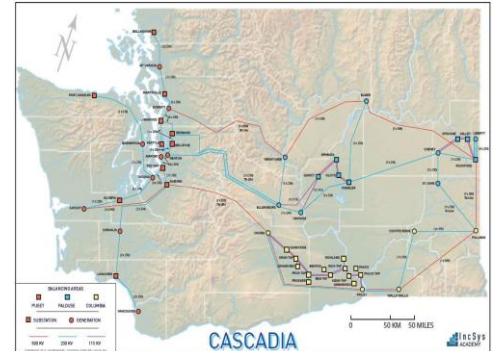


SOLs & IROLs

This is a computer-based training module which consists of a video lecture and two simulation exercises. The instructor describes on widespread interconnection outages and operating limits, using the Southern California Blackout and the Northeast Blackout as examples. The instructor describes the steps that led to the blackout, and recommendations made by NERC and FERC and also defines the various ratings and limits defined by NERC and reviews NERC standard TOP-001. In the first simulation exercise, students will operate a real-time scenario on a hypothetical power system according to the NERC Standard TOP-00 and respond to System Operating Limit violations, identify the location and return system to a stable state using contingency analysis. The second simulation scenario the student will operate a real-time simulation of a hypothetical power system according to the NERC Standards TOP-001 and IRO-009-2. They will respond to a Interconnection Reliability Operating Limit violation and use contingency analysis to identify and test different IROL violations. After experiencing a contingency that results in an IROL violation, students identify the condition and return the system to a stable state while adhering to NERC standards.



Cascadia 4010 Course Objectives

SOLs & IROLs

COURSE CE HOURS		
OT	STD	SIM
3	0	2

- Describe the sequence of events that occurred at a high level during the Southern California Blackout.
- Describe the recommendations, which the task force formed by NERC and FERC engineers.
- Relate this outage as a real-life use case to explain the relevance of the later topics.
- Explain how to identify and manage large standing phase angles.
- Definition of SOL – Thermal, voltage, stability, etc.
- Definition of IROL - System operating limits to interconnection reliability operating limits, simply by the fact that if that violation could lead to instability, uncontrolled separation or cascading outages, that effect adversely the overall bulk electrical system, that SOL gets elevated.
- Define the term N-1 Contingency & the functionality of Contingency Analysis.
- Describe the effects on equipment from exceeding operating limits.
- Review the applicable NERC standards that address SOL's and IROL's.
- Apply a transmission line fault.
- Use simulator displays to identify a Branch MVA SOL violation.
- Respond to an SOL violation alarm.
- Identify where the SOL violation has occurred.
- Apply corrective action to reduce or eliminate the SOL violation and assess that action's effectiveness.
- Remove a critical 500 kV line from service.
- Assess the current system state for SOL violations & current system state for IROL violations.
- Run Contingency Analysis for all N-1 contingencies.
- Identify SOL & IROL violations in the post-contingent state.
- Run PowerSimulator in study mode and verify that the generator and line contingencies identified by Contingency Analysis cause blackouts.
- Take corrective action to remove IROL violations by cutting interchange schedule and bringing additional generation online.

September 8, 2011 Event Causes

- System not in a secure N-1 state
- Operations planning weaknesses
- Real-time situational awareness weaknesses
- Impact of sub-100 kV facilities not considered
- WECC IROLs not recognized
- Effects of RAS (SPS) not studied
- No tools or instructions for large phase angles
- External contingency impact on internal systems.
- Impact of contingencies on neighbor systems



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