COURSE OVERVIEW EE1125
Power System Modernization

Course Title
Power System Modernization

Course Date/Venue
August 03-07, 2025/Meeting Plus 9, City Centre Rotana, Doha, Qatar

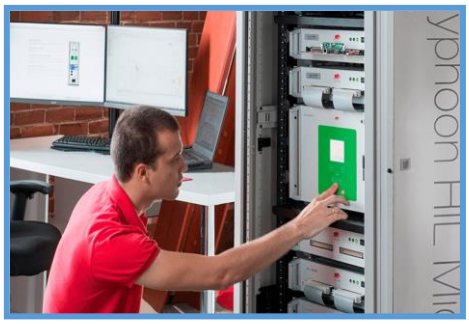
Course Reference
EE1125

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

This course is designed to provide participants with a detailed and up-to-date overview of Power System Modernization. It covers the evolution of power systems, architecture of modern power systems, renewable energy and grid integration and key challenges in legacy systems; the digital transformation in power systems, regulatory and policy frameworks and smart grid fundamentals; the SCADA and EMS/DMS systems, substation automation and modern protection, grid communication technologies and smart meters and AMI systems; the interoperability and standards; the power flow and network modeling for modern grids and load forecasting and grid planning; the DER hosting capacity and impact studies, power quality and harmonics in modern grids; and the energy storage system planning and data analytics and grid intelligence.



During this interactive course, participants will learn the grid resilience and reliability, distributed energy resources (DER) management, microgrids and islanding capabilities and demand side management and flexibility; the decentralization and peer-to-peer energy models, integration of electric vehicles (EVS) and grid modernization roadmaps and strategies; the investment, economics, and business models; and the cybersecurity in modern power systems.

Course Objectives

Upon the successful completion of this course, each participant will be able to: -

- Apply and gain an in-depth knowledge on power system modernization
- Discuss the evolution of power systems, architecture of modern power systems, renewable energy and grid integration and key challenges in legacy systems
- Explain digital transformation in power systems, regulatory and policy frameworks and smart grid fundamentals
- Recognize SCADA and EMS/DMS systems, substation automation and modern protection, grid communication technologies and smart meters and AMI systems
- Determine interoperability and standards including the power flow and network modeling for modern grids and load forecasting and grid planning
- Recognize DER hosting capacity and impact studies, power quality and harmonics in modern grids as well as energy storage system planning and data analytics and grid intelligence
- Discuss grid resilience and reliability, distributed energy resources (DER) management, microgrids and islanding capabilities and demand side management and flexibility
- Explain decentralization and peer-to-peer energy models, integration of electric vehicles (EVS) and grid modernization roadmaps and strategies
- Analyze investment, economics, and business models and the cybersecurity in modern power systems

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of power system modernization for electrical engineers, utility professionals, energy policy makers and regulators, project managers, technology providers and vendors, consultants and other technical staff.

Course Fee

US$ 6,000 per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- British Accreditation Council (BAC)

  Haward Technology is accredited by the British Accreditation Council for Independent Further and Higher Education as an International Centre. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

- The International Accreditors for Continuing Education and Training (IACET - USA)

Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the ANSI/IACET 2018-1 Standard which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the ANSI/IACET 2018-1 Standard.

Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking Continuing Education Units (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Mr. Pan Marave, PE, MSc, BEng, is a **Senior Electrical & Instrumentation Engineer** with over **45 years** of extensive experience in **Oil**, **Gas**, **Petrochemical**, **Refinery** & **Power** industries. His expertise includes Safety Instrumented Systems (**SIS**), Safety Integrity Level (**SIL**), Emergency Shutdown (**ESD**); **DCS**, **SCADA** & **PLC**; **Measurement** (**Flow**, **Temperature**, **Pressure**); **Process Analyzers** & **Analytical Instrumentation**; **Process Control**, **Instrumentation** & **Safeguarding**; **Process Controller**, **Control Loop & Valve Tuning**; Industrial **Distribution Systems**; Industrial **Control & Control Systems**, Power Systems **Protection & Relaying**; **Earthing**, **Bonding**, **Grounding**, **Lightning & Surge Protection**; Electric Power **Substation** & **Systems**; Electrical Engineering Principles; **Motor Control Circuit**; **Electrical Fault Analysis**; Electrical Networks & Distribution **Cables**; **Circuit Breakers**, **Switchgears**, **Transformers**, **Hazardous Areas Classification** and **Detailed Engineering Drawings**, **Codes** & **Standards**. Furthermore, he is also well-versed in Microprocessors Structure, Lead Auditor (**ISO 9000:2000**), **ISO 9002**, Quality Assurance, and Projects & Contracts Management.

