COURSE OVERVIEW EE1141
Power Systems Quality Analysis & Problem Solving

Course Title
Power Systems Quality Analysis & Problem Solving

Course Date/Venue
August 04-08, 2025/Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

Course Reference
EE1141

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 Systems Quality Analysis and Problem Solving. It covers the types and sources of power quality disturbances; the voltage sags and swells and harmonics in power systems; the power factor and reactive power including power quality standards and compliance; the power quality monitoring equipment, measurement techniques and parameters and power quality data interpretation; and the site surveys and power quality audits, voltage imbalance and flicker.

During this interactive course, participants will learn the PQ issues in distributed energy systems and root cause analysis for PQ issues; the harmonic filters and reactors, uninterruptible power supplies (UPS) and conditioners; the power factor correction strategies, surge protection and grounding techniques and voltage regulation and stabilization; the power quality in transmission and distribution and power quality in industrial plants; the PQ impacts of renewable integration, smart grid and PQ monitoring; and the economic impact of power quality issues, PQ solutions for critical systems and reporting and communication of PQ findings.

Course Objectives

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

- Apply and gain an in-depth knowledge on power systems quality analysis and problem solving
- Identify the types and sources of power quality disturbances as well as voltage sags and swells and harmonics in power systems
- Discuss power factor and reactive power including power quality standards and compliance
- Recognize power quality monitoring equipment, measurement techniques and parameters and power quality data interpretation
- Carryout site surveys and power quality audits and identify voltage imbalance and flicker
- Address PQ issues in distributed energy systems and root cause analysis for PQ issues
- Determine harmonic filters and reactors, uninterruptible power supplies (UPS) and conditioners
- Apply power factor correction strategies, surge protection and grounding techniques and voltage regulation and stabilization
- Employ power quality in transmission and distribution and power quality in industrial plants
- Recognize PQ impacts of renewable integration, smart grid and PQ monitoring
- Discuss economic impact of power quality issues, design PQ solutions for critical systems and apply reporting and communication of PQ findings

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 systems quality analysis and problem solving for electrical engineers, industrial plant engineers, facility managers, maintenance engineers and technicians and utility company personnel.

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.

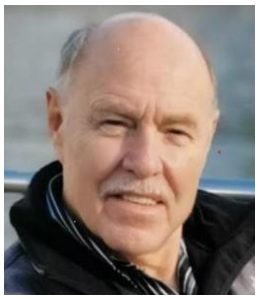
  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation 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. Fred Du Plessis is a **Senior Electrical Engineer** with over **30** years of extensive experience within the **Oil**, **Gas**, **Petrochemical**, **Refinery** & **Power** industries. His expertise widely covers in the areas of **Thermal Gas Power Generation**, **Power Station** Operations, **Power Generation Plant Outage** Management, **Power System** Analysis, **Power System** Generation & Distribution, **Electric Power System** Design, **Renewable Energy**, **Energy Storage** Technologies, Maintenance, Testing & Troubleshooting, **Transformer Protection**, **Transformer** Problem and Failure Investigations, **Power System Operation and Control**, Fault Analysis in **Power Systems**, **HV/MV Cable Splicing**, **High Voltage Electrical Safety**, **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**, ORHVS for Responsible and Authorized Person **High Voltage Regulation**, **Transformers** Maintenance, inspections & repairs, Commissioning of **LV & HV Equipment**, Oil Purification and **High Voltage Maintenance**, HT Switch Gear -Testing, Safe Operating, Maintenance, Inspection & Repairs on **LV & HT Cables** - Testing (Pulse & Megger), Line Patrol in **Low Voltage & Distribution**, **Transmission**, **Operating Principles up to 132KV**, Abnormal Conditions & Exceptions, Commissioning & Testing, **Transformer Inspections & Repairs**, **Live Line Work up to 33KV**, **Basic Power System Protection**, **High Voltage** Operating Preparedness Phasing (**110V to 132KV**), **HV Operating & Fault** Finding (up to 132KV), Maintenance & Construction Supervision, **VSD/VFD** Installations & Testing, **Electrical Panel Design**, **VSD/VFD Installations & Testing**, Instrument Installation and wiring, **AC/DC Supplies & Change Over Systems**, **AC & DC Winders** and VLF Testing, **Gas Turbines**, **Steam Turbine** with a **Station Generation**, **Project** Management & Project Controls, **Water Treatment & Reverse Osmosis** Plant Management and **Mechanical Maintenance** Management.

