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COURSE BROCHURE

# Advanced Power Chain Efficiency and Reliability Improvement Training Course

22 March – 2 April 2027
Paris

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Registered in the United Kingdom and Saudi Arabia

# Advanced Power Chain Efficiency and Reliability Improvement Training Course

**Ref:** 2579_98113 **Date:** 22 March – 2 April 2027 **Location:** Paris **Fees:** 10500 GBP

Power Chain Efficiency and Reliability Improvement is a 2-week training course for senior engineers and managers across generation, transmission, distribution and supply, who leave with a Power Chain Improvement Case: a costed set of loss and outage measures for one system. Rising demand, ageing plant and variable generation now expose every weak link between the turbine hall and the customer meter. Jupiter Prime Training places Power Chain Efficiency and Reliability Improvement within that whole-system view.

## Why Power Chain Efficiency and Reliability Improvement Matters Now

Three forces press on the electricity chain at once. Variable wind and solar output changes how thermal units cycle and how feeders load, so heat rate and outage behaviour shift together. Ageing transformers, cables and switchgear raise failure probability faster than replacement budgets grow. Customers and asset owners expect fewer and shorter interruptions while tariffs stay under scrutiny. An organisation that measures losses and outages along the whole chain directs spending where each unit of capital buys the most avoided energy and the most avoided customer minutes lost; one that treats stages separately often fixes symptoms twice and the root cause never.

## Who Gains Most from Power Chain Efficiency and Reliability Improvement

- Generation performance leads accountable for heat rate, auxiliary load and forced outage rate
- Transmission and substation engineers responsible for line loading, transformer health and protection settings
- Distribution planners owning feeder losses, voltage profiles and interruption indices
- System operation leads balancing dispatch, reserves and contingency security
- Asset and investment managers ranking capital and maintenance spending across the network

The greatest gain comes when a utility or industrial power owner sends generation, network and asset staff together, so one shared loss and outage picture replaces separate departmental views.

## Power Chain Efficiency and Reliability Improvement Capabilities

Participants trace energy and failure from fuel input to delivered kilowatt-hour and convert those findings into ranked interventions.

- Calculate technical and non-technical losses at each voltage level — loss reduction targets
- Assess unit heat rate and auxiliary consumption drivers — generation dispatch and overhaul choices
- Apply interruption indices and failure-mode analysis to feeders and substations — reliability investment
- Weigh reactive power, voltage control and loading options — network operating policy
- Build a lifecycle cost comparison of competing upgrades — capital committee decisions
- Communicate a chain-wide improvement case — executives, operators and asset owners

## Key Power Chain Efficiency and Reliability Improvement Terms

- Heat rate — fuel energy a generating unit consumes for each kilowatt-hour sent out; lower values mean better conversion efficiency.
- Technical losses — energy dissipated as heat in conductors, transformers and equipment while power flows from source to load.
- Non-technical losses — energy delivered but not billed, caused by metering faults, data errors or unauthorised connections.
- Interruption duration index — average minutes each connected customer goes without supply over a period, used to compare network reliability.
- N-1 security — the ability of a system to keep supplying load after losing any single major component.
- Load factor — ratio of average demand to peak demand over a period, showing how evenly assets are used.

## Power Chain Efficiency and Reliability Improvement Day by Day

## Day 1: The Electricity Chain as One System

- Fuel-to-Meter Energy Balance — Where Each Stage Loses Value
- Demand Growth and Peak Profiles — Capacity Margin Planning
- Variable Generation Penetration — Changing Duty on Conventional Plant
- Ageing Asset Populations — Timing of Renewal Spending
- Stakeholder Expectations on Supply Quality — Performance Target Setting

## Day 2: Generation Efficiency

- Heat Rate Testing and Deviation Tracking — Unit Overhaul Priorities
- Auxiliary Power Consumption Audits — Station Service Reduction
- Part-Load and Cycling Penalties — Dispatch Order Choices
- Condenser and Cooling Performance — Seasonal Output Recovery
- Combined Cycle and Cogeneration Options — Fuel Use per Delivered Unit

## Day 3: Generation Reliability

- Forced Outage Rate and Equivalent Availability — Plant Performance Benchmarks
- Failure Mode and Effects Analysis for Rotating Plant — Spares Strategy
- Condition Monitoring of Turbines and Generators — Inspection Intervals
- Black Start and Islanding Capability — Restoration Readiness
- Root Cause Analysis of Unit Trips — Repeat Failure Prevention