Presently, Mr. Marave is the **Technical Advisor** of **Chamber of Industry & Commerce** in Greece. Prior to this, he gained his thorough practical experience through several positions as the **Technical Instructor**, **Engineering Manager**, **Electronics & Instruments Head**, **Electrical**, **Electronics & Instruments Maintenance Superintendent**, **Assistant General Technical Manager** and **Engineering Supervisor** of various international companies such as the **Alumil** Mylonas, **Athens Papermill**, **Astropol** and the **Science Technical Education**.

Mr. Marave is a **Registered Professional Engineer** and has **Master's** and **Bachelor's** degrees in **Electrical Engineering** from the **Polytechnic Institute of New York** and **Pratt Institute of New York** (**USA**) respectively. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**) and an active member of the **Technical Chamber** and the Institute of Electrical and Electronics Engineer (**IEEE**) in Greece. He has presented and delivered **numerous international** courses, conferences, trainings and workshops worldwide.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the workshop for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1: ***Sunday, 03rd of August 2025***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Evolution of Power Systems*** *Historical Overview: Central Generation to Distributed Energy • Drivers for Modernization: Aging Assets, Renewables, Resilience • Transition from Passive to Active Grid • Key Modernization Goals: Efficiency, Flexibility, Sustainability*
0930 – 0945	*Break*
0945 – 1030	***Architecture of Modern Power Systems*** *Generation, Transmission, Distribution, and Prosumer Integration • Hierarchical versus Meshed System Structures • Role of DERs, Microgrids, and Smart Substations • Communication and Data Layers in Modern Grids*
1030 – 1130	***Renewable Energy & Grid Integration*** *Characteristics of Solar PV and Wind • Variability and Intermittency Management • Curtailment and Overgeneration Issues • Grid Codes for Renewables*
1130 – 1215	***Key Challenges in Legacy Systems*** *Infrastructure Aging and Maintenance Backlogs • Voltage and Frequency Instability • Limited Observability and Control • Lack of Digital Interoperability*
1215 – 1230	*Break*
1230 – 1330	***Digital Transformation in Power Systems*** *Role of IoT and AI in Modern Grid Management • Cloud-Based and Edge Computing Solutions • Digital Twin Concepts for Grid Assets • Advanced Metering Infrastructure (AMI)*

1330 – 1420	***Regulatory & Policy Frameworks*** *Grid Modernization Mandates (e.g., FERC, DOE, EU Clean Energy Package) • Role of Energy Regulators and Utilities • Incentive-Based Modernization Programs • Decarbonization and Electrification Policies*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2: Monday, 04th of August 2025

0730 – 0830	***Smart Grid Fundamentals*** *Features and Architecture of Smart Grids • Grid Intelligence and Situational Awareness • Self-Healing, Adaptive Protection, and Real-Time Control • Benefits to Consumers and Utilities*
0830 – 0930	***SCADA & EMS/DMS Systems*** *Core Functions of SCADA in Modern Substations • EMS and DMS for Transmission/Distribution Control • Data Acquisition and Command Execution • Trends Toward Integrated Control Centers*
0930 – 0945	*Break*
0945 – 1100	***Substation Automation & Modern Protection*** *IEC 61850 Protocol and System Configuration • IEDs and Their Role in Automation • Station Bus versus Process Bus • Adaptive Relaying and Event Recording*
1100 – 1215	***Grid Communication Technologies*** *Fiber Optics, PLC, Wireless (LoRa, LTE, 5G) • Network Topologies for Reliability • Data Latency and Bandwidth Requirements • Cybersecurity in Communication Networks*
1215 – 1230	*Break*
1230 – 1330	***Smart Meters & AMI Systems*** *Functionality of Smart Meters • Head-End Systems and Meter Data Management • Customer-Side Benefits and Demand Response • Integration with Home Energy Management Systems (HEMS)*
1330 – 1420	***Interoperability & Standards*** *Open Protocols (DNP3, Modbus, IEC) • Role of IEEE, NIST, and IEC in Standardization • Importance of Harmonization for Scalability • Testing and Certification of Smart Grid Devices*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3: Tuesday, 05th of August 2025

