



**STUDIES & CONSULTING
FOR POWER QUALITY SERVICES**

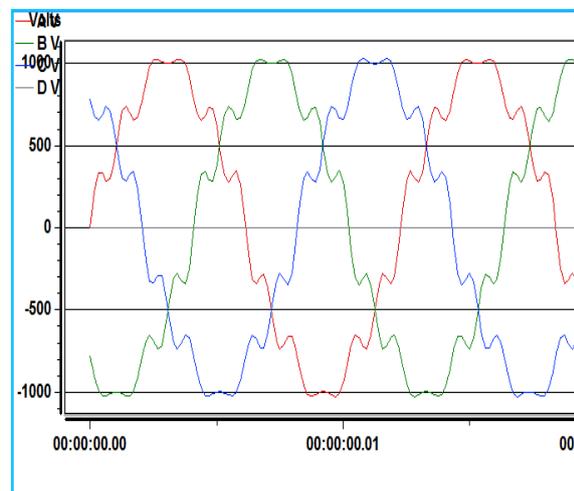


PROTASIS is an **Independent Electrical Engineering and Consulting Company**. With a dynamic, flexible and highly competent Engineering team **PROTASIS** is an ideal partner for Independent Power Producers (IPP), Utilities and Industrial Clients seeking high quality power systems consulting and systems integration services. The company is divided in three departments, the **Power System Studies & Consulting Department (PSS&C-D)**, the **Power System Applications Department (PSA-D)**, and the **Metering & IT Applications Department (M&ITA-D)**.

Description of **Power Quality** with related issues and a list of expert services and solutions provided by **PROTASIS** in **Power Quality** field are given below.

The Institute of Electrical and Electronic Engineers (IEEE) defines **Power Quality** as: “The concept of powering and grounding electronic equipment in a manner that is suitable to the operation of that equipment and compatible with the premise wiring system and other connected equipment”. **Power Quality** is the requirement for all networks and is becoming more opportune due to harmonics-producing loads that have been increased over the years. And while there are several approaches how to improve **Power Quality**, **System Studies** need to be conducted in order to conclude the best strategy and evaluate the possible impacts.

Non-linear loads and harmonics are the main sources of Power Quality issues. The term “Harmonics” generally refers to the distorted non-sinusoidal current waveform, due to the presence of nonlinear loads. Once disturbed current flows through the system impedances, it causes disturbed voltage affecting also the rest of the loads in the system. Switch-mode power supplies (SMPS), variable speed motors and drives, photocopiers, personal computers, laser printers, fax machines, battery chargers and UPS systems are examples of nonlinear loads. Single-phase non-linear loads are prevalent in modern office buildings, while three-phase, non-linear loads are widespread in factories and industrial plants.



Minimizing energy costs and maximizing reliability are top priorities for all networks today. Harmonics make both goals harder to achieve by causing the following problems:

- Reduced energy-efficiency: Harmonic currents increase losses on the power system conductors and transformers, adding heat to the power chain that drives up power and cooling costs.

- Decreased reliability: The heat created by harmonics can increase downtime by causing premature equipment failure or malfunctions, overheated wiring, and other hardware issues, including generator transfer switch and control malfunctions.
- Higher capital expenses: Harmonics can reduce the lifespan of electrical equipment, forcing companies to purchase replacement devices sooner than would otherwise be necessary. They can also compel network managers to compensate for increased heating and distortion by investing in oversized generators, neutral conductors, and transformers.
- Costly utility penalties: Electrical utilities must compensate for harmonic-related waste by deploying additional generating capacity. For that reason, and to discourage harmonic pollution, many utilities penalize customers that exceed distortion limits defined by the IEEE-519 standard. In addition, many utilities penalize customers with a power factor below 0.9.
- Inconsistent meter readings: Phase imbalances and high harmonic voltages and currents can cause electrical meters to report figures that are inaccurate by as much as 20%.

Power Quality Measurements is the “tool” for identifying the existing condition and the potential problems. **PROTASIS** performs facility assessment by collecting precise measurements of the harmonics affecting the network and diagnosing their origin. **PROTASIS** equipment lists a large number of calibrated Power Quality Analyzers (PQAs) which are considered the state of the art. Our equipment along with our experience ensures that the data collected from the measurements are sufficient to evaluate the existing condition of the network. Measurements are taking place for a period of time that would be chosen in order to cover all the operational scenarios of the network as different harmonic profiles might be raised for different configurations of the system. PQAs are used for measurements of voltage, current, active and reactive power, power factor, harmonics and related indices and parameters and are capable of capturing both transient disturbances and steady-state variations.



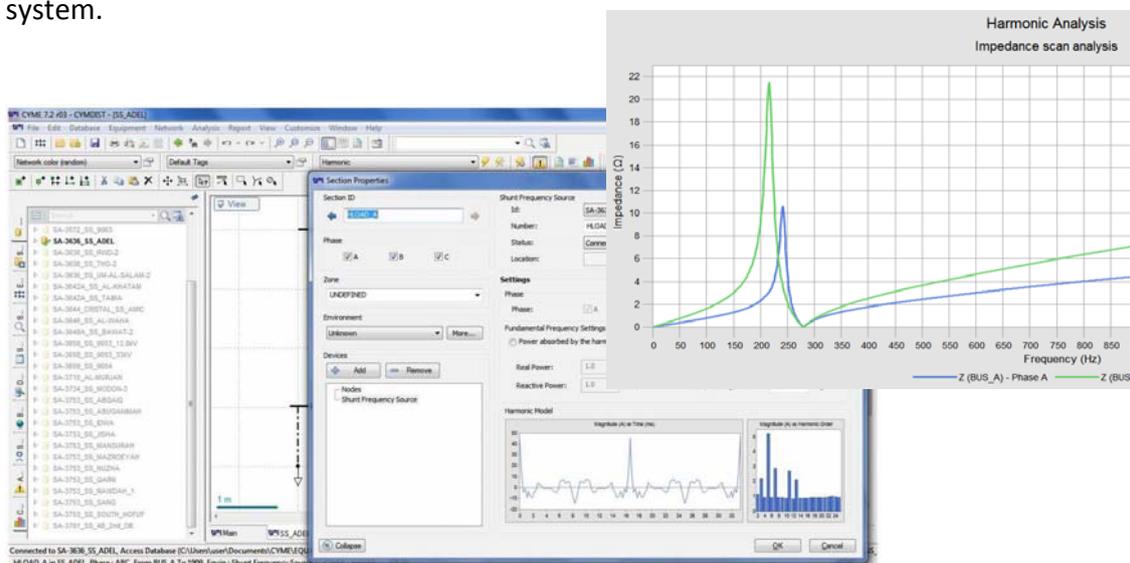
The primary objectives of the measurements are to:

- Determine the harmonic generation characteristics of the loads fed from the associated measurement point (especially non-linear loads). Three-phase measurements are made so that characteristic and non-characteristic (triplen) harmonic components can be determined.
- Determine system response characteristics for particular conditions. Voltage measurements are used in conjunction with the current measurements to characterize system response for specific system conditions.
- Determine the background harmonic voltage and current levels.

It should be noted that even if there are available instruments in the system that measure volts and amperes, or calculate watts and watt-hours, most likely they will give false information since most of them are not designed for nonlinear loads. Therefore, consideration must be given to the accuracy of power and energy metering devices for precise measurements.

Once the existing condition of the network has been evaluated using the **Power Quality Measurements**, next step is the determination of the necessity for harmonic mitigation and the strategy to be followed in order to achieve this goal. **PROTASIS** Consultant Services cover the expert **System Studies** need to be conducted to evaluate the possible solutions or combination of them. The installation of equipment for improving the Power Quality raises concerns primarily in the areas of harmonic distortion, harmonic resonance, switching surges and overvoltages. Hence, it is prudent to perform all electrical studies required for such cases, so that any adverse conditions can be accounted for and identified.

Harmonic Study addresses issues of Harmonic Flow in the network. The simulation of the network in appropriate software is used for evaluating and compare possible solutions for the harmonic mitigation. The measurements data are been used for tuning of the system model in the software. Once the model has been finalized, the system is been simulated for all possible operational scenarios depicted from the operators of the system.

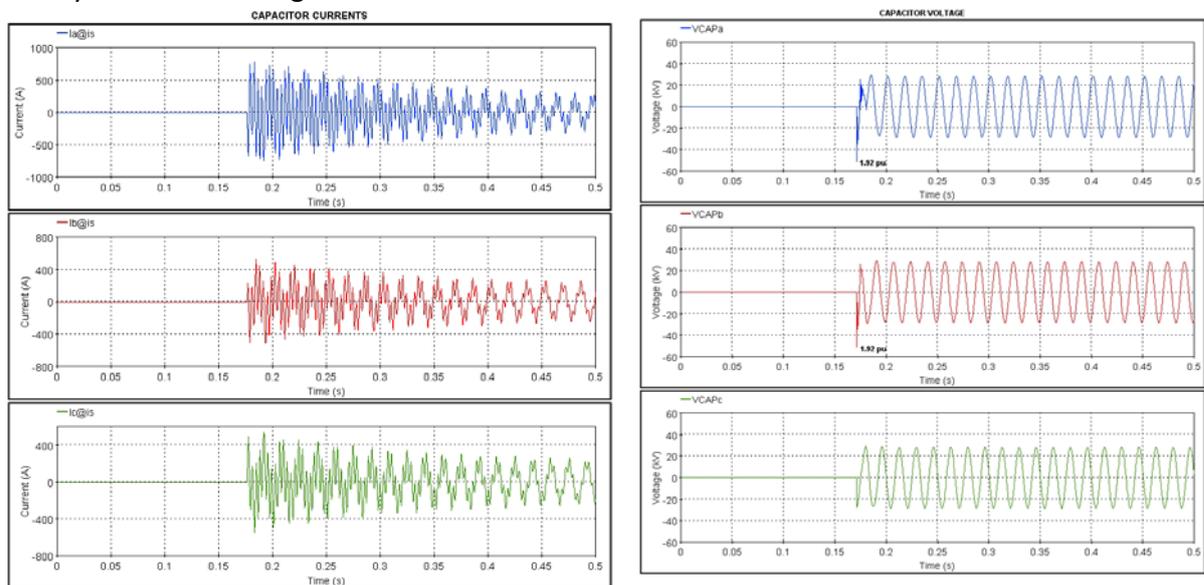


Purpose of the study is:

- To evaluate the impact of the installation of any equipment for the harmonic mitigation.
- To evaluate the stress on the equipment considering harmonics.
- To verify that the ratings of the selected equipment are adequate.

Transient Study addresses equipment switching actions which result in transient voltage and current that might cause problems to the equipment itself or to the components and the load of the system. Cases that are investigated:

- Equipment energization.
- Fault clearance.
- Dynamic overvoltages.



Purpose of the study is:

- To reveal potential problems of switching surges, if any, and provide recommendations for their mitigation.
- To check the insulation and withstand capability of the circuit breaker and the equipment.
- To estimate the worst-case voltage stresses possible to be experienced by the equipment.

PROTASIS has built an international reputation for technical expertise through constant innovation, with Clients in several regions worldwide including European, North African and Middle East Countries.

Contact our company for more information and details on how we can better serve your key infrastructure Project needs and how we can solve important aspects challenging your operations.



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