## Day 4: Transmission Losses and Loading

- Load Flow Studies — Corridor Congestion and Loss Allocation
- Conductor Upgrading and Dynamic Line Rating — Thermal Headroom Release
- Transformer No-Load and Copper Losses — Replacement Economics
- Reactive Power Compensation — Voltage Stability Margins
- Corona and Insulation Losses — Line Maintenance Scope

## Day 5: Transmission and Substation Reliability

- N-1 Contingency Screening — Reinforcement Triggers
- Protection Coordination Review — Fault Clearance and Selectivity
- Substation Automation and Remote Monitoring — Faster Fault Location
- Dissolved Gas and Insulation Diagnostics — Transformer Health Ranking
- Circuit Breaker Condition Assessment — Switching Duty Risk

## Day 6: Distribution Losses and Metering

- Feeder Loss Estimation by Voltage Level — Reconductoring Candidates
- Phase Balancing and Network Reconfiguration — Loss Reduction at Low Cost
- Energy Accounting at Feeder and Transformer Level — Non-Technical Loss Detection
- Smart Metering Data Analytics — Theft and Billing Error Targeting
- Distribution Transformer Sizing — Overload and Idle Loss Trade-Off

## Day 7: Distribution Reliability and Power Quality

- Interruption Frequency and Duration Indices — Feeder Reliability Ranking
- Sectionalising and Automatic Reclosing Schemes — Customer Minutes Avoided
- Harmonics, Sags and Flicker Measurement — End-Use Equipment Impact
- Vegetation and Weather Exposure Mapping — Preventive Work Planning
- Hosting Capacity Assessment — Distributed Generation Connection Limits

## Day 8: End Use and System Operation

- Industrial and Commercial Load Efficiency — Demand-Side Measures
- Demand Response and Peak Shaving — Deferred Network Investment
- Battery Energy Storage Placement — Reserve and Congestion Relief
- Economic Dispatch and Reserve Scheduling — Operating Cost and Security
- Generation and Load Forecasting — Balancing Error Reduction

## Day 9: Ranking Improvement Options

- Lifecycle Cost and Net Present Value Comparison — Upgrade Selection
- Value of Lost Load Estimation — Reliability Spending Justification
- Risk-Based Asset Prioritisation Matrix — Maintenance Budget Allocation
- Key Performance Indicator Dashboard Design — Chain-Wide Monitoring
- Sensitivity Testing of Fuel, Demand and Failure Assumptions — Robust Choices

## Day 10: Practising the Power Chain Improvement Case

- Case System Energy Balance from Generation to Meter — Loss Hotspot Identification
- Reliability Index Analysis of the Case Network — Weak Link Selection
- Costed Comparison of Efficiency and Reliability Measures — Investment Sequence
- Peer Challenge of Assumptions and Risks — Case Refinement
- Power Chain Improvement Case Presentation — Executive Approval Request

## Applying Power Chain Efficiency and Reliability Improvement After the Course

- Lead a fuel-to-meter energy balance for one supply area, separating technical from non-technical losses at each voltage level.
- Rank the ten worst-performing feeders or units by interruption indices and forced outage rate, then propose sectionalising, monitoring or overhaul measures for each.

## Power Chain Efficiency and Reliability Improvement Questions FAQ

### What is power chain efficiency and reliability improvement and why does it matter now?

It is the practice of reducing energy losses and supply interruptions across generation, transmission, distribution and end use as one system. It matters now because variable generation, ageing assets and tighter customer expectations make isolated, stage-by-stage fixes too costly.

### Which roles gain most from power chain efficiency and reliability improvement?

Senior generation, transmission, distribution, system operation and asset investment staff gain most. Each controls part of the chain's losses or outages, and the course gives them one shared method for measuring and ranking improvements across organisational boundaries.

### How does power chain efficiency and reliability improvement differ from a power system protection course?

It looks at the whole electricity chain rather than one discipline. A protection course concentrates on relays and fault clearance; this one links protection with heat rate, losses, metering, asset condition and investment ranking to decide where improvement delivers most.

## What do you bring back from power chain efficiency and reliability improvement training?

You bring back a costed, ranked set of loss and outage measures built on a case system. It shows how to balance energy from fuel to meter, compare reliability indices and present an investment sequence that executives and operators can act on.

## Power Chain Efficiency and Reliability Improvement: The Way Forward

The Power Chain Improvement Case gives asset and operations leaders a ranked list of measures whose first use is setting next year's loss and reliability spending. Network planners and plant managers use it to agree which weak link to fix first. After the first budget round, revisit the value placed on lost load and the share of losses traced to metering.