0730 – 0830	***Power Flow & Network Modeling for Modern Grids*** *AC versus DC Load Flow in Modern Systems • Handling Bidirectional Flows from DERs • Modeling Inverter-Based Resources • Impacts on Short-Circuit Levels and Stability*
0830 – 0930	***Load Forecasting & Grid Planning*** *Traditional versus Probabilistic Load Forecasting • Integrating EVs, Heat Pumps, and Smart Appliances • Long-Term Infrastructure Planning • Impact of Climate Change on Grid Design*

0930 – 0945	*Break*
0945 – 1100	***DER Hosting Capacity & Impact Studies*** *Methods for Assessing Hosting Capacity • Tools for Simulation and Modeling (CYME, DIgSILENT, OpenDSS) • Voltage and Thermal Constraint Analysis • Dynamic Behavior of Inverters under Fault*
1100 – 1215	***Power Quality & Harmonics in Modern Grids*** *Harmonic Sources and Filter Requirements • Flicker, Voltage Dips, Transients, and Imbalance • Measurement Techniques and Standards (IEC 61000 Series) • Power Quality Indices for Grid Benchmarking*
1215 – 1230	*Break*
1230 – 1330	***Energy Storage System Planning*** *Role of Storage in Frequency and Voltage Regulation • Battery Sizing and Siting Strategies • Charging Algorithms and Battery Lifecycle • Integration with Renewables and Peak Shaving*
1330 – 1420	***Data Analytics & Grid Intelligence*** *Big Data from Smart Devices and Sensors • Predictive Maintenance Using AI/ML • Asset Performance Analytics • Grid Visualization Dashboards and Decision Support*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4: ***Wednesday, 06th of August 2025***

0730 – 0830	***Grid Resilience & Reliability*** *Defining Resilience versus Reliability • Strategies to Mitigate Outages and Blackouts • Physical and Cyber Risk Preparedness • Grid Hardening and Undergrounding Initiatives*
0830 – 0930	***Distributed Energy Resources (DER) Management*** *Solar, Wind, CHP, Energy Storage, and EVs • DERMS (Distributed Energy Resource Management Systems) • Grid-Forming versus Grid-Following Inverters • Visibility and Control Challenges*
0930 – 0945	*Break*
0945 – 1100	***Microgrids & Islanding Capabilities*** *Microgrid Architecture and Control Modes • Black Start and Islanding Detection • Grid-Connected versus Standalone Operation • Microgrid Business Models and Economics*
1100 – 1215	***Demand Side Management & Flexibility*** *Demand Response Strategies • Time-of-Use Tariffs and Load Shifting • Aggregators and Virtual Power Plants (VPPs) • DSM Tools and Platforms*
1215 – 1230	*Break*
1230 – 1330	***Decentralization & Peer-to-Peer Energy Models*** *Blockchain-Based Energy Trading • Peer-to-Peer and Transactive Energy Frameworks • Role of Prosumers and Community Energy • Regulatory and Legal Implications*

