The National Energy Research Center

The National Energy Research Center (NERC) was established for the purposes of research, development and training in the fields of new renewable energy and promotion of energy conservation in the different sectors.

Royal Scientific Society (RSS)

The Royal Scientific Society (RSS) is the largest applied research institution, consultancy, and technical support service provider in Jordan and is a regional leader in the fields of science & technology.

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Royal Scientific Society

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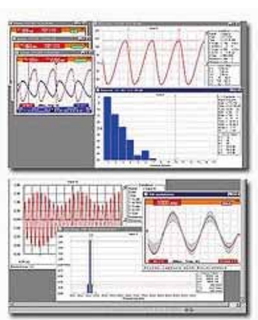
Power Quality (PQ)

Power Quality (PQ) related issues are of most concern nowadays. The widespread use of electronic equipment, such as information technology equipment, power electronics such as adjustable speed drives (ASD), programmable logic controllers (PLC), energy-efficient lighting, led to a complete change of electric loads nature.

These loads are simultaneously the major causers and the major victims of power quality problems. Due to their non-linearity, all these loads cause disturbances in the voltage & current waveform.



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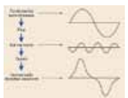
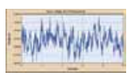
Types of Power Quality Problems:

Harmonic Distortion



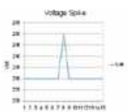
Description: Voltage or current waveforms assume non-sinusoidal shape.
Consequences: Increased probability in occurrence of resonance, neutral overload in 3-phase systems, overheating of all cables and equipment, loss of efficiency in electric machines.

Voltage Fluctuation



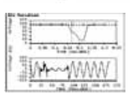
Description: Oscillation of voltage value, amplitude modulated by a signal with frequency of 0 to 30 Hz.
Consequences: Most consequences are common to under voltages & the flickering of lighting and scree

Voltage Spike



Description: Very fast variation of the voltage value for several microseconds to few milliseconds.
Consequences: Destruction of components (particularly electronic components)

Voltage Sag (or dip)



Description: A decrease of the normal voltage level between 10 and 90% of the nominal rms voltage
Consequences: Malfunction of information technology equipment, (PCs, PLCs, ASDs, etc). Tripping of contactors and electromechanical relays. Disconnection and loss of efficiency in electric rotating machines.

Long Interruptions

Description: Total interruption of electrical supply for duration greater than 1 to 2 seconds
Consequences: Tripping of protection devices, loss of information and malfunction of data processing equipment.

Voltage Swell

Description: Momentary increase of the voltage, at the power frequency, outside the normal tolerances, with duration of more than one cycle .
Consequences: Data loss, flickering of lighting and screens, stoppage or damage of sensitive equipment, if the voltage values are too high

Instrument

Power Analyzer
Measures all three phases and neutral with included 4 current probes; measures true-rms and peak voltage and current, frequency, dips and swells, transients, interruptions, power and power consumption, peakdemand, harmonics up to the 50th, interharmonics, flicker, mains signaling, inrush and unbalance.

Deliverable

Based on power quality measurements, NERC staff make a technical report, proposing proper solutions for power quality problems.

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Shading Analysis
& Measurements

Shading Analysis

Solar systems are adversely affected by partial shading caused by objects surrounding the systems such as towers, poles, deciduous trees and other objects.

Shade over a portion of the panel can greatly limit power output.

Several solar sites should be evaluated to find the one with the greatest collection potential and the least shading.
As one of the basics of the sizing of the solar systems is to find the percentage of the sun's radiation can be blocked by trees, buildings, hills, clouds, dust, water vapor in the air, and other things.

PV & Solar Thermal Systems

Sizing

The Solar Pathfinder instrument will help in determining the size of the solar thermal and PV systems.

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Solar pathfinders will help to determine the following:

The sun's energy that could potentially and actually reach the collectors surface, a percentage of the sun's radiation can be blocked .
The energy that will be lost between the collector and the point of use.
Test The effect of the slope and orientation of the collector on the amount of solar energy received.

