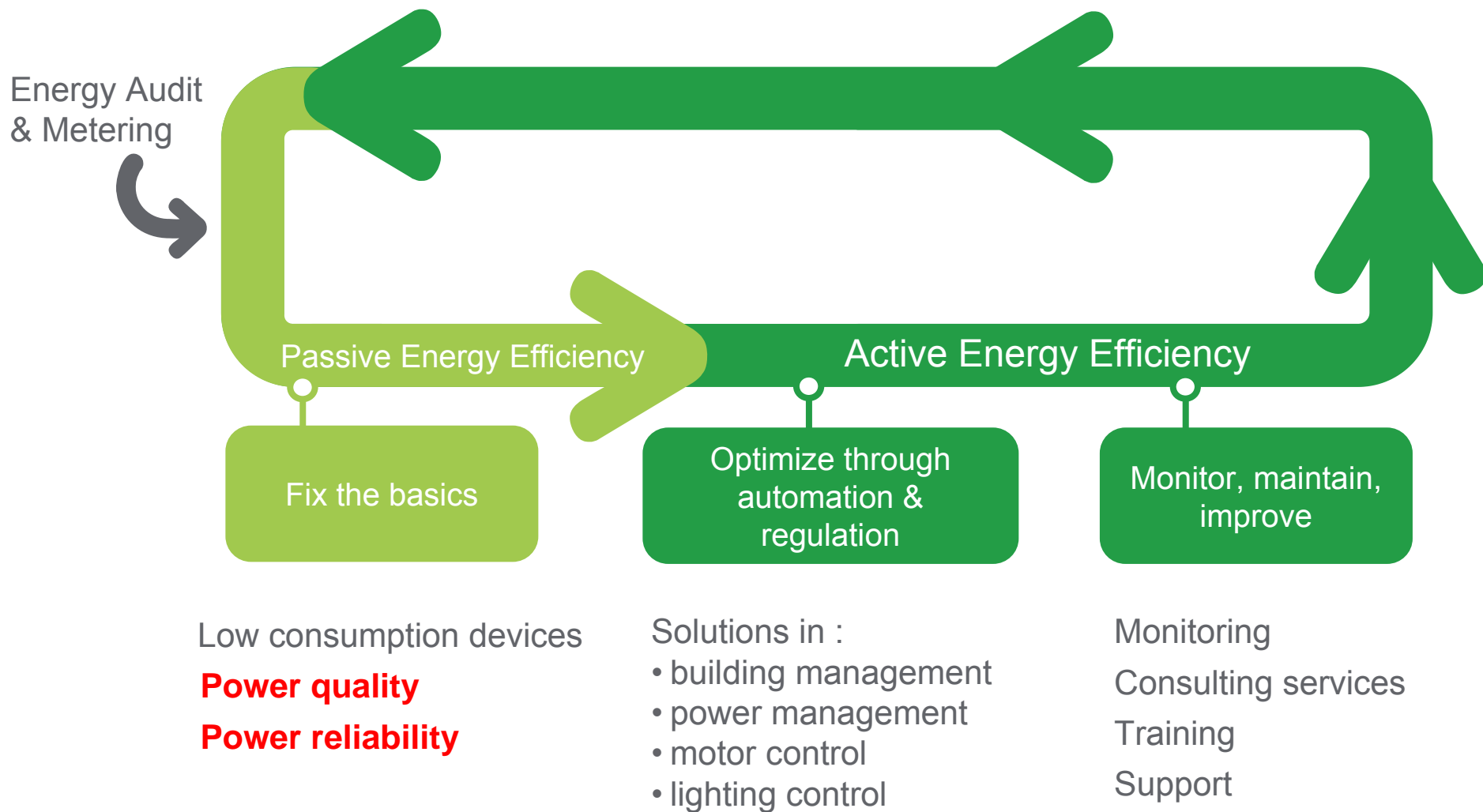


# The Overlooked part of Energy Efficiency and Reliability - Power Quality

Symptoms – Causes – Solutions

**John Straughn**  
**Power Monitoring Offer Line Manager**  
**Power Quality Meters**

# We enable the Energy Efficiency Lifecycle



# Payback: Real ROI is found when you look below the surface



**Power Quality** and Energy management system

+

Three dimensions of savings opportunities

=

Increased efficiency, uptime and revenue

# Poor Power Quality may be stealing your Energy Efficiency savings....



Proper monitoring of power quality and power factor are critical components to your Reliability and Energy Efficiency programs