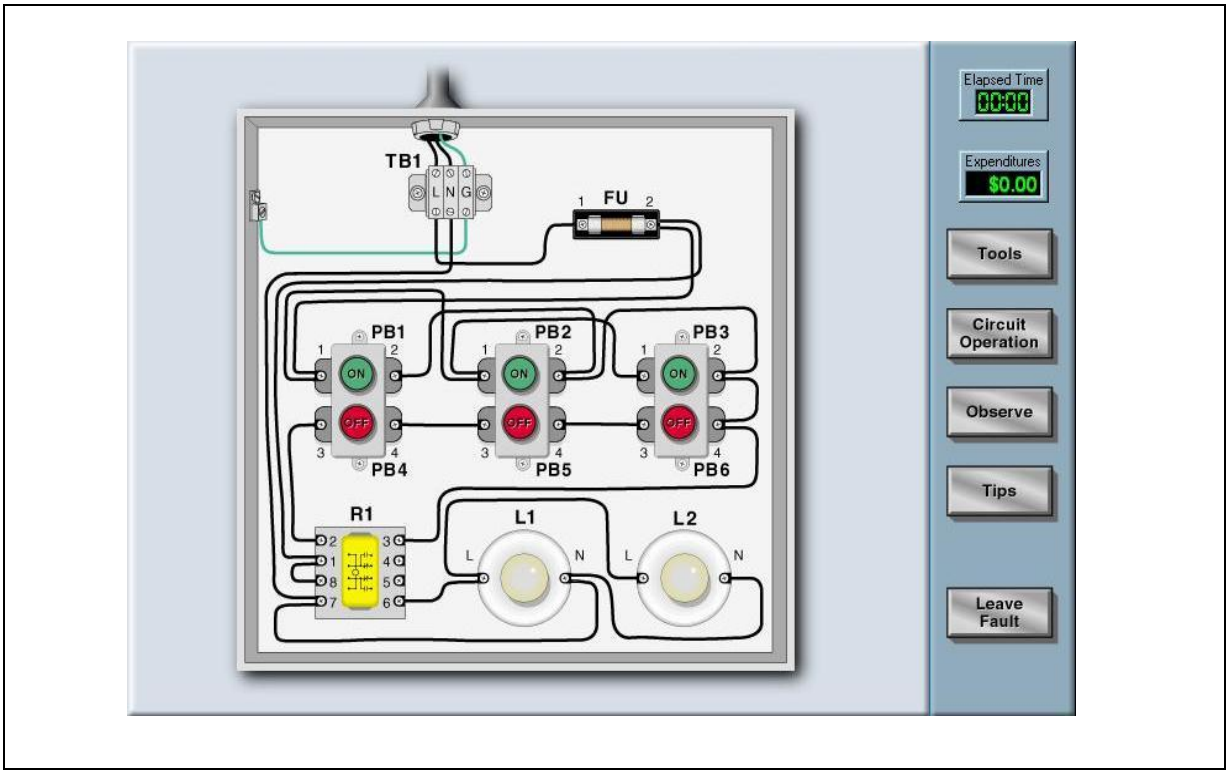
1330 – 1420	***Integration of Electric Vehicles (EVs)*** *Impact of EV Charging on Grid Demand • Smart Charging and V2G (Vehicle-to-Grid) Systems • Charging Infrastructure and Standards • Planning for EV Penetration Scenarios*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

