COURSE OVERVIEW EE1140
Power Network Performance Analysis

Course Title
Power Network Performance Analysis

Course Date/Venue
July 21-25, 2025/Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

3.0 CEUs (30 PDHs) AWARD

Course Reference
EE1140

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 Network Performance Analysis. It covers the components of a power network, types of electrical loads, role of utilities in power network operation and basic performance parameters; the power flow in transmission networks, voltage profiles and control, frequency control and stability and power losses in the network; the power quality, load flow analysis, short-circuit analysis and contingency analysis; and the reliability indices and performance metrics, system stability studies and performance benchmarking in utilities.

During this interactive course, participants will learn the dynamic simulation of power systems, harmonics and power quality analysis, voltage stability assessment, energy loss analysis and network reconfiguration and optimization; the data acquisition and SCADA systems including online monitoring and diagnostics; the load forecasting techniques, asset performance management (APM), condition-based maintenance and outage and incident analysis; the GIS and digital twin for network performance, smart grids and digitalization and integration of renewable energy; and the resilience and cybersecurity, regulatory and compliance performance and future trends in performance analysis.

Course Objectives

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

- Apply and gain an in-depth knowledge on power network performance analysis
- Identify the components of a power network, types of electrical loads, role of utilities in power network operation and basic performance parameters
- Recognize power flow in transmission networks, voltage profiles and control, frequency control and stability and power losses in the network
- Carryout power quality, load flow analysis, short-circuit analysis and contingency analysis
- Discuss reliability indices and performance metrics, system stability studies and performance benchmarking in utilities
- Determine dynamic simulation of power systems and apply harmonics and power quality analysis, voltage stability assessment, energy loss analysis and network reconfiguration and optimization
- Recognize data acquisition and SCADA systems including online monitoring and diagnostics
- Employ load forecasting techniques, asset performance management (APM), condition-based maintenance and outage and incident analysis
- Identify GIS and digital twin for network performance, smart grids and digitalization and integration of renewable energy
- Discuss resilience and cybersecurity, regulatory and compliance performance and future trends in performance analysis

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 network performance analysis for power system engineers, utility company planners and operators, energy consultants and analysts, SCADA and control room technicians, industrial electrical engineers, regulatory and compliance professionals and other technical staff.

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
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. 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.

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: ***Monday, 21st of July 2025***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction to Power Networks*** *Components of a Power Network (Generation, Transmission, Distribution) • Types of Electrical Loads • Role of Utilities in Power Network Operation • Basic Performance Parameters*
0930 – 0945	*Break*
0945 – 1030	***Power Flow in Transmission Networks*** *Real & Reactive Power Concepts • Single-Line Diagram Interpretation • Power Flow Direction & Balancing • Load versus Generation Demand Analysis*
1030 – 1130	***Voltage Profiles & Control*** *Voltage Drop & Regulation • Reactive Power Compensation • Tap Changers & Shunt Capacitors • Impact of Poor Voltage Profile on Performance*
1130 – 1215	***Frequency Control & Stability*** *Frequency Variations & Impact on Equipment • Primary & Secondary Frequency Control • Role of Governors & AGC (Automatic Generation Control) • Frequency Response Metrics*
1215 – 1230	*Break*
1230 – 1330	***Power Losses in the Network*** *Types of Losses (Technical, Non-Technical) • Loss Measurement & Monitoring • Impact of Losses on Performance • Methods to Reduce Losses*
1330 – 1420	***Power Quality Overview*** *Definition & Significance of Power Quality • Power Quality Indices (THD, Flicker, Unbalance) • Harmonics Basics • Power Quality Issues & Mitigation*
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:	Tuesday, 22nd of July 2025
0730 – 0830	***Load Flow Analysis*** *Purpose & Importance • Types of Load Flow Methods (Gauss-Seidel, Newton-Raphson) • Input Data Requirements • Interpretation of Results*
0830 – 0930	***Short-Circuit Analysis*** *Types of Faults (LG, LL, LLG, LLLG) • Symmetrical Components • Impact on Equipment & System • Fault Current Calculation Techniques*
0930 – 0945	*Break*
0945 – 1100	***Contingency Analysis*** *N-1 & N-2 Security Assessments • Outage Simulation Techniques • Preventive versus Corrective Actions • Ranking of Contingencies*
1100 – 1215	***Reliability Indices & Performance Metrics*** *SAIDI, SAIFI, CAIDI, ENS • MTBF & MTTR • Network Availability & Dependability • KPI Benchmarking & Target Setting*
1215 – 1230	*Break*
1230 – 1330	***System Stability Studies*** *Transient versus Steady-State Stability • Rotor Angle Stability • Voltage & Frequency Stability • Damping Techniques & FACTS*
1330 – 1420	***Performance Benchmarking in Utilities*** *National & International Benchmarks • CIGRÉ & IEEE Standards • Performance Reporting & Audits • TRANSCO Case Study Comparisons*
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:	Wednesday, 23rd of July 2025
0730 – 0830	***Dynamic Simulation of Power Systems*** *Time-Domain versus Frequency-Domain Simulations • Modeling Synchronous Machines & Loads • Tools for Dynamic Simulation (e.g., PowerFactory, PSS®E) • Simulation Setup & Case Study*
0830 – 0930	***Harmonics & Power Quality Analysis*** *Harmonic Sources & Propagation • Harmonic Filters & Solutions • Impact on Transformers, Motors • Power Analyzers & PQ Meters*
0930 – 0945	*Break*
0945 – 1100	***Voltage Stability Assessment*** *PV & QV Curve Analysis • Load Margin Estimation • Reactive Power Planning • Monitoring Tools & Indicators*
1100 – 1215	***Energy Loss Analysis*** *Technical Loss Calculation (I^2R Losses) • Non-Technical Loss Detection • Smart Meter Data Analytics • Loss Reduction Strategies*
1215 – 1230	*Break*
1230 – 1330	***Network Reconfiguration & Optimization*** *Objective of Reconfiguration • Load Balancing Techniques • Switching Strategies • Optimization Using AI Techniques*

