

Power Quality Audit (PQA)



**PRASA INFOCOM & POWER
SOLUTIONS PVT. LTD.**

A perfect power supply must guarantee an uninterruptible service within voltage and frequency tolerance limits with a distortion-free sinusoidal waveform. The acceptability of deviations from specified power ratings depends on the kind of use, the systems installed and their requirements.

What is PQA?

The Power Quality Audit (PQA), is a service offered by the PRASA'S technical support centre that checks the reliability, efficiency and safety of an organisation's electrical system. It verifies the following aspects:

- the continuity of the power supply: i.e., that the power in the network is available on a regular basis and is able to ensure the efficient operation of the equipment ;
- the quality of the voltage: i.e., that there are no low or high frequency disturbances in the network capable of damaging the system components. The PQA uses network analysers, instruments specially designed to detect faults and deteriorations and record parameters and information that may be of use in locating the causes of disturbances. The data is collected and analysed by our engineers, who can then diagnose the problems and suggest the most appropriate solutions.

What does 'Quality' of Energy Mean?

A quality electrical power supply must be available at all times, always within the frequency and magnitude tolerance limits, and always with a perfectly sinusoidal waveform. A reliable, efficient and safe power supply is essential for guaranteeing productivity and precision in any organisation. Business and industrial organisations, public authorities, hospitals and laboratories and banking and finance groups are relying more and more on computerised and electronic equipment for their daily work activities. These important electrical loads are subject to a range of disturbances that adversely affect the quality of the power supply and the reliability of the electrical system.



The Problems That may Rise

The most common disservice of a not fully reliable electrical system is a break in the power supply: either complete breaks, lasting from a few seconds to several hours, or voltage sags / drops, when the voltage falls to below the rated level for short times. Longer breaks are a problem for all users, but many processes, such as continuous and synchronised production processes or high value data processing, are sensitive to even the shortest of breaks. Other disturbances that may occur are: over voltages, harmonic distortions, imbalances, reduction of power factor etc.

The Risks

Ignoring the symptoms of possible disturbances in the electrical system could lead to damaged equipment, consequently reducing its working efficiency and shortening the life span. The resulting break in critical processes (i.e. machine downtime) could lead to a loss of earnings that could far outweigh the mere cost of the actual operation. **In addition, there is also the likely risk of having to bear increased energy costs and pay penalty charges in electricity bills, with the possibility of legal disputes with energy providers.**



The Improvement Measures

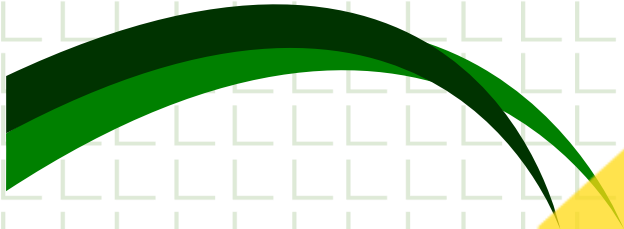
The quality of the energy can be improved by taking action on 3 levels:

- 1) user's electrical system ;
- 2) equipment connected to system ;
- 3) mains.

If the problem is in the electrical system, the PQA could advise the user to install active or passive filters, harmonic compensators, emergency generators or UPS systems, or to intervene directly on the system structure (transformers, new distribution lines, etc.). Although the advance of technology has led to the introduction of standards that tend to reduce the creation of disturbances and make equipment less disturbance-prone, problems can however arise with the mismatching of non-homogeneous equipment in the same system. The PQA makes it possible to find the right arrangement within the system.

The Advantages of PQA

The PQA final report provides a complete picture of the electrical system's correct state of operation. The report is a tool of primary importance for preventive maintenance, in that it lists all the measures to be taken promptly when disturbances are detected, before the negative impact on production and the running of the equipment is felt.



EDF Energy
Power Generation (Electricity)

National Grid

Voltage drop / flicker

What is it ?

voltage drops lasting for fractions of a second, caused by inrush currents

Signs: perceptible flickering in incandescent lamps

Causes:

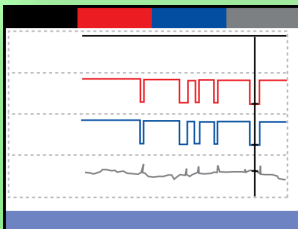
starting or stopping of big loads, such as an air conditioner compressor or a big motor, or equipment that draws current intermittently

Effects:

loss of data, overheating of motors, unexpected equipment resets and poor / uneven visibility (flicker)

Note:

transitory currents constitute almost 90 % of electrical disturbances



Reduction of power factor

What is it ?

increase in the reactive power (VAR) of the load in relation to its active power (W)

Signs:

$\cos\phi$ is lower than agreed with manufacturer

Causes:

