COURSE OVERVIEW EE1106
Transmission System Engineering

Course Title
Transmission System Engineering

Course Date/Venue
Session 1: August 11-15, 2025/Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
Session 2: December 15-19, 2025/Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

Course Reference
EE1106

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 Transmission System Engineering. It covers the role of electrical transmission systems in power system network; the types of transmission systems, transmission system components, voltage levels and grid topologies; the transmission system standards and regulations and the basic electrical calculation for transmission, line route selection and conductor selection and sizing; the types of towers, wind and loading considerations, structural materials and foundation design principles; and the insulation and clearance design, grounding and shielding and thermal rating and line ampacity.

Further, the course will also discuss the substation layout and types, power transformers in transmission systems, switchgear and circuit breakers and protection and control systems; the instrument transformers (CTs and VT), auxiliary and DC systems and power flow in transmission lines; the reactive power and voltage control, system stability analysis, economic dispatch consideration and minimization techniques; and the load dispatch and grid control, smart grids and transmission automation and transmission line inspection and maintenance.

During this interactive course, participants will learn the substation maintenance practices, commissioning and field testing and asset management and lifecycle optimization; the renewable energy integration into transmission and high-temperature superconductors (HTS); and the HVDC upgrades and MMC converters, digital substations and cybersecurity in transmission systems.

Course Objectives

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

- Apply and gain an in-depth knowledge on transmission system engineering
- Discuss the role of electrical transmission systems in power system network and identify the types of transmission systems, transmission system components, voltage levels and grid topologies
- Review transmission system standards and regulations and apply basic electrical calculation for transmission, line route selection and conductor selection and sizing
- Recognize the types of towers, wind and loading considerations, structural materials and foundation design principles
- Describe insulation and clearance design, grounding and shielding as well as thermal rating and line ampacity
- Determine substation layout and types, power transformers in transmission systems, switchgear and circuit breakers and protection and control systems
- Recognize instrument transformers (CTs and VT), auxiliary and DC systems and power flow in transmission lines
- Carryout reactive power and voltage control, system stability analysis, economic dispatch consideration and minimization techniques
- Apply load dispatch and grid control, smart grids and transmission automation and transmission line inspection and maintenance
- Employ substation maintenance practices, commissioning and field testing and asset management and lifecycle optimization
- Apply renewable energy integration into transmission and discuss high-temperature superconductors (HTS), HVDC upgrades and MMC converters, digital substations and cybersecurity in transmission 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 transmission system engineering for project engineers and managers, electrical engineers, power system planners and analysts, utility company staff, transmission system operators (TSOs), consultants in power and energy sector, renewable energy engineers and other technical staff.

