COURSE OVERVIEW EE1109
Power System

Course Title
Power System

Course Date/Venue
Session 1: May 12-16, 2025/Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
Session 2: September 15-19, 2025/Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

Course Reference
EE1109

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. It covers the components and types of power systems, power generation methods and the role of water in power generation; the basic electrical engineering concepts, power generation technologies, power transmission basics and power distribution network; the importance of energy storage in power systems, types of energy storage (BESS, pumped storage) and applications of energy storage; the electrical protection systems, time-current characteristics of relays and voltage and frequency control; and the remote monitoring and control of substations, data acquisition and telemetry and fault detection and response.

Further, the course will also discuss the various types of power system stability, stability analysis methods, dynamic stability and transient analysis; the smart grids and advanced control systems, economic dispatch and load forecasting, power system reliability and power market and trading; the role of demand side management (DSM) in power system operations; the grid modernization and smart metering; the power system planning and forecasting, fault analysis in power systems and power system protection coordination; and the short circuit calculations, generator protection and transformer protection.

During this interactive course, participants will learn the function and types of fuses, operation and selection of circuit breakers, role of disconnectors in protection systems and coordination of protective devices; the integration of renewable energy sources and the energy transition and decarbonization; the trends and technologies of power systems, disaster recovery plans for power grids and resilience metrics and performance indicators; the regulatory framework for power systems and environmental impact of power generation; the compliance with international standards (ISO, IEC) and the renewable energy regulations.

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
- Identify the components and types of power systems, power generation methods and the role of water in power generation
- Discuss basic electrical engineering concepts, power generation technologies, power transmission basics and power distribution network
- Explain the importance of energy storage in power systems, types of energy storage and applications of energy storage
- Recognize electrical protection systems, time-current characteristics of relays and voltage and frequency control
- Apply remote monitoring and control of substations, data acquisition and telemetry and fault detection and response
- Identify various types of power system stability and apply stability analysis methods and dynamic stability and transient analysis
- Carryout smart grids and advanced control systems, economic dispatch and load forecasting, power system reliability and power market and trading
- Discuss the role of demand side management (DSM) in power system operations and illustrate grid modernization and smart metering
- Employ power system planning and forecasting, fault analysis in power systems and power system protection coordination
- Apply short circuit calculations, generator protection and transformer protection
- Identify the function and types of fuses, operation and selection of circuit breakers, role of disconnectors in protection systems and coordination of protective devices
- Integrate renewable energy sources and discuss energy transition and decarbonization including the trends and technologies of power systems
- Develop disaster recovery plans for power grids and discuss resilience metrics and performance indicators
- Review Regulatory framework for power systems and environmental impact of power generation, comply with international standards (ISO, IEC) and discuss renewable energy regulations

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 for electrical engineers, design engineers, power system analysts, project managers, maintenance and operations personnel and technical staff.

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.

Accommodation

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

Course Fee

US$ 5,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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.

  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.

- 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.

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. Herman Eksten, PE, PgDiP, is a **Senior Electrical Engineer** with over **30 years** of extensive experience **Oil**, **Gas**, **Petrochemical**, **Refinery** & **Power** industries and **Water & Utilities** specializing in **Electrical Safety**, Certified **HV Electrical Safety**, **Low Voltage Electrical Safety**, **Electrical Circuits**: Series and Parallel Connection, **Electrical Faults & Protective Devices**, **Renewable Energy Integration**, **Smart Grid** & **Renewable Integration**, **Renewable Energy** Storage Systems, **Renewable Energy** Economics & Finance, Risk Control Methods, **LOTO – Breakers** Operation in Electricity Substation, **LOTO** Principles and Procedures, **Arc Flash Risk Assessment**, Safety in **Power Electronic Equipment & Lasers**, **Circuit Breakers & Switchgears**, **Switchgear Assets Management**, **Circuit Breakers Control Circuits**, **Substation Maintenance** Techniques, **High Voltage Operation, Electrical Protection**, **Overhead Lines & Substation**, **Power Supply**, **High Voltage Substation**, **Electrical Protection Design**, **Earthing & Lightning Protection Design, Underground Equipment**, **Distribution Network Maintenance & Construction**, **Transformers Operation & Maintenance**, **Electric Power System, Power Plant Management**, **Substation Commissioning & Troubleshooting**, **Cable Splicing & Termination, Electrical Installation & Maintenance**, **Power Generation Operation & Control, Switchgear Life Assessment**, **Structured Cabling, Electric Power System, Power System Stability, Power System Planning & Economics**, **Power Flow** Analysis, **Combined Cycle Power Plant**, **UPS & Battery System, Variable Speed Drives,** and **HV Motors & Transformers**. He is currently the **Lead Electrical Engineer** of **SNC-LAVALIN** wherein he is responsible for basic designs and successful implementation of electrical engineering to plant overhead lines and substations.

