COURSE OVERVIEW EE1124
Design, Installation and Maintenance of Electrical Systems and Components

Course Title
Design, Installation and Maintenance of Electrical Systems and Components

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

Course Reference
EE1124

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 design, installation and maintenance of electrical systems and components. It covers the electrical engineering design, electrical system architecture and distribution and load calculation and demand estimation; the cable and conductor sizing, short circuit and fault current calculations and earthing and grounding systems; the switchgear and protection devices, distribution boards and panelboards, transformers and power supplies and electric motors and starters; the electrical cable installation practices, electrical installation safety requirements and electrical control panel design.

During this interactive course, participants will learn the motor control centers (MCCs), lighting systems design, uninterruptible power supplies (UPS) and backup systems and low current & auxiliary systems; the electrical system documentation, pre-commissioning and installation testing and transformer and switchgear testing; the power quality and harmonics analysis, fault finding and troubleshooting and maintenance scheduling and techniques; the testing equipment and safety precautions and energy efficiency in electrical systems; the renewable integration and smart grids and earthing system testing and maintenance; and the compliance with electrical standards and codes.

Course Objectives

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

- Apply and gain an in-depth knowledge on design, installation and maintenance of electrical systems and components
- Discuss electrical engineering design, electrical system architecture and distribution and load calculation and demand estimation
- Explain cable and conductor sizing, short circuit and fault current calculations and earthing and grounding systems
- Identify switchgear and protection devices, distribution boards and panelboards, transformers and power supplies and electric motors and starters
- Recognize electrical cable installation practices, electrical installation safety requirements and electrical control panel design
- Discuss motor control centers (MCCs), lighting systems design, uninterruptible power supplies (UPS) and backup systems and low current & auxiliary systems
- Perform electrical system documentation, pre-commissioning and installation testing and transformer and switchgear testing
- Explain power quality and harmonics analysis, fault finding and troubleshooting and maintenance scheduling and techniques
- Carryout testing equipment and safety precautions and discuss energy efficiency in electrical systems, renewable integration and smart grids and earthing system testing and maintenance
- Apply compliance with electrical standards and codes

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 design, installation and maintenance of electrical systems and components for, electrical engineers, electrical technicians and electricians, maintenance engineers and supervisors, project engineers and managers, facility managers, construction engineers, health and safety officers, utility and power generation professionals, procurement and planning engineers, engineers transitioning into electrical roles, Technically inclined managers or consultants

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

Haward's 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**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). 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.

Accommodation

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

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.

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.

