Integrated Power System Planning and Load Forecasting Training Course



19 - 23 Oct 2026

Madrid

5900 € (Per Person)

Ref: #ERE1137_95329

Course Introduction / Overview:

This comprehensive training course provides an in-depth exploration of the principles and practices of modern power system planning and load forecasting. In an era of rapid energy transition, grid modernization, and the integration of variable renewable resources, the ability to accurately forecast electricity demand and develop robust, long-term system plans is more critical than ever. This program is designed to equip professionals with the essential skills to navigate these complexities. Drawing upon foundational concepts detailed in works like "Power System Analysis and Design" by J. Duncan Glover, this course bridges the gap between theoretical knowledge and practical application. Participants will delve into everything from fundamental power flow analysis to advanced machine learning techniques for energy demand forecasting. At BIG BEN Training Center, we have structured this curriculum to address the entire planning lifecycle, covering generation, transmission, and distribution systems. The course emphasizes an integrated approach, ensuring that participants understand how forecasting directly influences strategic investment decisions and operational reliability, ultimately preparing them to build resilient and efficient power grids for the future.

Target Audience / This training course is suitable for:

- Power System Planners and Engineers.
- Grid Operations Specialists.
- Energy Analysts and Forecasters.
- Utility Managers and Supervisors.
- Electrical Engineers in the power sector.
- Regulatory and Policy Advisors.
- Renewable Energy Integration Specialists.
- Project Managers in energy infrastructure.
- Consultants in the power and utility industry.
- Researchers and Academics in power systems.

Target Sectors and Industries:

- Electric Power Utilities (Generation, Transmission, and Distribution).
- Independent System Operators (ISOs) and Regional Transmission Organizations (RTOs).
- Renewable Energy Development Companies.
- Energy Consulting and Engineering Firms.
- Large Industrial Consumers of Electricity.
- Technology Providers for Smart Grids and Energy Management.
- Financial Institutions investing in energy infrastructure.
- Governmental bodies, energy ministries, and regulatory agencies.

Target Organizations Departments:

- System Planning and Engineering.
- Grid Operations and Control.
- Asset Management and Strategy.
- Forecasting and Data Analytics.
- Regulatory Affairs and Compliance.
- Renewable Energy Integration.
- Grid Modernization and Smart Grid Projects.
- Research and Development.
- Market Analysis and Trading.

Course Offerings:

By the end of this course, the participants will have able to:

- Master the fundamentals of integrated power system planning from generation to distribution.
- Apply various statistical and AI-based models for accurate short-term and long-term load forecasting.
- Analyze the technical and economic impacts of integrating renewable energy sources and energy storage systems.
- Develop robust generation and transmission expansion plans to meet future demand reliably.
- Evaluate the role of demand-side management and smart grid technologies in modern distribution planning.
- Utilize industry-standard methodologies for contingency analysis and system reliability assessment.
- Conduct comprehensive economic, environmental, and risk analyses for power system projects.
- Formulate integrated resource plans (IRP) that align with regulatory requirements and policy goals.

Course Methodology:

The training methodology at BIG BEN Training Center is designed to be highly interactive, practical, and engaging, ensuring that participants can immediately apply their learning in a professional context. This course moves beyond traditional lectures by incorporating a blended learning approach. Each module is supported by real-world case studies that explore planning challenges faced by utilities and grid operators globally. Participants will engage in hands-on workshops and simulation exercises using conceptual models to practice load forecasting and system planning scenarios. Collaborative group projects will encourage teamwork and peer-to-peer learning, allowing attendees to solve complex problems and present their findings. Expert-led sessions will facilitate deep-dive discussions on emerging trends, such as the impact of electric vehicles and decarbonization on grid planning. Continuous feedback is a cornerstone of our approach, with structured Q&A sessions and one-on-one guidance from the instructor. This immersive methodology ensures a comprehensive understanding of both the theoretical principles and the practical tools needed for effective power system planning and forecasting.

Course Agenda (Course Units):

Unit One: Fundamentals of Integrated Power System Planning

- Introduction to power system components and structure.
- The objectives and hierarchy of power system planning.
- Regulatory frameworks and energy policy drivers.
- Key concepts in power system economics and reliability.
- Introduction to load characteristics and forecasting principles.
- Overview of generation, transmission, and distribution planning.
- Data requirements for effective system planning and analysis.

Unit Two: Advanced Load and Energy Forecasting Techniques

- Time-series analysis methods (ARIMA, Exponential Smoothing).
- Regression models for load forecasting.
- Impact of weather, economic factors, and special events on load.
- Introduction to Artificial Intelligence (AI) and Machine Learning (ML) models.
- Applying neural networks and support vector machines for forecasting.
- Probabilistic forecasting to quantify uncertainty.
- Techniques for spatial load forecasting and long-term energy prediction.

Unit Three: Generation and Transmission Expansion Planning

- Principles of Generation Expansion Planning (GEP).
- Modeling different generation technologies (thermal, hydro, renewables).
- Integration of Energy Storage Systems (ESS) into the grid.
- Transmission planning criteria and power flow analysis.
- Contingency analysis (N-1, N-2) and system security.
- Optimal power flow and economic dispatch principles.
- Co-optimization of generation and transmission investments.

Unit Four: Modern Distribution System Planning

- Challenges in traditional distribution planning.
- Hosting capacity analysis for Distributed Energy Resources (DERs).
- Impact of electric vehicles (EVs) and rooftop solar PV.
- Voltage and var control strategies in modern distribution grids.
- Role of smart grid technologies, automation, and SCADA.
- Non-wires alternatives and demand-side management programs.
- Planning for grid resilience against extreme weather events.

Unit Five: Integrated Resource Planning and Future Trends

- The Integrated Resource Planning (IRP) process and methodologies.
- Conducting economic analysis and evaluating project feasibility.
- Environmental impact assessment and decarbonization pathways.
- Risk analysis and decision-making under uncertainty.
- Capstone project: Developing a simplified integrated resource plan.
- The future of grid planning with AI and big data analytics.
- Course review, final assessment, and strategic outlook.

FAQ:

Qualifications required for registering to this course?

There are no requirements.

How long is each daily session, and what is the total number of training hours for the course?

This training course spans five days, with daily sessions ranging between 4 to 5 hours, including breaks and interactive activities, bringing the total duration to 20 - 25 training hours.

Something to think about:

As power grids transition towards 100% renewable energy, how must traditional deterministic planning models evolve to manage the inherent stochasticity and uncertainty of these resources effectively?

What unique qualities does this course offer compared to other courses?

This course distinguishes itself by offering a truly integrated perspective that holistically combines the distinct yet interdependent disciplines of power system planning and load forecasting. Unlike programs that address these topics in isolation, our curriculum is built on the premise that robust planning is impossible without accurate forecasting, and forecasting is only valuable when applied to strategic planning. We move beyond outdated models to focus on the contemporary challenges shaping the industry, including deep decarbonization, the integration of distributed energy resources, and the need for enhanced grid resilience. The curriculum emphasizes a forward-looking approach, equipping participants with skills in advanced methodologies like probabilistic forecasting and AI-driven analytics, which are becoming industry standards. Furthermore, the course content is deeply practical, focusing on the application of knowledge through complex case studies and simulation-based exercises that mirror real-world decision-making scenarios. This focus on a unified, modern, and application-oriented framework provides participants with a more profound and immediately applicable skill set than more narrowly focused or purely theoretical courses.