During his career life, Mr. Eksten held various positions such as the **Lead Electrical Engineer**, **Operations Manager**, **Project Engineer**, **Technical Specialist**, **Customer Executive**, **District Manager**, **Electrical Protection Specialist**, **High-Voltage Operator** and **Apprentice Electrician** for FOX Consulting, UHDE (ThyssenKrupp Engineering), TWP Projects/Consulting (EPMC-Mining), ISKHUS Power, Rural Maintenance (PTY) Energia de Mocambique Lda., Vigeo (PTY) Ltd and ESKOM.

Mr. Eksten is a **Registered Professional Engineering Technologist** and has a Postgraduate Diploma in Management Development Programme and a National Higher Diploma (NHD) in Electrical Power Engineering. Further, he is a **Certified Instructor/Trainer**, a Senior member of the South African Institute Electrical Engineers (**SAIEE**) and holds a Certificate of Registration Membership Scheme from the Engineering Council of South Africa (**ESCA**). He has further delivered numerous trainings, courses, seminars, workshops and conferences internationally.

Course Program

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

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Power System Overview*** *Definition & Components of Power Systems • Types of Power Systems: Transmission, Distribution & Generation • Power Generation Methods • Role of Water in Power Generation*
0930 - 0945	*Break*
0945 – 1045	***Basic Electrical Engineering Concepts*** *Ohm's Law & Electrical Quantities • Alternating Current (AC) versus Direct Current (DC) • Power Factor & its Importance • Voltage, Current & Impedance Relationships*
1045 - 1145	***Power Generation Technologies*** *Thermal Power Plants • Hydropower & Renewable Energy Integration • Nuclear Power Plants • Combined Cycle Gas Turbines (CCGT)*
1145 - 1230	***Power Transmission Basics*** *High-Voltage Transmission Lines • AC & DC Transmission: Differences & Applications • Grid Connection & Power Flow • Role of Transformer Stations*
1230 – 1245	*Break*
1245 – 1330	***Power Distribution Network*** *Distribution Systems Design • Distribution Substations & Transformers • Secondary Distribution Networks • Load Balancing & Management*
1330 - 1420	***Energy Storage Systems in Power Networks*** *Importance of Energy Storage in Power Systems • Types of Energy Storage (BESS, Pumped Storage) • Applications of Energy Storage • Integration with Renewable Power*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2

0730 – 0830	***Electrical Protection Systems*** *Protection Relays: Purpose & Types • Short Circuit Protection • Ground Fault Protection • Overload Protection*
0830 – 0930	***Relay Coordination & Settings*** *Time-Current Characteristics of Relays • Setting Protection Relays • Coordination of Overcurrent Relays • Testing & Commissioning of Relays*
0930 - 0945	*Break*
0945 – 1130	***Voltage & Frequency Control*** *Automatic Generation Control (AGC) • Voltage Regulation & Control • Frequency Control Mechanisms • Role of Governors & AVR in Control*

1130 - 1230	***Substation Automation & SCADA Systems*** *SCADA Systems Overview • Remote Monitoring & Control of Substations • Data Acquisition & Telemetry • Fault Detection & Response*
1230 - 1245	*Break*
1245 - 1330	***Power System Stability*** *Types of Stability: Voltage, Rotor Angle, Frequency • Stability Analysis Methods • Dynamic Stability & Transient Analysis • Stability of Renewable-Dominant Power Systems*
1330 - 1420	***Smart Grids & Advanced Control Systems*** *Definition & Components of Smart Grids • Integration of Distributed Generation • Real-Time Power System Monitoring • Demand Response & Load Control*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3

