
Blackout Defence, Cascading Outages and Black Start Training Course for Grid Leaders

1 – 5 March 2027
Madrid





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Programme Summary

Blackout defence, covering cascading outages, load shedding and black start recovery, is the subject of this one-week training course for grid and control room leaders at a managerial level, ending in a blackout defence and recovery plan for one network. Large outages spread when warnings are missed, protection acts without coordination and recovery is improvised. The programme moves from principles and failure mechanisms, through diagnosis of network and operator weaknesses, to defence and restoration design, then to a worked plan. Mars Training Centre UK delivers this programme in blackout defence.

The Business Case

When wide-area outages are treated as rare events, alarms, protection settings and restoration steps stay in separate hands, and the first hour of a disturbance decides how far it spreads. Leaders who test these links together can show how a network behaves under stress, how supply is shed and how quickly it returns to customers and critical sites.

- Outage Spread: Falls as warnings, protection and shedding schemes are checked against each other.
- Restoration Time: Shortens as cranking paths and island building are planned before they are needed.
- Operator Error: Declines as alarm handling and handover routines are rehearsed in simulation.

Principles and Evidence Base

- IEEE guidance on power system restoration: It shapes the restoration sequence and re-synchronisation rules built in Session 3.
- Cascading failure models drawn from published blackout investigations: They frame the failure chain diagnosed in Session 2.
- Under-frequency load shedding schemes: They guide the shedding stages and settings reviewed in Session 3.
- Black start and cranking path planning: These inform the recovery plan completed in Session 5.

Intended Participants

- Control room managers who direct operators during disturbances and restoration.
- Transmission and grid managers who set protection, shedding and reserve policy.
- Utility directors who answer for supply continuity and recovery readiness.
- Emergency planners who coordinate grid recovery with hospitals, water and industry.

The programme serves electricity utilities, oil and gas operators with large private networks, industrial estates and energy regulators.



Learning Outcomes

1. Participants will be able to diagnose the failure chain behind a published blackout from alarms, line trips and operator actions.
2. Participants will be able to evaluate a network's exposure to cascading outages and rank its weakest links.
3. Participants will be able to construct under-frequency load shedding stages that protect critical loads.
4. Participants will be able to design a black start plan with cranking paths, islands and re-synchronisation steps.
5. Participants will be able to prioritise customers, sites and generating units during staged restoration.
6. Participants will be able to justify a blackout defence and recovery plan to a utility director.

Programme Structure

Day 1: Blackout Defence Principles and Cascading Failure

How does a local fault grow into a wide-area blackout?

- Cascading Outage Sequence Map
- Frequency and Voltage Stability Basics
- Role of Protection in Containing Faults
- Operator Situational Awareness Model
- Published Blackout Case Timeline

Day 2: Diagnosing Network and Operator Weaknesses

Where are the weak links that would let a disturbance spread in this network?

- Alarm Flood and Missed Warning Review
- Line Loading and Vegetation Risk Check
- Protection Mis-operation Audit
- Reserve and Reactive Support Gap Analysis
- Control Room Handover Observation

Day 3: Designing Defence Schemes and Restoration Strategy

Which schemes stop a disturbance, and how is supply rebuilt after a collapse?

- Under-Frequency Load Shedding Stage Table
- Controlled Islanding Design
- Black Start Unit and Cranking Path Selection
- Re-synchronisation Checklist
- Load Pick-up Priority Matrix



Day 4: Rehearsal, Communication and Recovery Governance

How are decisions made, shared and recorded while the grid is down?

- Restoration Simulation Drill
- Crisis Communication Script for Customers and Authorities
- Decision Log and Command Roles Chart
- Coordination with Critical Sites Protocol
- Post-Event Review Template

Day 5: Applying Blackout Defence to One Network

Is the plan ready for a utility director to adopt?

- Applying the Session 2 Weak Link Ranking to the Chosen Network
- Testing the Session 3 Shedding Table Against a Scenario
- Running the Session 4 Drill on the Recovery Steps
- Setting Readiness Indicators for the Control Room
- Completing the Blackout Defence and Recovery Plan

Methodology

The programme uses case analysis and simulation drills built on anonymised disturbance records from transmission, industrial and generation settings. Participants work in small teams as control room lead, planner and utility director, and take one disturbance from first alarm to full restoration while the group reviews each decision.

- Suggested activity: Reconstructing the sequence of a published blackout from a timeline of trips.
- Suggested activity: Setting shedding stages for a sample network and defending the choices.
- Suggested activity: Running a tabletop black start and recording each handover.

Capstone Output

Each participant completes a blackout defence and recovery plan for one network. It holds a ranked list of weak links, a shedding stage table, a black start and cranking path outline, a load pick-up priority matrix and readiness indicators. The plan is used to brief a utility director and to rehearse the control room team.

Frequently Asked Questions

Is blackout defence suitable for managers who are not power system engineers?

Yes. Blackout defence is set at managerial level and assumes basic familiarity with grid operation, not detailed network calculation. Technical ideas are explained through cases and simple tables.



Which models does blackout defence rest on in this training?

Blackout defence rests on cascading failure models from published investigations, IEEE guidance on power system restoration, under-frequency load shedding schemes and black start planning.

How is the plan from blackout defence used at work?

You use the blackout defence plan to brief a utility director, set shedding and restoration priorities and rehearse the control room team against a defined scenario.

How does blackout defence differ from a programme on power system protection?

Blackout defence covers wide-area collapse, shedding and restoration across a whole network, while a protection programme centres on relay settings and fault clearing for individual equipment.