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 Fee

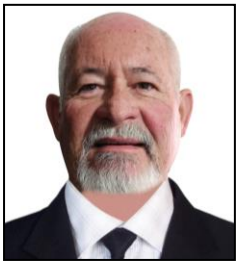
US$ 5,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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. Ken Steel is a **Senior Electrical & Instrumentation Engineer** with over **30 years** of extensive experience. His expertise widely covers **Electrical Motors Testing**, **Heat Tracing** & Insulation Installation & Testing, **HV Terminations**, **High & Low Voltages** on Overhead Cranes, **HV/MV Cable Splicing**, **Cable & Over Head Power Line**, **HV/MV Switchgear, HV Cable** Design, **Medium & High Voltage** Equipment, **High Voltage Circuit Breaker** Inspection & Repair, **High Voltage Power** System, **HV Equipment** Inspection & Maintenance, **HV Switchgear** Operation & Maintenance, Resin / **Heat Shrink & Cold Shrink** Joints, **HV/LV Equipment**, **LV & HV** Electrical System, **Cable** Splicing & Termination, **High Voltage** Electrical Safety, **LV**, **MV & HV Cable** Installations & Properties, **LV Substation**, **MV & LV Cable**, **UPS Systems**, **MV & LV** Direct on Line Motor Drives, **MV & LV** VSD Motor Drives, **MV & LV** Soft Starter Motor Drives, **LV Two Speed Motor Drives**, Underground **Transformer Oil Containment Tank**, **Electrical & Instrumentation Construction** Installation, 1500KW, 1000KW, 1752KW **Diesel Power Plant Installation**, **110KV Overhead Line**, **110KV Outdoor Switchgear**, 110KV/10KV 6500KVA **Transformer**, **Transformer Substation**, 1600KVA 10KV/0.4KV & 2 Off 1000KVA **Diesel Generators**, 1600KVA 10KV/0.4KV & 1650KVA **Diesel Generator**, **110KV/35KV/10KV Substation**, 110KV/10KV **Transformers**,110KV & 2 Off 6KV **Overhead Lines**, 34.5KV,13.8KV ,4.16KV & 480V **Switchgear**, 4.16KV & 480V MCC, **Transformers & Motor Drives** Substations, **Diesel Driven Generators**, **Overhead Cranes**, **Overhead Cranes & HVAC Units**, **AC & DC Drives**, **Data Logger**, **Electrical, Instrumentation & Mechanical** Installation Maintenance, Slab Mills, Pre Heat Ovens, Hydraulic Shears, Stamping Machine, Gearboxes, Rollers, Pumps, Valves, Electro Magnets & Pump House Operation, Boilers Construction And Commissioning, Valve Calibration & Testing, Level Gauges, Pressure & Flow Transmitters Installation & Calibration, Pressure & Leak Testing of Boilers, Leak Testing, SMP, Elect, I&C, F&G, HVAC & Utility Services, Nitrogen Leak Test Operations, Steam Blowing Activities, SMP, Elect, I&C, F&G, HVAC & Utility Services, PTW Issue (PA/AC), Installation & Mechanical Piping and Hydro Testing & Leak Testing of Lines Installation.

During Mr. Steel's career life, he has gained his practical experience through several significant positions and dedication as the **3GP PBF & Boilers SC Commission Support**, **SC Site Execution Superintendent**, **E&I Construction Superintendent**, **High Voltage Construction Supervisor**, **Control & Power Construction Supervisor**, **Electrical & Instrumentation Supervisor**, **Electrical Technician**, **Construction Support Electrical Engineer**, **E&I Engineer**, **Electrical/Instrumentation Site Supervisor**, **Q.A/Q.C Inspector**, **Electrical/ Instrumentation Technician**, **Maintenance Fitter Instrumentation Technician**, **Millwright**, **Apprentice Millwright** and **Senior Instructor/Lecturer** for Tengiz Chevron Oil Kazakhstan, Al Jubail Saudi Arabia, Escravos Delta state Nigeria, Lurgi S.A, SuD Chemie Sasol Catalysts, J C Groenewalds Construction (LTA), Tycon (Goodyear S.A.), Dragline Construction and Iscor Vanderbijlpark.

Mr. Steel has a **Diploma** in **Electronics Mechanic**. Further, he is a **Certified Instructor/Trainer** and delivered numerous trainings, courses, workshops, seminars and conferences internationally.

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

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction to Electrical Transmission Systems*** *Role in Power System Network • Transmission versus Distribution Systems • Historical Development • Future Trends and Challenges*
0930 – 0945	*Break*
0945 – 1030	***Types of Transmission Systems*** *HVAC versus HVDC Systems • Overhead Lines versus Underground Cables • Single versus Three-Phase Systems • Selection Criteria*
1030 – 1130	***Transmission System Components*** *Transmission Lines and Towers • Insulators and Conductors • Substations and Switchyards • Transformers and Circuit Breakers*
1130 – 1215	***Voltage Levels & Grid Topologies*** *Common Transmission Voltage Levels • Radial, Ring and Mesh Systems • Regional Interconnections • National and GCC Interconnection Overview*
1215 – 1230	*Break*
1230 – 1330	***Transmission System Standards & Regulations*** *IEC and IEEE Standards • EWEC and National Grid Codes • Safety Compliance • Permitting and Environmental Considerations*
1330 – 1420	***Basic Electrical Calculations for Transmission*** *Voltage Drop • Power Loss and Efficiency • Current Capacity • Thermal Limits*
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