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	***Basics of Electrical Engineering Design*** *Voltage, Current, Power, and Energy Relationships • Power Factor and Efficiency Basics • Single-Phase versus Three-Phase Systems • AC and DC System Design Differences*
0930 – 0945	*Break*
0945 – 1030	***Electrical System Architecture & Distribution*** *Generation, Transmission, and Distribution Overview • Radial versus Ring Distribution Systems • Low, Medium, and High-Voltage Networks • Main Switchboard and Sub-Distribution Structure*
1030 – 1130	***Load Calculation & Demand Estimation*** *Connected Load versus Demand Load • Load Diversity and Demand Factor • Load Classification (Lighting, HVAC, Motors, etc.) • Panelboard and Transformer Sizing Based on Loads*
1130 – 1215	***Cable & Conductor Sizing*** *Current-Carrying Capacity • Voltage Drop and Length Considerations • Derating Factors (Ambient Temperature, Grouping) • Cable Selection by Application (XLPE, PVC, Armored)*
1215 – 1230	*Break*
1230 – 1330	***Short Circuit & Fault Current Calculations*** *Types of Faults (L-L, L-G, L-L-G, 3-Φ) • Calculating Prospective Fault Current • Equipment Short Circuit Ratings • Arc Flash and Energy Mitigation*
1330 – 1420	***Earthing & Grounding Systems*** *Types: TN, TT, IT Earthing Systems • Equipment and System Grounding Principles • Grounding Resistance and Testing • Lightning Protection Grounding Integration*
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	***Switchgear & Protection Devices*** *ACBs, MCCBs, MCBs, and Fuses • Relays: Overcurrent, Earth Fault, Differential • CTs, VTs, and Trip Settings • Coordination and Discrimination*
0830 – 0930	***Distribution Boards & Panelboards*** *Construction and Rating of Panels • Busbar Sizing and Arrangements • IP Ratings and Ingress Protection • Thermal Management and Clearances*
0930 – 0945	*Break*
0945 – 1100	***Transformers & Power Supplies*** *Oil-Immersed versus Dry-Type Transformers • Sizing and Efficiency Considerations • Installation Precautions and Clearances • Tap Changer Operation and Maintenance*
1100 – 1215	***Electric Motors & Starters*** *Motor Nameplate Data Interpretation • DOL, Star-Delta, VFD Starter Applications • Motor Protection Methods • Vibration and Thermal Monitoring*
1215 – 1230	*Break*
1230 – 1330	***Electrical Cable Installation Practices*** *Conduit, Trunking, Tray, and Ladder Systems • Cable Routing, Bending Radius, and Pulling Tension • Underground Cable Installation Techniques • Termination, Gland, and Jointing Methods*
1330 – 1420	***Electrical Installation Safety Requirements*** *Lockout-Tagout (LOTO) Procedures • Safe Isolation and Live Working Regulations • Arc Flash Labeling and PPE • Electrical Permit Systems and HSE Integration*
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	***Electrical Control Panel Design*** *PLC Panels and Automation Control • Pushbuttons, Selector Switches, Relays • Terminal Blocks, Interlocking, and Wiring • Cable Labeling and Schematic Documentation*
0830 – 0930	***Motor Control Centers (MCCs)*** *Fixed vs. Draw-Out Type MCCs • Motor Feeders and Branch Circuit Design • Bus Coupling and Segregation • Testing and Commissioning of MCCs*
0930 – 0945	*Break*
0945 – 1100	***Lighting Systems Design*** *Interior Lighting Calculation (Lux Levels) • Emergency and Exit Lighting Requirements • Lighting Control Strategies (Manual, Occupancy Sensor, DALI) • Energy-Efficient Lighting Technologies (LED, CFL)*
1100 – 1215	***Uninterruptible Power Supplies (UPS) & Backup Systems*** *UPS Sizing and Runtime Calculations • Static and Rotary UPS Types • Battery Bank Design and Maintenance • Diesel Generator Sizing and Auto Changeover*
1215 – 1230	*Break*
1230 – 1330	***Low Current & Auxiliary Systems*** *Fire Alarm, CCTV, Access Control Systems • Structured Cabling and Data Backbone • Public Address (PA) and Paging Systems • BMS and SCADA Electrical Interface*

1330 – 1420	***Electrical System Documentation*** *Single-Line Diagrams (SLD) • Cable Schedules and Routing Plans • Equipment Datasheets and Specification Sheets • As-Built Drawings and Operation Manuals*
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	***Pre-Commissioning & Installation Testing*** *Visual Inspections and Installation Checks • Megger (IR) Testing for Cables and Motors • Continuity and Polarity Testing • Earth Loop Impedance and RCD Trip Testing*
0830 – 0930	***Transformer & Switchgear Testing*** *Transformer Ratio and Insulation Resistance Tests • CT Polarity and Burden Testing • Breaker Insulation and Contact Resistance • Functional Testing of Interlocks and Relays*
0930 – 0945	*Break*
0945 – 1100	***Power Quality & Harmonics Analysis*** *Voltage Fluctuation, Sag/Swell, Harmonics • THD and Waveform Distortion • Effects on Sensitive Equipment • Solutions: Filters, Reactors, Phase Balancing*
1100 – 1215	***Fault Finding & Troubleshooting*** *Systematic Fault Diagnosis Steps • Use of Multimeters, Clamp Meters, Thermal Cameras • Common Electrical Faults (Nuisance Tripping, Loose Contacts) • Root Cause Analysis and Reporting*
1215 – 1230	*Break*
1230 – 1330	***Maintenance Scheduling & Techniques*** *Preventive, Predictive, and Condition-Based Maintenance • Maintenance Checklists for Panels, Motors, Cables • Thermography and Vibration Analysis • Reliability-Centered Maintenance (RCM) Basics*
1330 – 1420	***Testing Equipment & Safety Precautions*** *Using Insulation Testers and Earth Testers • Safety Around High Voltage Testing • Ground Fault and Loop Testers • Equipment Calibration and Standard Adherence*
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*