0730 – 0830	***Economic Dispatch & Load Forecasting*** *What is Economic Dispatch? • Load Forecasting Techniques • Load Factor & its Impact on Power Generation • Optimal Generation Scheduling*
0830 – 0930	***Power System Reliability*** *Types of Reliability: Generation, Transmission, Distribution • Reliability Indices: SAIDI, SAIFI • Reliability Modeling Techniques • Impact of Renewable Energy on Reliability*
0930 - 0945	*Break*
0945 – 1130	***Power Market & Trading*** *Structure of Power Markets • Wholesale & Retail Power Markets • Energy Trading Mechanisms • Power Purchase Agreements (PPAs)*
1130 - 1230	***Demand Side Management (DSM)*** *Role of DSM in Power System Operations • Energy Efficiency Programs • Time-of-Use (TOU) Pricing & Load Shifting • Smart Metering & Consumer Engagement*
1230 - 1245	*Break*
1245 - 1330	***Grid Modernization & Smart Metering*** *Benefits of Grid Modernization • Deployment of Smart Meters • Data Analytics for Grid Optimization • Role of Consumer Feedback in Grid Management*
1330 - 1420	***Power System Planning & Forecasting*** *Long-Term Power System Planning • Load Growth Forecasting • Resource Planning & Development • Integration of New Generation Sources*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4

0730 – 0830	***Fault Analysis in Power Systems*** *Types of Faults: Symmetrical, Asymmetrical • Fault Current Calculation • Fault Detection & Location • Fault Clearing Time & its Impact*
0830 – 0930	***Power System Protection Coordination*** *Coordination of Protection Devices • Selectivity & Sensitivity in Protection • Protection System Testing & Evaluation • Fault Detection Techniques*
0930 - 0945	*Break*
0945 – 1130	***Short Circuit Calculations*** *Methods for Short Circuit Calculation • Symmetrical & Asymmetrical Faults • Fault Current Distribution in Networks • Coordination of Circuit Breakers & Relays*
1130 - 1230	***Generator Protection*** *Overload & Short Circuit Protection • Differential Protection for Generators • Protection Against Unbalanced Loads • Synchronization & Protection During Start-Up*
1230 - 1245	*Break*
1245 - 1330	***Transformer Protection*** *Types of Protection for Transformers • Differential Protection for Transformers • Overcurrent & Overload Protection • Buchholz Relay & its Function*
1330 - 1420	***Fuses, Circuit Breakers & Disconnectors*** *Function & Types of Fuses • Circuit Breakers: Operation & Selection • Role of Disconnectors in Protection Systems • Coordination of Protective Devices*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