1330 – 1420	***Data Acquisition & SCADA Systems*** *Role of SCADA in Performance Monitoring • RTUs & IEDs in Substations • Data Visualization & Alarms • Integration with EMS/DMS Systems*
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: Thursday, 24th of July 2025

0730 – 0830	***Online Monitoring & Diagnostics*** *Online Sensors & Digital Substations • Transformer & Cable Monitoring • Thermal & Vibration Diagnostics • Predictive Maintenance Practices*
0830 – 0930	***Load Forecasting Techniques*** *Short, Medium & Long-Term Forecasting • Statistical & AI-Based Methods • Load Profiling • Impact of Renewables on Forecasting*
0930 – 0945	*Break*
0945 – 1100	***Asset Performance Management (APM)*** *Asset Health Index (AHI) Formulation • Risk-Based Maintenance • Lifecycle Costing • Integration with CMMS*
1100 – 1215	***Condition-Based Maintenance*** *CBM versus Time-Based Maintenance • Decision Criteria & Sensors • Fault Trend Analysis • Maintenance Scheduling Tools*
1215 – 1230	*Break*
1230 – 1330	***Outage & Incident Analysis*** *Types & Causes of Outages • Outage Management Systems (OMS) • Restoration Time Metrics • Root Cause Analysis (RCA)*
1330 – 1420	***GIS & Digital Twin for Network Performance*** *GIS in Grid Planning & Analysis • Digital Twin for Asset Simulation • Real-Time Data Integration • Use Cases for TRANSCO Operations*
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*