Instrument

This instrument uses a highly polished, transparent, convex plastic dome to give a panoramic view of the entire site. All the trees, buildings or other obstacles to the sun are plainly visible as reflections on the surface of the dome. The sun path diagram can be seen through the transparent dome at the same time.
Because It works on a reflective principle rather than actually showing shadows, it can be used anytime of the day, anytime of the year, in either cloudy or clear weather.

Deliverable

Based on Solar Shading inspection, NERC staff will prepare a Technical Report, reflecting images for the inspected locations and propose the appropriate solutions for shading problem.

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Thermal Imaging In-Plant Electrical

Abnormal heating associated with high resistance or excessive current flow is the main cause of many problems in electrical systems. Infrared thermography allows us to see these invisible thermal signatures of impending damage before the damage occurs. When current flows through an electric circuit, part of the electrical energy is converted into heat energy. This is normal. But, if there is an abnormally high resistance in the circuit or abnormally high current flow, abnormally high heat is generated which is wasteful, potentially damaging and not normal.Infrared Camera

infrared imagers enable us to see the heat signatures associated with high electrical resistance long before the circuit becomes hot enough to cause an outage or explosion. Be aware of two basic thermal patterns associated with electrical failure: 1) a high resistance caused by poor surface contact and 2) an over loaded circuit or multi-phase imbalance problem.

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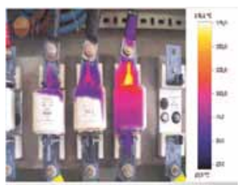
Typical Reasons for Temperature Hotspots or Deviations:

- Unbalanced loads
- Harmonics (3rd harmonic current in Neutral)
- Overloaded systems/excessive current
- Loose or corroded connections increased resistance in the circuit (typically one side of components heats up)
- Insulation failure
- Component failure
- Wiring mistakes
- Underspecified components (like fuses) would heat up on both side of the fuse

Commonly Inspected Components:

- (3 phase) Power distribution
- Fuse boxes
- Cables & connections
- Relays/Switches
- Insulators
- Capacitors
- Substations
- Circuit breakers
- Controllers
- Transformers
- Motors
- Battery banks



Instrument

Thermal imagers discover anomalies and weak spots in buildings quickly and without damage. Thermal imagers allow an evaluation of the heat status of low, medium and high voltage systems.

Deliverable

Based on thermal cameras inspection, NERC staff make a technical report, reflecting images for the inspected locations.

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Thermal Imaging / Thermal Losses Detection

Thermal imaging, known as thermography, is a technique for producing an image of invisible infrared light emitted by objects with the use of a thermal imaging camera. Thermal imaging cameras provide rapid scanning of a surface that is nondestructive and environmentally friendly, which allows for quick detection of potential problems or defects. This will reduce troubleshooting time and preventative maintenance.

Thermal imaging cameras don't actually see temperature. Instead, they capture the infrared (IR) energy transfer from an object to its environment and produce a real-time image in a color palette where hotter objects appear brighter and cooler objects appear darker. IR energy is generated by the vibration of atoms and molecules and behaves similarly to visible light where it can be reflected, refracted, absorbed and emitted. The more these atoms and molecules move, the higher the temperature of the object.

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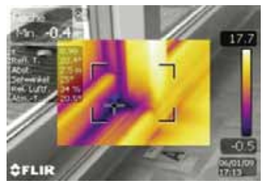
Thermal Imaging Camera Applications and Uses

Thermal imaging cameras are used to locate & diagnose heat leaks and thermal bridges for different applications which include the following:

- Thermal heat loss inspections of buildings. Most air infiltrations are located at wall penetrations (such as windows, doors, vents, etc), and at transition areas of fully insulated walls, ceilings and floors
- Locate radiant heating wires or pipes
- Locate potential areas for mold growth
- Flat-roof leak detection for buildings
- Detect thermal patterns on boiler tubes
- Mechanical bearing inspections



Instrument

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Deliverable

Based on thermal cameras inspection, NERC staff NERC staff make a Technical Report, proposing proper solutions for reducing thermal losses.

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