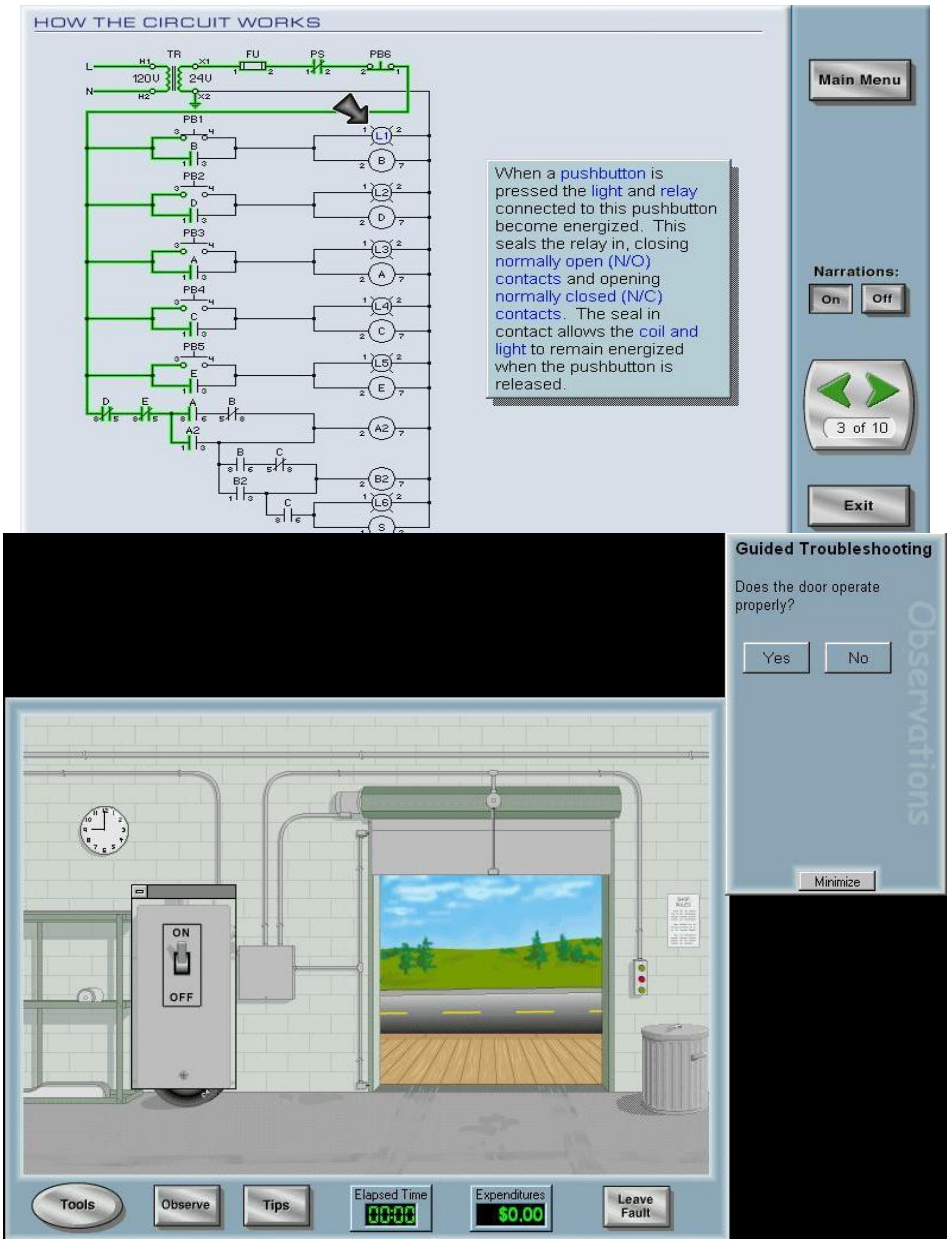
Day 5: ***Thursday, 07th of August 2025***

0730 – 0830	***Grid Modernization Roadmaps & Strategies*** *Steps to Develop a Modernization Plan • Utility-Level versus National Strategies • Stakeholder Alignment and Value Realization • Cost-Benefit Analysis and KPI Development*
0830 – 0930	***Investment, Economics, & Business Models*** *Capital Planning and Funding Mechanisms • Regulatory Returns and Incentives • Public-Private Partnerships in Modernization • Lifecycle Cost of Modern Technologies*
0930 – 0945	*Break*
0945 – 1100	***Cybersecurity in Modern Power Systems*** *Threat Landscape for Digital Power Grids • Cyber Risk Assessment Methodologies • Role of Firewalls, Intrusion Detection, Encryption • NERC CIP & ISO 27001 Compliance*
1100 – 1215	***Case Studies from Global Utilities*** *US Smart Grid Deployments (PG&E, Con Edison) • EU Projects (Interflex, SmarterEMC2, FLEXGRID) • Asian Initiatives (Singapore SP Group, India's Smart Meter Mission) • Key Lessons and Success Factors*
1215 – 1230	*Break*
1230 – 1330	***Future Trends in Power System Modernization*** *AI-Powered Autonomous Grids • Quantum Computing for Optimization • Green Hydrogen and Sector Coupling • Digital Twins and Immersive Training Platforms*
1330 – 1345	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about t Topics that were Covered During the Course*
1345 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

