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ELECTRICAL POWER SYSTEMS - CEM
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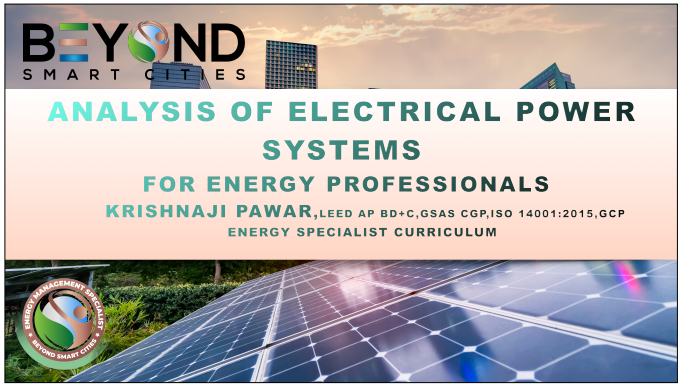
FOR ENERGY MANAGEMENT AND EFFICIENCY PROFESSIONALS


BEYOND
SMART CITIES
ANALYSIS OF ELECTRICAL POWER SYSTEMS
FOR ENERGY PROFESSIONALS
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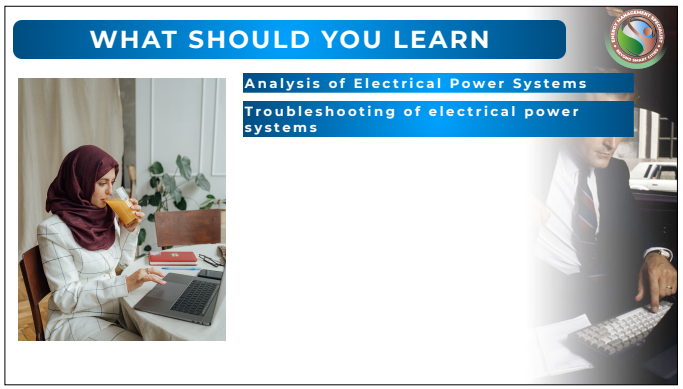
ENERGY SPECIALIST CURRICULUM


WHAT SHOULD YOU LEARN
Analysis of Electrical Power Systems
Troubleshooting of electrical power systems

WHAT IS POWER SYSTEM ANALYSIS

The process of performing different calculations and simulations to verify that the electrical system will perform as intended. It involves the study of system components, performing different calculations on components, and simulating the components of the power system so as to ensure that all parameters are correctly specified and protected against faults.

Power system analysis is a fundamental branch of Electrical Power Engineering. It is a key component in designing power systems and selecting the rating of power equipment such as generators, transformers, capacitor banks, shunt reactances, and transmission lines.

ELEMENTS OF POWER SYSTEM ANALYSIS

List of most important elements while doing Power System Analysis

Load flow analyses:
One of the most important elements of PSA is load flow analysis. During load flow analysis the power system is analyzed in normal steady-state operation.

Short circuit and fault analysis :
During short circuit analysis various short circuits simulations are performed. The resulting fault currents are studiend so as to design a suitable switchgear and other components of power system.

ELEMENTS OF POWER SYSTEM ANALYSIS +

Protective device coordination and settings analysis :
During protection coordination studies analysis of available fault currents in the power system is performed. Data is collected, and some computer software is used to determine the optimum setting that provides the finest protection. The results are tabulated and the final report is prepared.

An analysis of an electrical power system may uncover energy waste, fire hazards, and equip- ment failure. Facility /energy managers increasingly find that reliability-centered maintenance can save money, energy, and downtime (see Table).

TABLE 1 TROUBLE SHOOTING OF ELECTRICAL POWER SYSTEMS

System Problem	Common Causes	Possible Effects	Solutions
Voltage imbalances among the three phases	Improper transformer tap settings, single-phase loads not balanced among phases, poor connections, bad conductors, transformer grounds or faults.	Motor vibration, premature motor failure A 5% imbalance causes a 40% increase in motor losses.	Balance loads among phases.
Voltage deviations from rated voltages (too low or high)	Improper transformer settings, Incorrect selection of motors.	Over-voltages in motors reduce efficiency, power factor and equipment life Increased temperature	Correct transformer settings, motor ratings and motor input voltages
Poor connections in distribution or at connected loads.	Loose bus bar connections, loose cable connections, corroded connections, poor crimps, loose or worn contactors	Produces heat, causes failure at connection site, leads to voltage drops and voltage imbalances	Use Infra Red camera to locate hot-spots and correct.
Undersized conductors.	Facilities expanding beyond original designs, poor power factors	Voltage drop and energy waste.	Reduce the load by conservation load scheduling.
Insulation leakage	Degradation over time due to extreme temperatures, abrasion, moisture, chemicals	May leak to ground or to another phase. Variable energy waste.	Replace conductors, insulators
Low Power Factor	Inductive loads such as motors, transformers, and lighting ballasts Non-linear loads, such as most electronic loads.	Reduces current-carrying capacity of wiring, voltage regulation effectiveness, and equipment life.	Add capacitors to counteract reactive loads.
Harmonics (non-sinusoidal voltage and/or current wave forms)	Office-electronics, UPSs, variable frequency drives, high intensity discharge lighting, and electronic and core-coil ballasts.	Over-heating of neutral conductors, motors, transformers, switch gear. Voltage drop, low power factors, reduced capacity.	Take care with equipment selection and isolate sensitive electronics from noisy circuits.

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