BOOST
THE LEADING TRAINING PROVIDER

Electrical Engineering

Power System Restoration Strategy during Emergency & Blackout

Course Introduction

The primary objectives of Power System Planning and Operation are to minimize system outages, Load Interruptions and Equipment damage under Emergency Conditions. These goals are becoming more difficult to achieve because of the increasing pressures resulting from fast system demand growth and increased system complexity. There are strong influences to reduce operating and maintenance cost and to work equipment harder and longer.

Modern Power Systems.

Power System behavior under Emergency Conditions, as well during restoration processes, depends on its characteristics as related to real and reactive power balance, and the installed control and protective systems. The restoration process is also a function of pre-disturbance conditions, post-disturbance status and post-disturbance target systems. Therefore, the understanding of the factors involved in power system collapse and in the restoration procedure is crucial to the proper operation of Modern Power Systems.

The first focus of the course is on all the major issues associated with system restoration, including those associated with system characteristics and operating conditions. It is argued that restoration planning and training is an ongoing activity that involves system operators, planners, protection staff and trainers. The second focus is on implementing some of the principles gained in hands-on environment using the EPRI Operator Training Simulator. The students will be asked to carry out several “scenarios” involving restoration from a partial blackout, as well as, complete black start. The principles of top-down, versus bottom-up approaches will be practiced and evaluated using a realistic power system model.

Target Audience

- Power system protection engineers
- System planners
- Technical staff responsible for Smart Grid integration into power system monitoring and control

Learning Objectives

- How to organize and train the System Restoration Team in your Company.
- How to develop a Restoration Plan for different pre-disturbance operating Condition.
- How to carry out a Restoration Sequence without causing unacceptable voltage and frequency swings, both in theory and also using the Operator Training Simulator.
- How to set priorities in carrying out the Restoration Sequence.
- How to calculate the restoration duration given the time delays inherent in each action and operating order.
- How to avoid common mistakes experienced in the industry.
- How to maintain and implement the comprehensive system normalization procedures covering partial and total system shutdowns and Restoration approaches.

Course Outline

- **DAY 01**

Module (01) Introduction

- 1.1 Overview of Restoration Process
- 1.2 Major Power Disturbances
- 1.3 Restoration Process Issues
- 1.4 System Operating Condition

Module (02) P.S Operating Under Stress & Strain

- 2.1 P.S Failure States and Restoration Action
- 2.2 States of Operations
- 2.3 Emergency Prevention
- 2.4 Emergency Control
- 2.5 Recovery from Emergencies

• **Day 02**

Module (03) Mitigation of Abnormal Conditions

- 3.1 Scheduling
- 3.2 Reduction of Capacity Shortfall
- 3.3 Correction of Transmission Loading
- 3.4 Correction of Voltage Conditions
- 3.5 Light Load Conditions
- 3.6 High Load Conditions
- 3.7 Actual case study for Voltage Collapse
- 3.8 Open Discussion (Workshop)

• **Day 03**

Module (04) Blackout Conditions

- 4.1 History of Blackouts
- 4.2 Types and Causes of Blackouts
- 4.3 Causes of Black-out
- 4.5 Voltage Collapse
- 4.6 Cascading Thermal Overloads
- 4.7 Dynamic Instability
- 4.8 Types of Blackouts
- 4.9 Effects on Society / Public Scrutiny
- 4.10 Case Studies

• **Day 04**

Module (05) System Restoration Planning

- 6.1 Restoration for Complete Collapse
- 6.2 Restoration for Partial Collapse
- 6.3 Restoration Stages
- • Priority Load for Restoration
- • Frequency Control
- • Synchronization
- • Post-Synchronism
- 6.4 Scenarios for System Blackout with Exercise
- 6.5 Case Studies

Module (06) PS Restoration Plans Structures

- 7.1 Introduction
- 7.2 Objectives and Policy
- 7.3 Application of the Plan
- 7.4 Obligations of Restoration Plan Participants
- 7.5 Planning Requirements
- 7.6 Responsibilities and Procedures
- 7.7 Testing Requirements
- 7.8 Black Start
- 7.9 Preparation for System Restoration
- 8.1 General Call out Procedures
- 8.2 Restoration Scenarios

• **Day 05**

Module (07) Power System Restoration (Black Start)

- 9.1 Building the System Backbone
- 9.2 Gradual Restoration of Generation
- 9.3 Load Restoration
- 9.4 Calculating Restoration Duration
- 9.5 Advancing the System to Full Inter-area
- Operating with AGC tie-line bias Control

Confirmed Sessions

FROM	TO	DURATION	FEES	LOCATION
May 11, 2025	May 15, 2025	5 days	4250.00 $	KSA - Riyadh
July 14, 2025	July 18, 2025	5 days	4250.00 $	UAE - Dubai
Dec. 8, 2025	Dec. 12, 2025	5 days	5950.00 $	USA - Texas
Nov. 23, 2025	Nov. 27, 2025	5 days	4250.00 $	Oman - Muscat