- Proactively managing these can save you money

The costly effects of power quality problems

- Reduction of transformer life through heating
- Reduced system capacity
- Degraded motor performance and life
- Tripped sensitive loads
- Telecommunications interference

Average cost of momentary interruptions

- One- to two-second outage \$14,900
- 15-cycle voltage sag \$10,400

# Why focus on Power Quality?

Figure 4-1: Number of PQ problems by sector

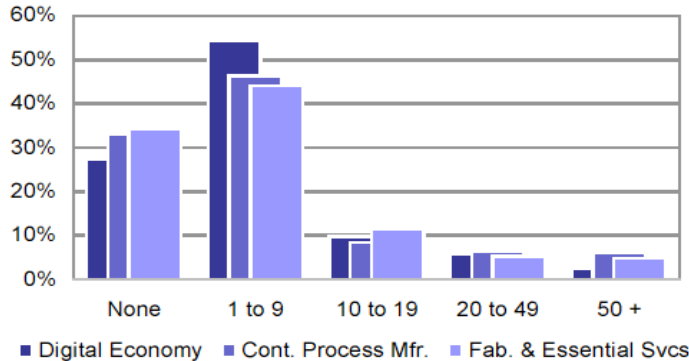
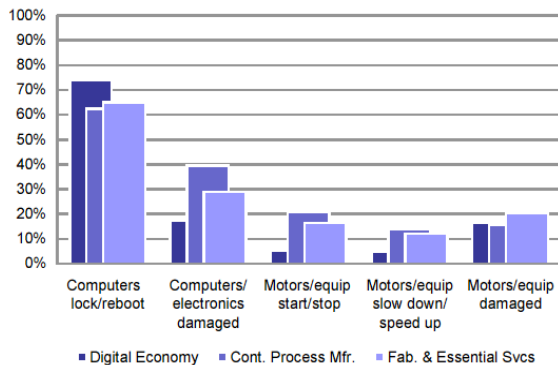


Figure 4-2: Percent of establishments with problems from PQ phenomena by sector



- The average industrial consumer is aware of **8** PQ events / year
- Equipment most impacted include computers, controls and motors
- Aggregate cost of PQ events estimated to be **\$300 million** for continuous process manufacturers

Source: [EPRI CEIDS](#) *Cost of Power Disturbances*

# Power Quality Quiz

- I show a symptom of a possible power quality related event
- I also show a list of possible power quality phenomena
- YOU select which phenomena may have caused the event!

# Power Quality Quiz – Question #1

## PQ Symptom

- Nuisance breaker trips/  
fuse clearing



And the answer is...

## PQ Phenomena

- Voltage sag
- Voltage swell
- Transients
- Poor power factor
- Harmonics

Peak loading may be the problem but harmonics can contribute to this.

Solutions include Schneider Power Factor Capacitor banks, standard, tuned, or automatic, keeping in mind harmonic concerns. Active filters may be needed. Load shifting may also be necessary.

# Power Quality Quiz – Question #2

## PQ Symptom

- Damage to sensitive equipment, such as failed printed circuit boards (PLC, drives, etc.)



**And the answer is...**

## PQ Phenomena

- Voltage sag
- Voltage swell
- Transients
- Poor power factor
- Harmonics

But remember that harmonics may (rarely) contribute, and poor grounding may also contribute

Solutions include using Schneider transient surge suppressors, and Schneider Services to investigate grounding issues



# Power Quality Quiz – Question #3

## PQ Symptom

- Shorten transformer life – a.k.a “Wow – that transformer sure is hot!”