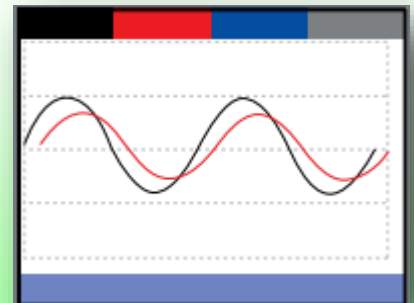
addition of excessive capacitive / inductive loads, fault in capacitor filters or compensation system

Effects:

greater operating costs, penalty charges in electricity bills

Note:

the cost of remedying the reduced power factor problem is much less than the payment of a penalty charge





**Local Distribution
Network Operators**

Homes & Businesses

Harmonic distortion

What is it ?

alterations to voltage and current waveforms due to absorption by the loads at frequencies differing by 50Hz from the basic one

Signs:

not visible without instrumentation

Causes:

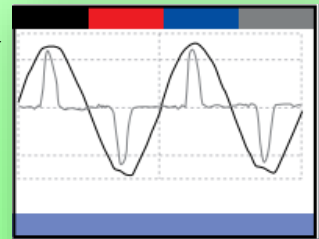
non-linear loads (in almost all electronic equipment or drives)

Effects:

overheating of electrical equipment, wiring and motors, automatic switch malfunctions, tripping of relays, opening of fuses and a general reduction in the efficiency of the system

Note:

most distortion is attributable to the third harmonic, typical of IT equipment



Imbalance on three-phase load

What is it ?

imbalance in the voltage value of a phase (> 2 %)

Signs:

not visible without instrumentation

Causes:

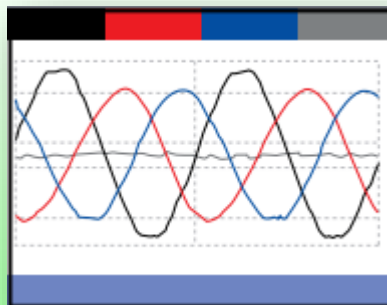
connected single-phase loads with different powers, three-phase load faults

Effects:

inefficiencies, overheating, motor and transformer faults

Note:

imbalances are typical in organisations that keep adding new loads to their systems



Transitory current / over voltage

What is it ?

Peak of Short Duration upto 1ms

Signs:

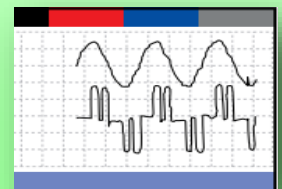
not visible without instrumentation

Causes:

switching of filter condensers, switching large equipment on and off, short circuit in wires or a lightning discharge

Effects:

shorter lamp life, equipment stopping / damage, PC crashes with memory loss, data processing errors, printed circuit card



Calculate energy loss in ₹

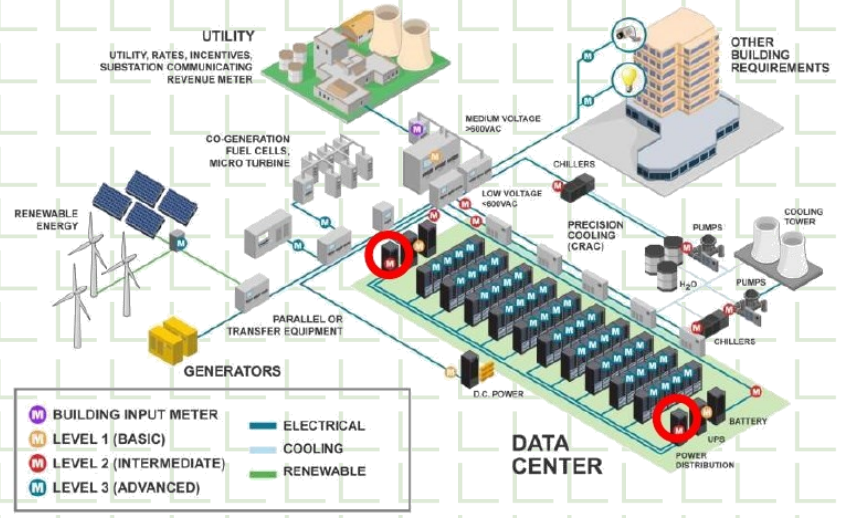


PQA with the FLUKE Power Analysers enables us to log in precise data at your site. Utilizing the new **Energy Loss Calculator function**, the 434 II measures the fiscal cost of energy wasted due to poor power quality. This energy monetization capability allows you to identify the most energy-wasteful areas of your facility so you can determine potential energy saving solutions. Add basic power quality measurements to the package and you're got yourself one powerful troubleshooting tool.