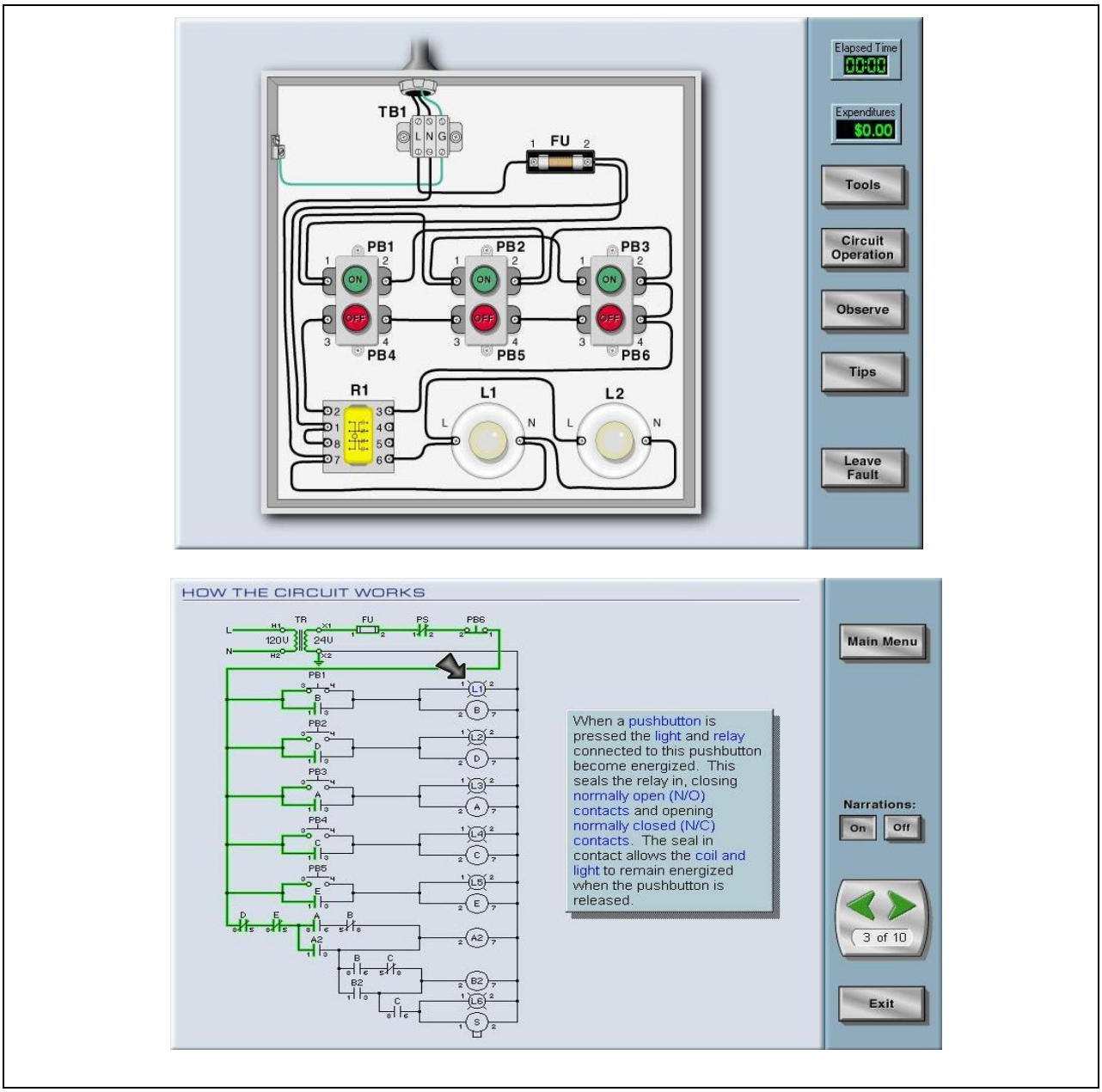
Day 5

0730 – 0830	***Integration of Renewable Energy Sources*** *Solar Power Generation & Integration • Wind Power & its Challenges • Impact of Distributed Energy Resources (DER) • Grid Integration of Storage Systems*
0830 – 0930	***Energy Transition & Decarbonization*** *Importance of Energy Transition • Low-Carbon Technologies in Power Systems • Impact of Climate Change on Power Systems • Decarbonizing the Power Grid*
0930 - 0945	*Break*
0945 – 1100	***Future of Power Systems: Trends & Technologies*** *Smart Grids & Digitalization • Blockchain & Energy Trading • AI & Machine Learning in Power Systems • Cybersecurity for Critical Power Infrastructure*
1100 – 1200	***Power System Resilience & Disaster Recovery*** *Definition of Resilience in Power Systems • Mitigation of Natural Disasters • Disaster Recovery Plans for Power Grids • Resilience Metrics & Performance Indicators*
1200 - 1215	*Break*
1215 – 1300	***Regulatory & Environmental Considerations*** *Regulatory Framework for Power Systems • Environmental Impact of Power Generation • Compliance with International Standards (ISO, IEC) • Renewable Energy Regulations*