0730 – 0830	***Line Route Selection*** *Environmental Constraints • Land Use and Terrain • Economic Considerations • Right-of-Way Acquisition*
0830 – 0930	***Conductor Selection & Sizing*** *Types of Conductors (ACSR, AAAC, etc.) • Current-Carrying Capacity • Sag-Tension Calculations • Bundled Conductors and Corona Effect*
0930 – 0945	*Break*
0945 – 1100	***Tower Design & Foundation*** *Types of Towers (Suspension, Tension) • Wind and Loading Considerations • Structural Materials • Foundation Design Principles*
1100 – 1215	***Insulation & Clearance Design*** *Electrical Stress Considerations • Air Clearance Standards • Pollution and Contamination Effects • Insulator Types and Selection*
1215 – 1230	*Break*
1230 – 1330	***Grounding & Shielding*** *Earth Wire Functions • Grounding Resistance Requirements • Lightning Protection • Step and Touch Potential Analysis*
1330 – 1420	***Thermal Rating & Line Ampacity*** *Heat Transfer Mechanisms • Ambient Temperature Impact • Dynamic Line Rating • Emergency Overload Capacity*
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

0730 – 0830	***Substation Layout & Types*** *AIS versus GIS Substations • One-Line Diagrams • Busbar Configurations • Urban versus Rural Designs*
0830 – 0930	***Power Transformers in Transmission Systems*** *Transformer Sizing and Ratings • Vector Groups and Phase Shift • Tap Changers and Regulation • Protection and Monitoring*
0930 – 0945	*Break*
0945 – 1100	***Switchgear & Circuit Breakers*** *Types: Air, Oil, SF_6, Vacuum • Operating Principles • Application in Substations • Maintenance Practices*
1100 – 1215	***Protection & Control Systems*** *Relay Types and Settings • Zone Protection Concepts • Differential and Distance Protection • SCADA Integration*
1215 – 1230	*Break*
1230 – 1330	***Instrument Transformers (CTs & VTs)*** *Purpose and Placement • Accuracy Classes • Safety Considerations • Application in Metering and Protection*
1330 – 1420	***Auxiliary & DC Systems*** *Battery Banks and Chargers • Control Cabling • Emergency Power • UPS and AC/DC Conversion*
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

0730 – 0830	***Power Flow in Transmission Lines*** *Real and Reactive Power • Load Flow Equations • Power Angle Characteristics • Voltage Regulation*
0830 – 0930	***Reactive Power & Voltage Control*** *Role of Capacitors/Reactors • SVC and STATCOM Systems • Tap Changer Coordination • Under/Over Voltage Protection*
0930 – 0945	*Break*
0945 – 1100	***System Stability Analysis*** *Transient, Steady-State and Dynamic Stability • Rotor Angle Stability • Frequency Response • Grid Disturbance Handling*
1100 – 1215	***Transmission Losses & Efficiency*** *I^2R Losses • Corona and Dielectric Losses • Economic Dispatch Considerations • Minimization Techniques*
1215 – 1230	*Break*
1230 – 1330	***Load Dispatch & Grid Control*** *Role of Load Dispatch Center (LDC) • Real-Time Monitoring • Load Forecasting • Load Shedding Schemes*
1330 – 1420	***Smart Grids & Transmission Automation*** *Wide Area Monitoring Systems (WAMS) • Synchrophasors and PMUs • Automation Standards • AI and Predictive Analytics*
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*

