



## Power System Blackouts (Cause and Preventive Measures) Training

### Description

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Major blackouts are caused by failing to conduct rigorous long term planning studies of the electrical system; and neglect to conduct appropriate multiple contingency or extreme condition assessment. Also the lack of sufficient voltage analysis and use of operational voltage criteria that do not reflect actual voltage stability conditions and needs can lead to catastrophic blackouts. Reliability requirements and standards must be followed during the system operation. The security of the transmission system must be ensured under all conditions. Usually major blackout can result in major loss of revenue, business interruptions, communication interruptions, security and bad quality of supply.

#### Course Objective

To provide electric system planners, designers and operators with concepts, tools and methodologies essential to address modern-day issues of competition, open access, wheeling and new technology in system planning

How to improve the quality of supply in A.C power system

Necessary steps to prevent cascading blackouts

#### Course Outline

##### Blackout causes overview

- Voltage instability initiating blackouts
- Induction motors role in triggering blackout
- Cold rush current effects on blackout
- Blackout prevention by general & network voltage control
- Blackout prevention by loads voltage stabilization
- Example

##### Blackout preventive measures

- How and why the blackout begin
- Causes of the blackout and violations of standards.
- Under-frequency and under-voltage load shedding
- Example

### **Planning criteria and reliable operation of power grid**

- Reliability organizations
- Key parties in the pre-cascade phase
- Review of international practice
- Representing reliability measures and customer costs
- Application examples (U.S and Jordan Blackout)
- Contingency analysis
- Ranking and screening methods
- Defining a study area
- Handling divergence, islanding, relying events
- Measuring customer impact

### **Transfer limit analysis**

- Thermal and voltage limits
- Defining transfer conditions
- PV curves for normal and contingency condition
- Transient stability

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