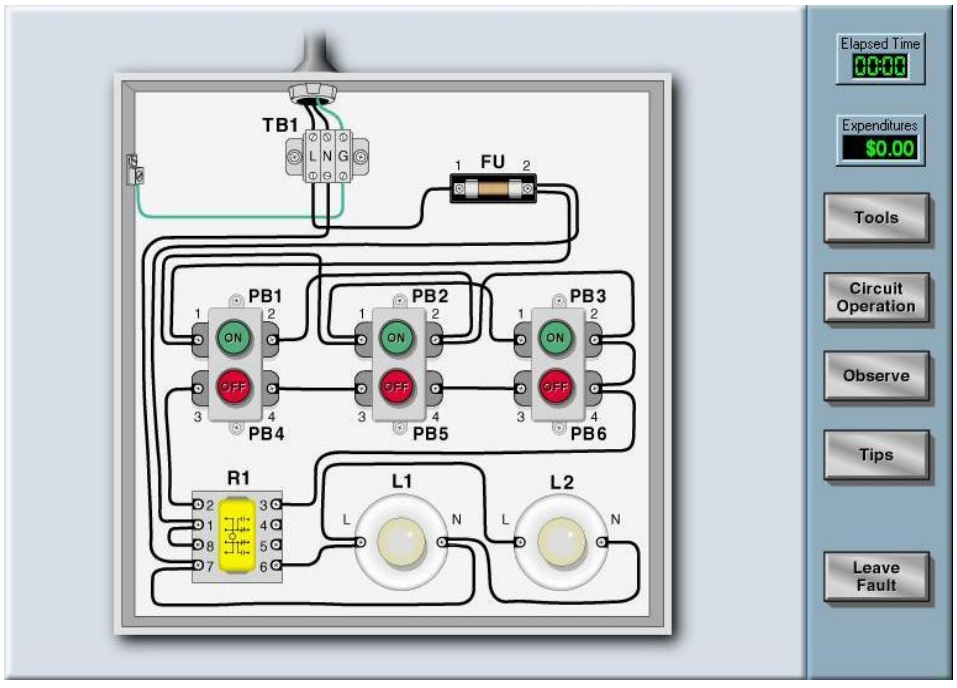
Day 5: Friday, 25th of July 2025

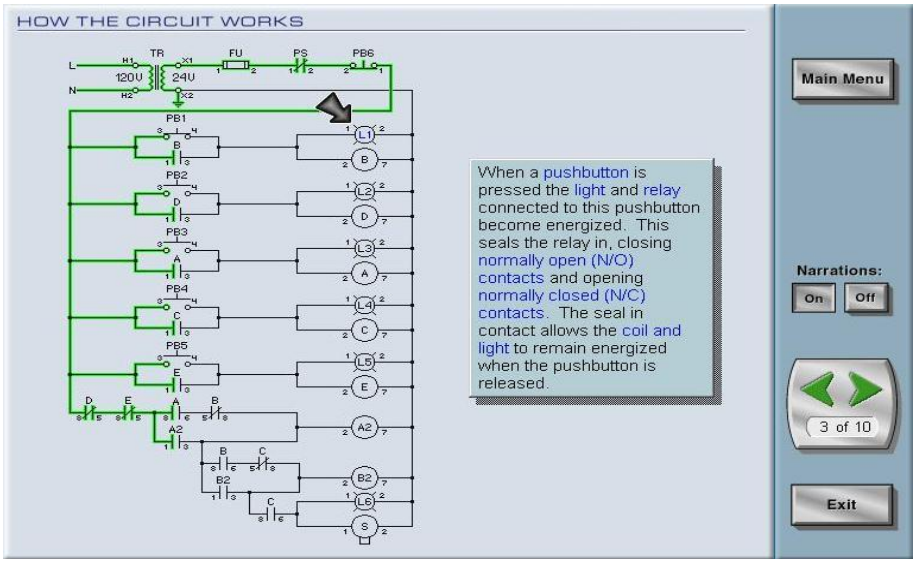
0730 – 0830	***Smart Grids & Digitalization*** *Characteristics & Components • Smart Meters & IoT Sensors • Real-Time Control & Analytics • Communication Protocols*
0830 – 0930	***Integration of Renewable Energy*** *Solar, Wind & Hybrid Integration • Variability & Intermittency Issues • Grid Codes & Compliance • Storage Technologies & Performance*
0930 – 0945	*Break*
0945 – 1100	***Resilience & Cybersecurity*** *Grid Vulnerability Assessment • Resilience Indices & Strategies • Cybersecurity Threats & Defenses • Regulatory Compliance & Audits*

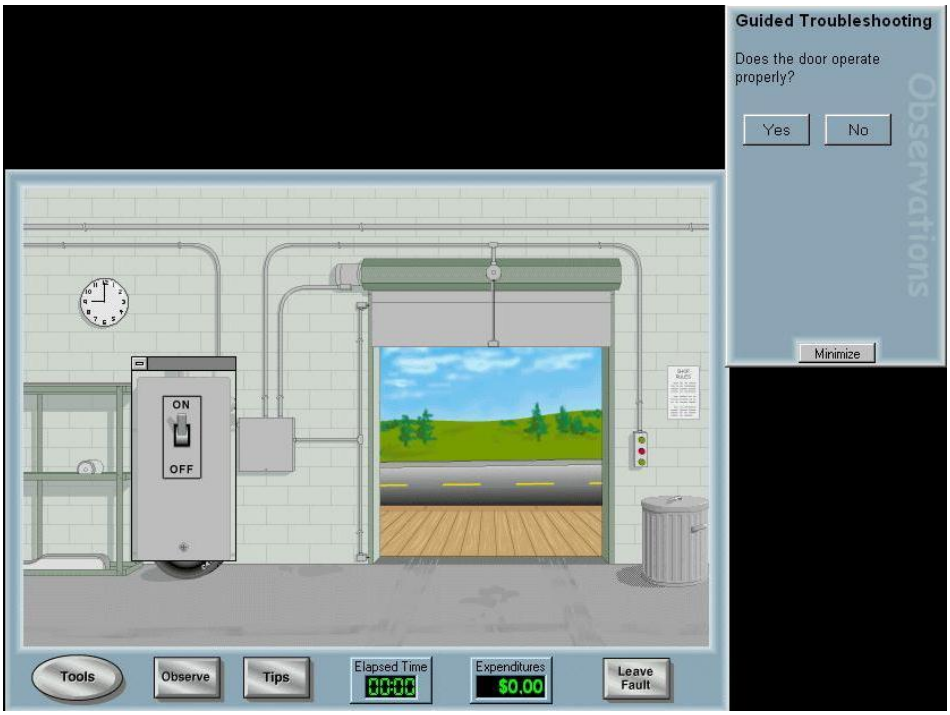
1100 – 1215	***Regulatory & Compliance Performance*** *UAE & GCC Grid Codes • Regulatory Reporting Obligations • Incentives & Penalties for Performance • Stakeholder Engagement*
1215 – 1230	*Break*
1230 – 1345	***Future Trends in Performance Analysis*** *AI & ML in Performance Optimization • Digital Substations & PMUs • Blockchain in Energy Transactions • Future Workforce Skills*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about t 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)