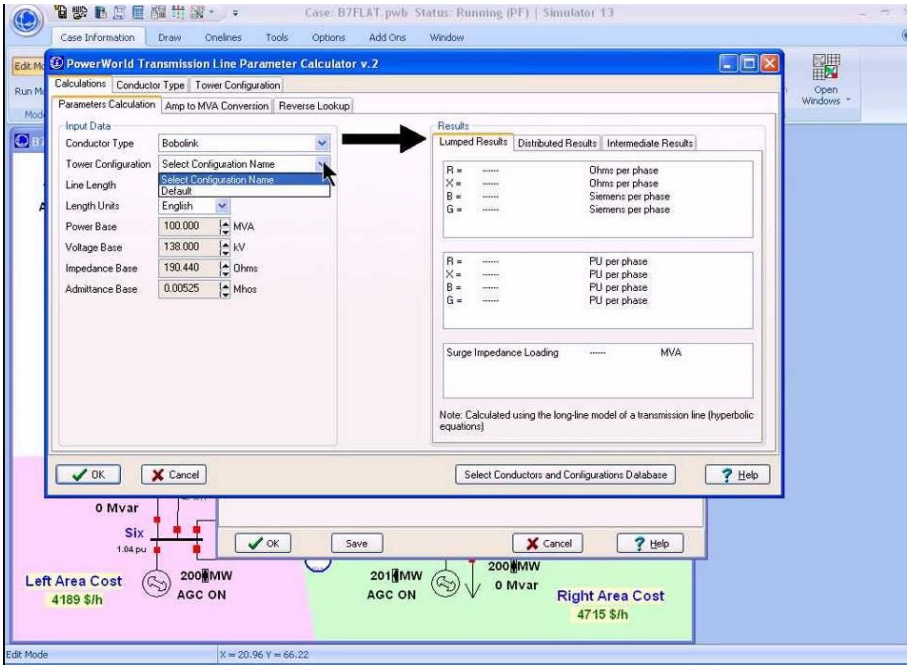
Simulator (Hands-on Practical Sessions)

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art simulator “Simutech Troubleshooting Electrical Circuits V4.1”, Power World” and “ETAP software”.

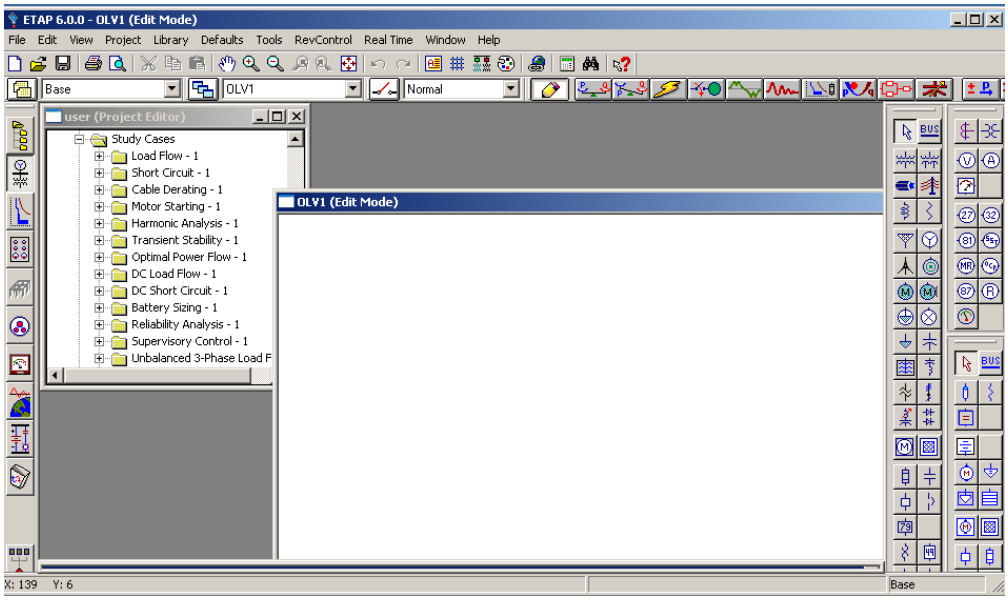




Simutech Troubleshooting Electrical Circuits V4.1



Power World Simulator



ETAP Software Simulator

Course Coordinator
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