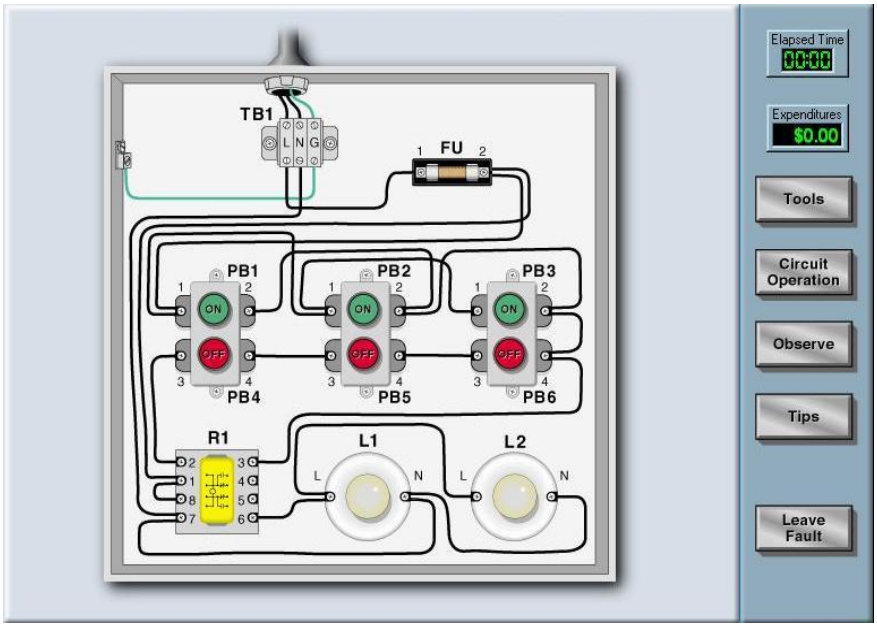
Day 5

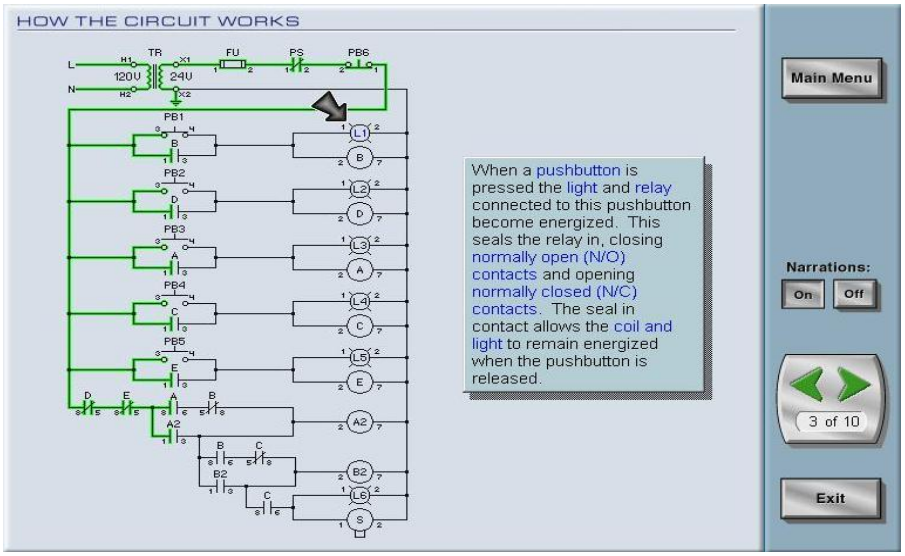
0730 – 0830	***Transmission Line Inspection & Maintenance*** *Visual Inspection Techniques • Thermography and UAVs • Condition-Based Maintenance • Live-Line Maintenance*
0830 – 0930	***Substation Maintenance Practices*** *Routine Testing Schedules • Infrared and Partial Discharge Analysis • Oil Sampling and Diagnostics • Circuit Breaker Timing Tests*
0930 – 0945	*Break*
0945 – 1030	***Commissioning & Field Testing*** *Line Testing (IR, HiPot, Tan Delta) • Relay Setting Validation • Protection Scheme Testing • Final Acceptance and Energization*
1030 – 1130	***Asset Management & Lifecycle Optimization*** *Lifecycle Cost Analysis • Asset Health Indexing • Predictive Maintenance • Reliability-Centered Maintenance*
1130 – 1230	***Renewable Energy Integration into Transmission*** *Wind and Solar Power Impact • Grid Intermittency Management • Storage Solutions • Hybrid AC/DC Grids*
1230 – 1245	*Break*