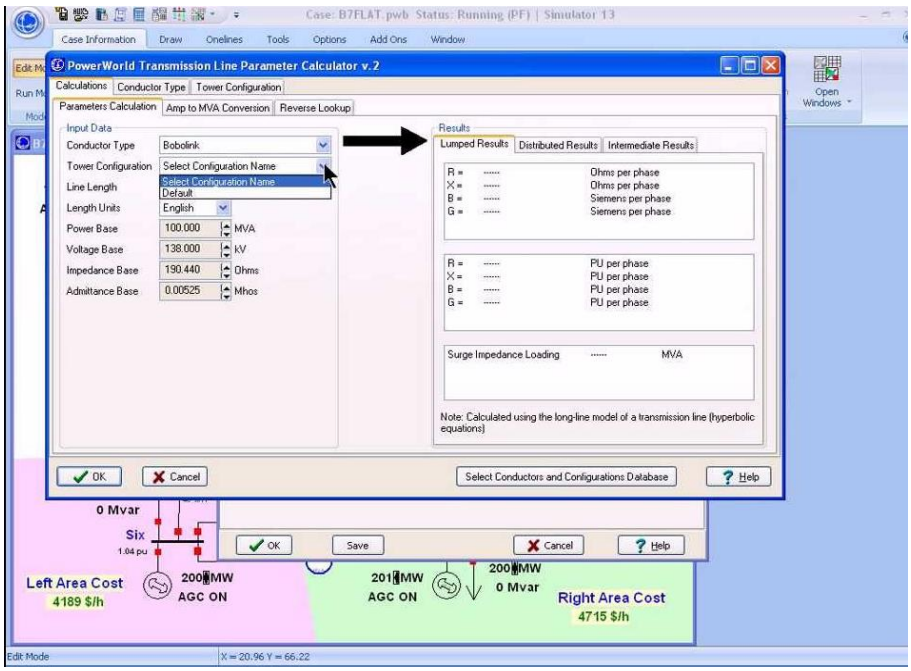
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art simulator "Simutech Troubleshooting Electrical Circuits V4.1", Power World" and "ETAP software".



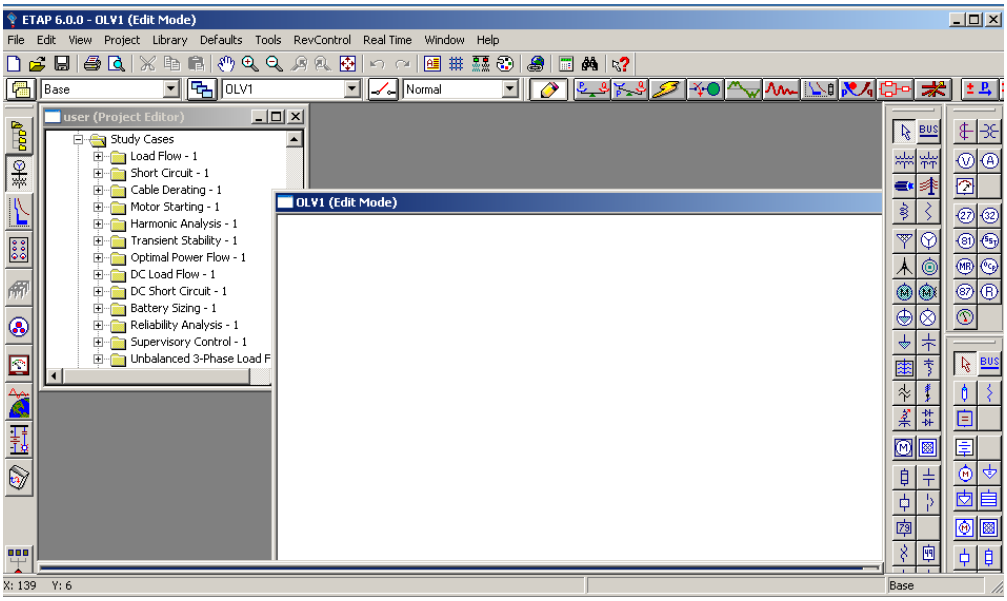




Simutech Troubleshooting Electrical Circuits V4.1



Power World Simulator



ETAP Software Simulator

Course Coordinator

Mari Nakintu, Tel: +971 2 30 91 714, Email: mari1@haward.org