Applications

- **Energy monetization** – calculate the fiscal cost of energy waste due to poor power quality
- **Energy assessment** – quantify the before and after installation improvements in energy consumption to justify energy saving devices
- **Frontline troubleshooting** – quickly diagnose problems on-screen to get your operation back online
- **Predictive maintenance** – detect and prevent power quality issues before they cause downtime
- **Long-term analysis** – uncover hard-to-find or intermittent issues
- **Load studies** – verify electrical system capacity before adding loads



Energy Loss Calculator

	Total	Loss	Cost
Effective kW	35.9	W 488	\$ 48.83 /hr
Reactive kvar	21.5	W 175	\$ 17.49 /hr
Unbalance kVA	2.52	W 1.5	\$ 0.15 /hr
Distortion kVA	7.17	W 57.2	\$ 5.72 /hr
Neutral A	29.3	W 57.7	\$ 5.77 /hr
Total		k	\$ 683 /y

11/10/11 10:49:38	230V	50Hz	3Ø	WVE	EN50160
LENGTH 100 m	DIAMETER 25 mm ²	METER	RATE 0.10 /kWh	HOLD RUN	

Unified Power Measurement

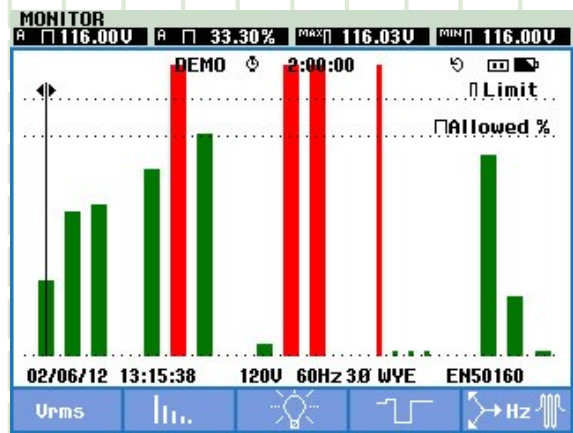
Fluke's patented Unified Power Measurement system (UPM) provides the most comprehensive view of power available, measure:

- Parameters of Classical Power (Steinmetz 1897) and IEEE 1459-2000 Power
- Detailed Loss Analysis
- Unbalance Analysis

These UPM calculations are used to quantify the fiscal cost of energy loss caused by power quality issues. The calculations are computed, along with other facility-specific information, by an Energy Loss Calculator that ultimately determines how much money a facility loses due to wasted energy.

AutoTrend - Quickly see the trend

Unique AutoTrend gives you fast insight into changes over time. Every displayed reading is automatically and continuously recorded without having to set up threshold levels or having to manually start the process. You can quickly view trends in voltage, current, frequency, power, harmonics or flicker on all three phases plus neutral.



Preventive Thermographic Audits

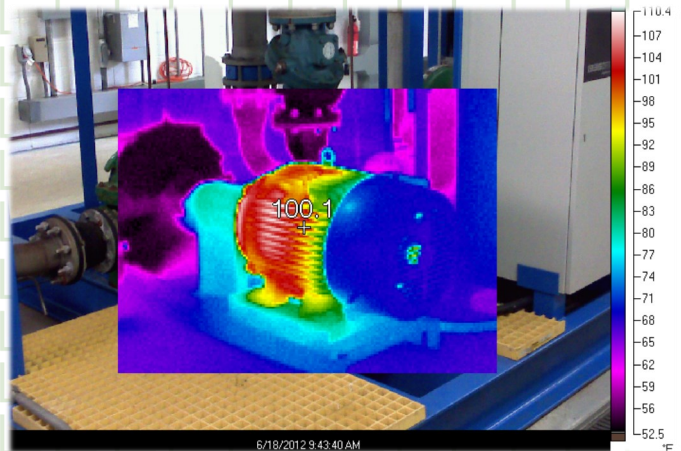
An infrared image that integrates accurate temperature data provides maintenance experts with crucial information about the condition of all kinds of equipment. As a non-contact measurement tool that also makes invisible heat issues visible, thermal cameras let technicians inspect production equipment more safely even at peak operation. Along with troubleshooting, thermal imagers can also help optimize the production process itself as well as monitor quality control.



Mechanical Equipment

Some examples of mechanical equipment where thermography is used:

- **Process valves:** Open, closed, leakage
 - **Storage tanks:** Sludge levels
 - **Pipelines:** Check if and where there are anomalies, for example locate build-up of scale, etc.
 - **Motors:** Overheating bearings, misalignment, overheated windings
 - **Conveyor belts:** Overheated bearings
- Furnace inspections:** With a special camera designed to “see through flames” for high temperature industrial furnace applications, ideal for monitoring all types of furnaces, heaters and boilers



Electrical Equipment

Some examples of electrical equipment where thermography is used:

- **Primary power source:** Outdoor high voltage switchyard
- **Switchgear**
- **Transformers**
- **Low voltage installations:** Breaker panels, faulty electrical outlets/wall sockets
- **Fuse panels**
- **Motor control centres (MCC)**
- **Electrical cabinets**

We can use the infrared camera to audit energy efficiency of your plant environment, including roofing, heating and cooling systems, and building structures.





“1kW
saved is
2kW

generated...”



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