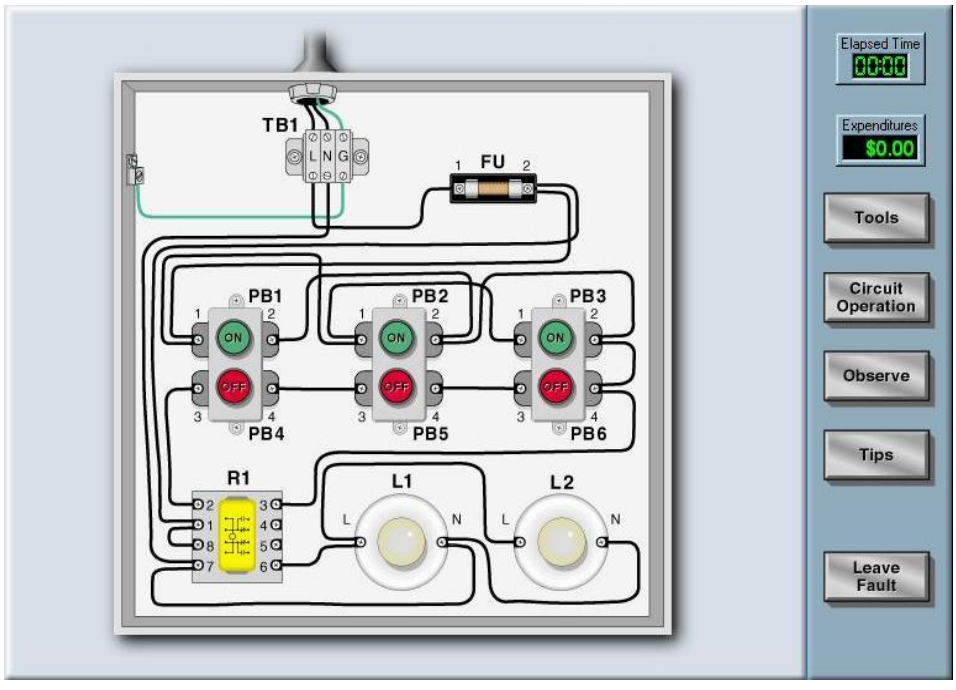
Day 5: Thursday, 07th of August 2025

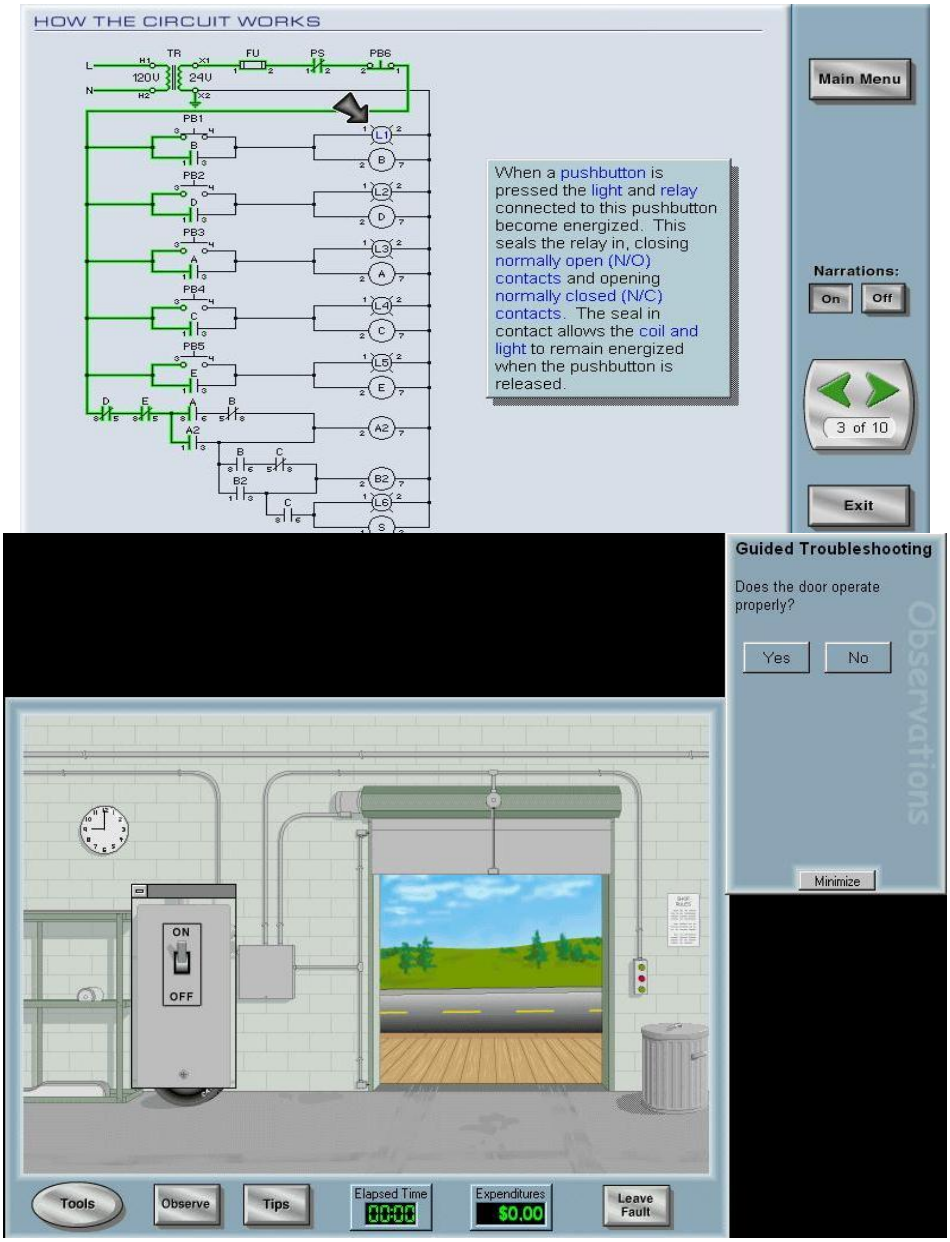
0730 – 0830	***Energy Efficiency in Electrical Systems*** *Identifying Electrical Losses • Power Factor Correction Using Capacitors • Load Management and Demand Control • Energy Metering and Energy Audits*
0830 – 0930	***Renewable Integration & Smart Grids*** *Solar PV System Integration with Grid • Inverters, Batteries, and Net Metering • EV Charging Stations and Load Planning • Smart Meters and Building Energy Management*

0930 – 0945	*Break*
0945 – 1100	***Earthing System Testing & Maintenance*** *Fall-of-Potential Test Method • Clamp-On Tester Usage • Soil Resistivity Testing • Maintenance of Ground Rods and Conductors*
1100 – 1200	***Compliance with Electrical Standards and Codes*** *IEC, NEC, BS, and IEEE Standard Overview • Local Authority Regulations • Inspection and Audit Readiness • Writing Method Statements and ITPs*
1200 – 1215	*Break*
1215 – 1245	***Case Studies & Real-World Scenarios*** *Transformer Overheating and Grounding Issue • Motor Failure Due to Insulation Damage • Improper Cable Sizing and Voltage Drop • Arc Flash Incident Investigation*
1315 - 1345	***Review, Workshop & Course Closure*** *Group Design Exercise: Electrical System Layout • Troubleshooting Workshop or Quiz • Participant Q&A and Recap • Certificate Distribution and Closing Remarks*
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*

