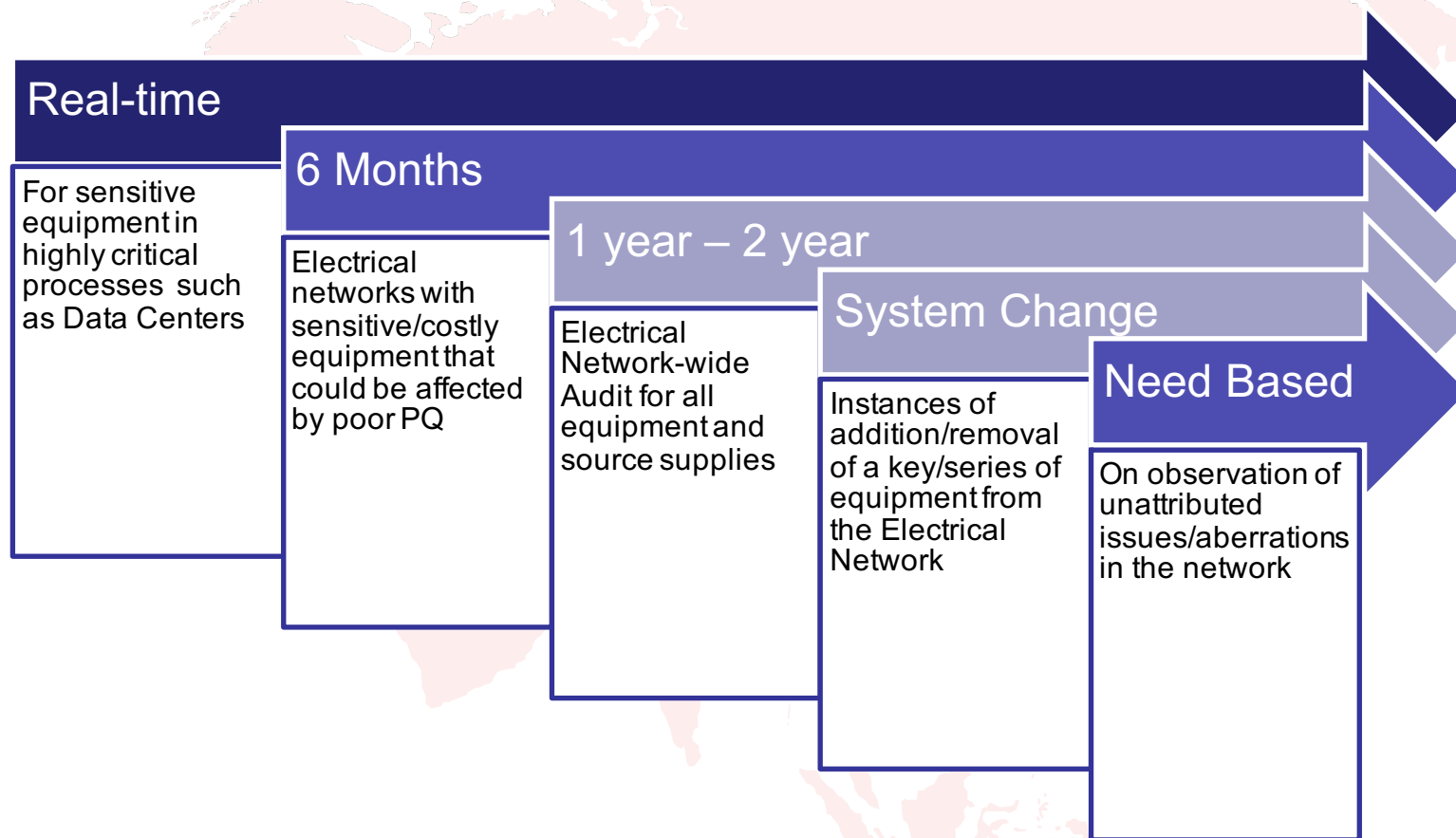
- PQ Audit is budgeted as a standard procedural cost
- Cost of assurance of availability, reliability of energy network realised over network life-cycle

PQ Audit as a Solution

- Budget for PQ Audit is created to address a specific (and often urgent) issue/need
- Returns vary from situation to situation, often perceived in relation to the magnitude of the issue/need

PQ Audit

When to conduct?