And the answer is...

Solutions include power factor capacitor banks, standard, tuned, or automatic, as needed to reduce reactive power and load current (Being mindful of the harmonics) and active filtering

## PQ Phenomena

- Voltage sag
- Voltage swell
- Transients
- Poor power factor
- Harmonics

But the transformer can simply be over loaded, so check the loading, too.

# Power Quality Quiz – Question #4

## PQ Symptom

- Nuisance Drive tripping & PLC / controls lockup or shutdown



**And the answer is...**

Solutions include UPS and /or Electronic Compensation Surge Suppressor for protection against utility transients. Also active filters

## PQ Phenomena

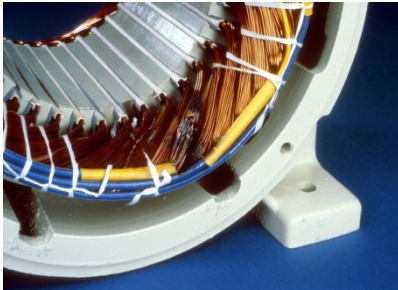
- Voltage sag
- Voltage swell
- Transients
- Poor power factor
- Harmonics

The starting of large loads can cause voltage sags, & utility switching can cause large transients

# Power Quality Quiz – Question #5

## PQ Symptom

- Motor failure – shorted windings or over heating



**And the answer is...**

Solutions include power factor capacitor banks, standard, tuned, or automatic, (being mindful of the harmonics), transient surge suppression, and active filtering

## PQ Phenomena

- Voltage sag
- Voltage swell
- Transients
- Poor power factor
- Harmonics

Voltage sags and harmonics can cause over heating, along with voltage unbalance. Transients can cause insulation failure..

# Power Quality Quiz – Question #6

## PQ Symptom

- What is the most common cause of power quality problems?

And the answer is...

## PQ Phenomena

- Voltage sag
- Voltage swell
- Transients
- Poor power factor
- Harmonics

None of the above – wiring and grounding problems are the most common

Solutions include Schneider Services to investigate wiring and grounding issues..

# Power Quality Quiz – Question #7

And finally...

- Based on what you can see in this picture, what is the best case scenario, in terms of power quality, the effects to the electrical user?

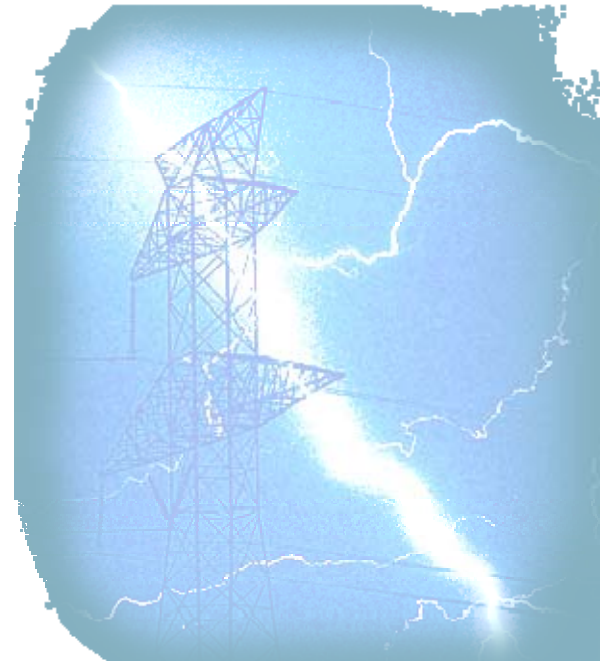
And the answer is...

No Event!



# Summary -

- Since our power systems are so dynamic, continuously monitoring with a PM System helps us manage our electrical network
- Power quality problems represent enormous costs for both energy suppliers and consumers
- A Power Monitoring System can help you:
  - Prevent downtime
  - Respond immediately to power quality events
  - Improve maintenance
  - Verify performance contracts



**Thank you...**

**Make the most of your energy**