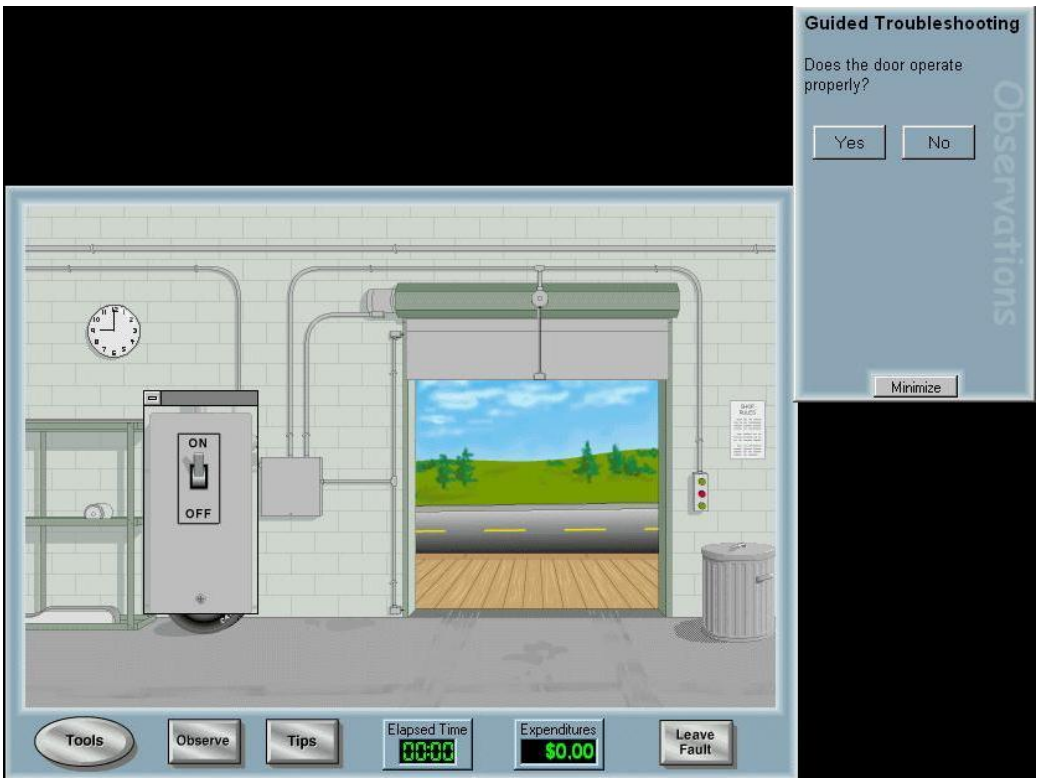
1245 – 1345	***Emerging Technologies & Future Trends*** *High-Temperature Superconductors (HTS) • HVDC Upgrades and MMC Converters • Digital Substations • Cybersecurity in Transmission Systems*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants 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)