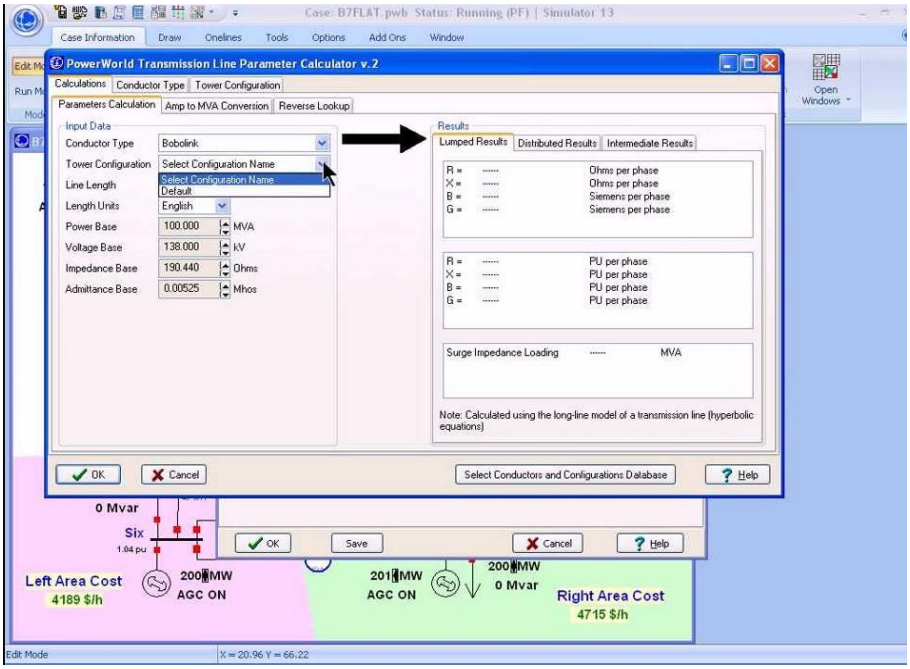
Simulator (Hands-on Practical Sessions)

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".

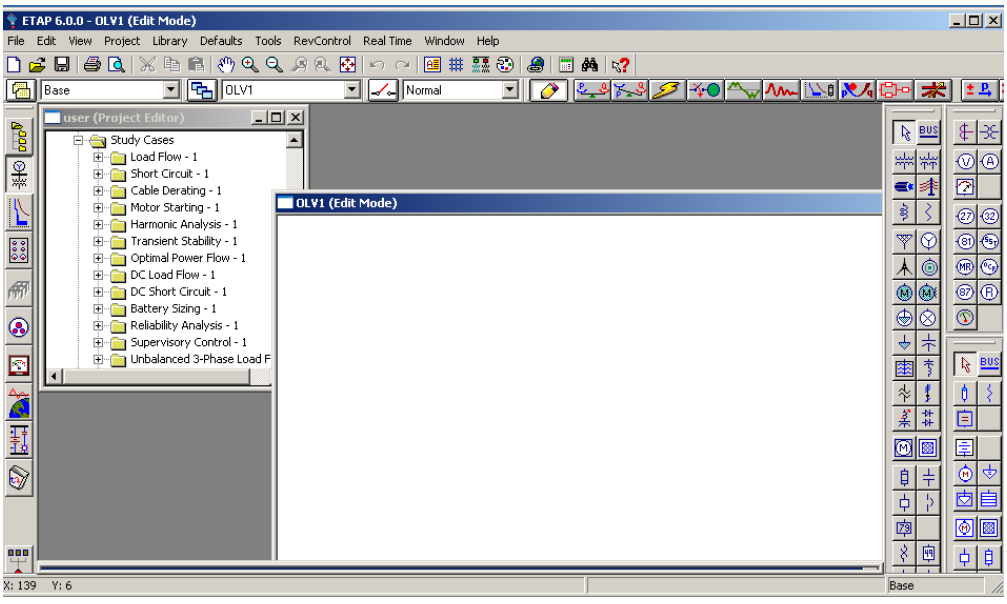




Simutech Troubleshooting Electrical Circuits V4.1



Power World Simulator



ETAP Software Simulator

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