PQ Audit – Typical Parameters

Parameter/Cause	Problems/Effects
Voltage Profile	
Voltage Unbalance	Overheating, Poor efficiency, Failure of Critical Equipments
Voltage Sags/Swells	Process/IT equipment downtime or rebooting, data loss.
Voltage Transients	Premature failure of newly installed electronic equipments.
3ϕ Symmetry	False Tripping, Failures/Malfunction of sensitive equipments.
Demand Optimization	Revenue saving, Reduced Per Unit Energy Cost
Harmonics	Overheating, Increased losses, false tripping, EMI, Transformer, Generators, Motors and Capacitors overload.
Power Factor	Reduced capacity, Regulatory penalties, reduced utilization of source and distribution equipments, Poor voltage regulation, reduced efficiency.

PQ Audit - What to expect?

Outcomes

- Identify outcome areas for the audit, beforehand

Operational Conditions

- PQ to be analysed in relation to the operational conditions > 70% normal operation

Resources

- Planned in relation to parameters to be monitored

Time of Study

- In most cases representative duration would be > 1 Week to capture entire spectrum of parameters

Locations

- Zero in on probable locations of study, Utilize existing metering infrastructure to supplement insights.

• Execution

- Include real-time analysis so that important events are not lost

PQ Audit

What to expect?

Deliverables

- Reports
 - indicating poor PQ incidents/occurrences
 - Non-compliance points
- Analysis
 - Magnitude and criticality of issues
- Insights
 - Clear co-relation of issues and poor PQ instances

Actions

- Prioritising actions and investments to improve PQ
- Risk mitigation by identifying and prioritising corrective measures, across stakeholders

PQ Audit

Symptoms that you need one!

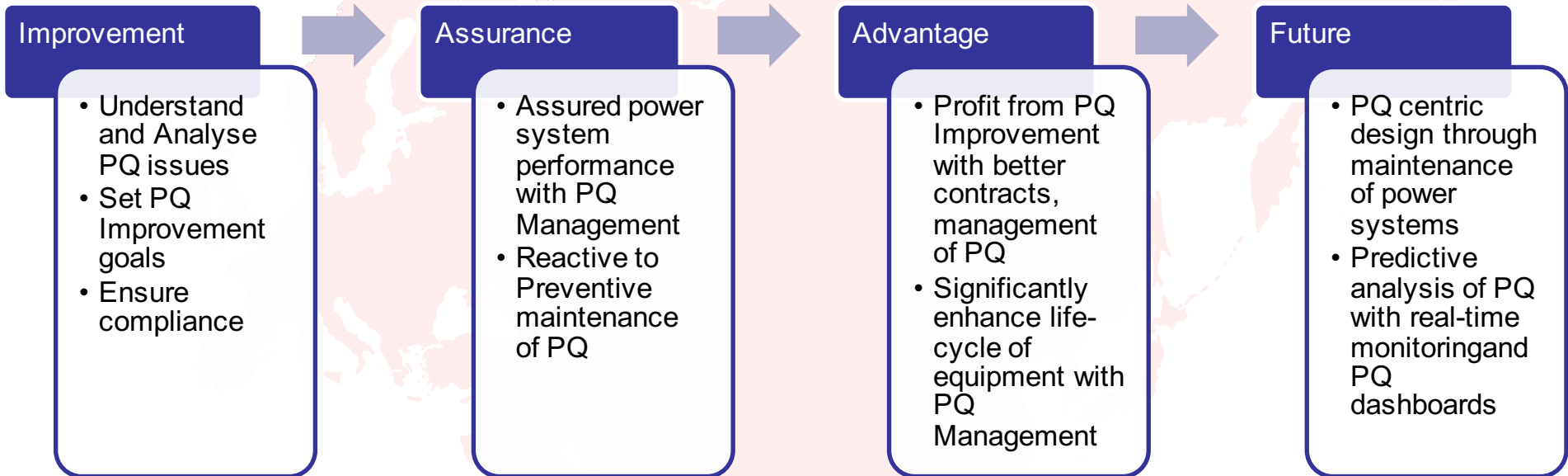
- Erratic/Sub-optimal performance and failures in electrical network are considered normal
 - Sign that the team has accepted to live with problems
- PQ improvement is entirely handled by Contractor or Commissioning agency itself

PQ Audit

Symptoms that you need one!

- Facilities/Maintenance is NOT able to assure reliability
- Losses/ Exposure to risks in case of leased Assets/Services, OEMs due to poor PQ
- Penalties imposed due to non-compliance with PQ parameters

PQ Audit – Getting Started!



PQ Audit – Do It Yourself

Routine checks of following can be undertaken in house

- Analyse Voltage trend patterns (sudden peaks) for a week
- Observe Current Trends - differences between loading of 3 phases
- Neutral Current – does it match the unbalance?
- Power Factor – fluctuations from leading to lagging
- Monitor Harmonics ThD-I/ ThD-V
- Ground Potentials – Trends w.r.t % of P-N Voltage

Thank You.

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