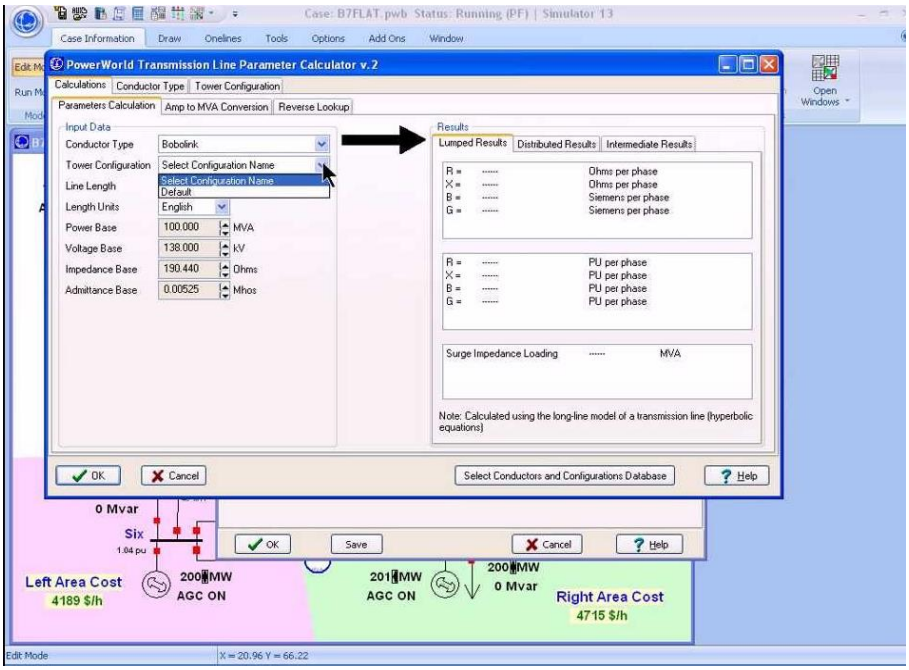
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art simulators "Troubleshooting Electrical Circuits V4.1", "Power World" and "ETAP software".



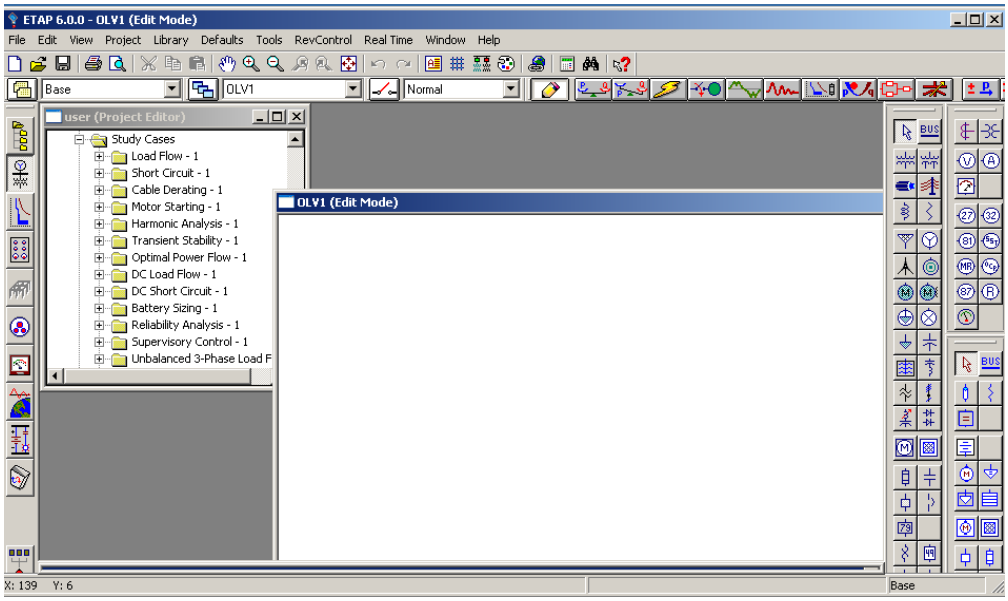




Troubleshooting Electrical Circuits V4.1 Simulator



Power World Simulator



ETAP Software Simulator

Course Coordinator
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