Grid Studies for Power Networks: Load Flow, Stability and Reinforcement Planning Course

4 – 8 April 2027
Muscat

Grid Studies for Power Networks: Load Flow, Stability and Reinforcement Planning Course

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Programme Summary

Grid studies, covering load flow, stability and reinforcement planning, are the subject of this one-week training course for network planning, system operation and engineering leaders, ending in a reinforcement options pack for one network area. Upgrade decisions made from unread or poorly framed studies lead to late reinforcement, overloaded circuits and avoidable spending. The programme moves from network models to load flow analysis, contingency analysis, power system stability and short-circuit studies, then to ranked upgrade options, using prepared network cases. Mars Training Centre UK delivers this programme on grid studies to mixed-organisation cohorts.

The Business Case

Transmission owners, distribution utilities and large industrial sites commission studies before every major connection or upgrade, yet the people who sign off the spending often cannot test what the studies assume. Leaders who can read the base case, the limits and the results challenge weak assumptions early and fund the upgrade that addresses the real constraint.

- Reinforcement Timing: Improves when upgrades are triggered by tested loading and voltage limits rather than by outages.
- Outage Exposure: Falls when critical contingencies and fault level shortfalls are identified before they occur.
- Study Rework: Reduces when scope, data and criteria are fixed before a study is commissioned.

Principles and Evidence Base

- Load Flow Analysis: Calculates steady-state voltages and loadings, applied in Session 2 to test normal operation against limits.
- Contingency Analysis: Tests the network after the loss of a circuit or unit, applied in Session 3 to rank critical outages.
- IEC 60909: The IEC method for short-circuit currents in three-phase alternating-current systems, applied in Session 3 to fault level checks.
- Transient Stability Methods: Time-domain assessment of how the system recovers from a fault, applied in Session 4.

Intended Participants

- Network planning managers who commission studies and recommend upgrades.
- System operation leaders who set operating limits from study results.
- Investment and asset managers who approve reinforcement budgets.
- Engineering managers who review study reports and connection requests.

Typical settings include electricity transmission, distribution networks, large industrial sites and renewable generation connections.

Learning Outcomes

1. Participants will be able to construct a study scope and base case with stated assumptions and planning criteria.
2. Participants will be able to evaluate load flow results against voltage and loading limits.
3. Participants will be able to diagnose critical outages and fault level shortfalls from contingency and short-circuit results.
4. Participants will be able to evaluate stability results to set a stated operating limit.
5. Participants will be able to prioritise reinforcement options and justify the ranking to an investment board.

Programme Structure

Day 1: Grid Studies Foundations

What do planning studies show, and what do they assume?

- Network Model Data Sheet
- Study Scope Statement
- Base Case Assumptions Register
- Study Types Map
- Planning Criteria Table

Day 2: Load Flow Analysis

Are voltages and loadings within limits in normal operation?

- Bus and Branch Result Reading
- Voltage Profile Plot
- Thermal Loading Table
- Loss Estimate Review
- Reactive Power Support Check

Day 3: Contingency and Short-Circuit Studies

What happens when a circuit is lost or a fault occurs?

- Single Outage Screening
- Contingency Ranking List
- IEC 60909 Method Review
- Fault Level Margin Table
- Equipment Rating Comparison

Day 4: Power System Stability

Will the system hold together after a disturbance?

- Transient Stability Case Review
- Rotor Angle Plot Reading
- Voltage Stability Margin Check
- Fault Clearing Time Test
- Stability Limit Statement

Day 5: Reinforcement Options Pack for One Network Area

Do the study results join into a ranked set of upgrades?

- Applying the Session 2 Loading Table
- Testing the Session 3 Contingency Ranking
- Reading the Session 4 Stability Limit Statement
- Ranking the Reinforcement Options
- Completing the Reinforcement Options Pack

Methodology

The programme is a structured exercise built on prepared network cases from a utility transmission area and a large industrial site. Participants read results, test them against criteria, rank critical events and defend upgrade choices to peers acting as an investment board.

- Suggested activity: Reading a load flow result and listing the circuits that breach thermal limits.
- Suggested activity: Ranking a set of single outages by severity and proposing a first response.
- Suggested activity: Comparing two reinforcement options against the stability limit statement.

Capstone Output

Each participant completes a reinforcement options pack for one network area. It holds a study scope, a loading table, a contingency ranking, a stability limit statement and a ranked option list with reasons. At work it goes to the investment board and sets the review routine for later studies.

Frequently Asked Questions

Is grid studies training suitable for managers who are not power engineers?

Yes. Grid studies are taught through prepared network cases and templates. You need responsibility for planning, operation or investment in a network, but no earlier experience of running study software.

Which methods do grid studies rest on in this training?

Grid studies rest on load flow analysis, contingency analysis, transient stability methods and the IEC 60909 method for short-circuit currents, which together support reinforcement decisions.

How is the pack from grid studies training used at work?

You put the reinforcement options pack to your investment board, use its ranking to justify upgrades, and keep its checks as the routine for later study reviews.

How does grid studies work differ from a programme on substation protection?

Grid studies concentrate on network loading, outages and stability to plan upgrades, while a programme on substation protection concentrates on relay settings and fault clearing equipment.