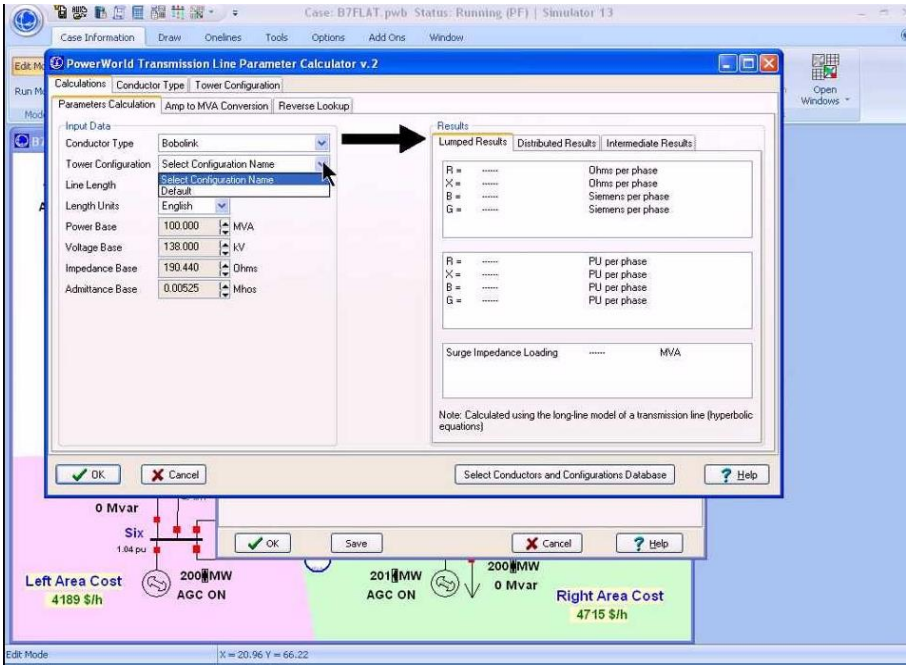
1300 - 1345	***Emerging Technologies in Power Systems*** *Superconducting Power Cables • Advanced Transmission Technologies • Energy Harvesting in Power Systems • Quantum Computing & its Potential Impact*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Simulator (Hands-on Practical Sessions)

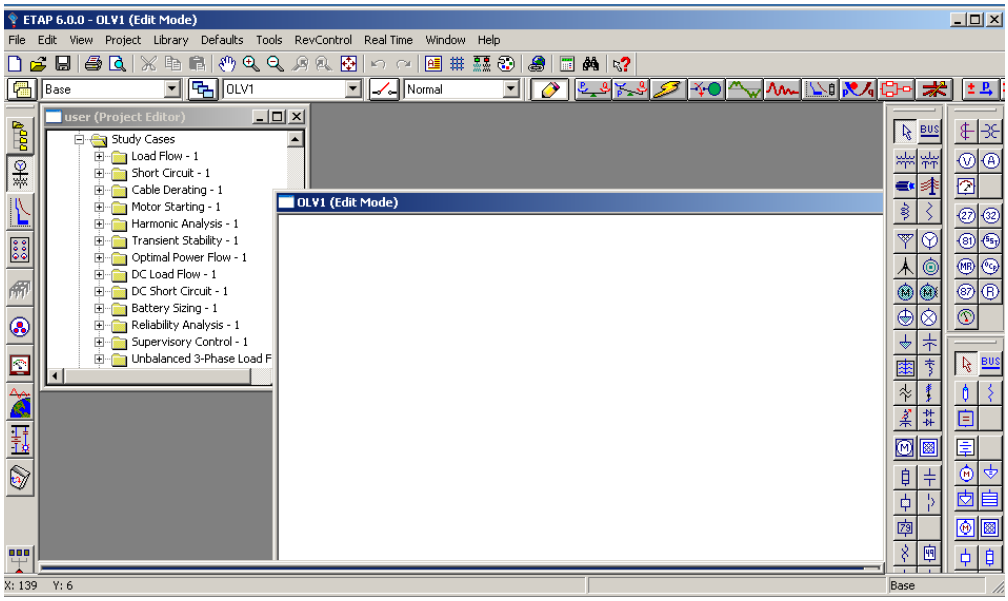
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art simulators "Troubleshooting Electrical Circuits V4.1", "Power World" and "ETAP software".



Troubleshooting Electrical Circuits V4.1 Simulator



Power World Simulator



ETAP Software Simulator

Course Coordinator

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