During Mr. Du Plessis's career life, he has gained his practical experience through several significant positions and dedication as the **Project Manager/Owner**, **Maintenance Manager**, **Project Excecution Manager**, **Commissioning & Operating Manager**, **Acting Operating Manager**, **Optimization/Commissioning Manager**, **Operating Support Manager**, **Operating Production/Shift Manager**, **Operations Lead Engineer**, **Electrical Engineer**, **Production/Maintenance Planner**, **Unit Shift Supervisor**, Principal **Plant Operator**, **Workshop & Maintenace Consultant**, Assistant **Electrical Supervisor**, Trainee **Motor Mechanic** and **Senior Instructor/Trainer** from various international **power station** companies like the Dunamis Energy, Peterhead Power Station, Lijaco Services, Eskom, Matla Power Station, Grootvlei Power Station, Ellisras Brick & Ceramic, Hlalisanani Mechanical Contractor, Matimba Power Station, Matimba Power Station, Eskom Kriel Power Station and Transvaal Provincial.

Mr. Du Plessis has a **Bachelor's** (with Honours) degree in **Operations Management**. Further, he holds certification in Red & Silver Seal Accreditation Power Generation – (ESETA), a SAMTRAC & NOSA **Auditor** – (NOSA), a **Certified Instructor/Trainer** and has further delivered various trainings, seminars, conferences, workshops and courses globally.

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, 04th of August 2025

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction to Power Quality*** *Definition and Importance in Power Systems • Power Quality Standards (IEEE 519, IEC 61000) • Key Power Quality Parameters • Effects of Poor Power Quality on Utilities and End-Users*
0930 – 0945	*Break*
0945 – 1030	***Types & Sources of Power Quality Disturbances*** *Voltage Sags and Swells • Transients and Spikes • Harmonic Distortion • Flicker, Interruption and Imbalance*
1030 – 1130	***Voltage Sags & Swells*** *Root Causes and Classification • Equipment Sensitivity and Impact • Mitigation Techniques • Standards for Voltage Tolerance*
1130 – 1215	***Harmonics in Power Systems*** *Fundamentals of Harmonics and Waveform Distortion • Harmonic Sources: Nonlinear Loads • Total Harmonic Distortion (THD) Calculation • Resonance and Mitigation Techniques*
1215 – 1230	*Break*
1230 – 1330	***Power Factor & Reactive Power*** *Real, Reactive and Apparent Power • Causes and Effects of Poor Power Factor • Correction Using Capacitors and Filters • Utility Penalties and Economic Impacts*
1330 – 1420	***Power Quality Standards & Compliance*** *Overview of IEEE 519, IEC 61000, EN 50160 • Compliance Thresholds and Industry Practices • Utility Responsibilities and Customer Limits • Case Study on Standard Application*
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: Tuesday, 05th of August 2025

0730 – 0830	***Power Quality Monitoring Equipment*** *Types of PQ Analyzers and Loggers • Installation and Configuration Basics • Data Logging and Synchronization • Real-Time versus Post-Event Monitoring*
0830 – 0930	***Measurement Techniques & Parameters*** *RMS Voltage and Current • Crest Factor, K-Factor and Distortion Factor • Harmonic Spectrum Analysis • Capturing Transient Events*
0930 – 0945	*Break*
0945 – 1100	***Power Quality Data Interpretation*** *Analyzing Waveform Recordings • Pattern Recognition for Fault Identification • Duration versus Magnitude Assessment • Creating PQ Event Logs*
1100 – 1215	***Site Surveys & Power Quality Audits*** *Objectives and Methodology • Key Instruments and Measurements • Load Profile Assessment • Reporting and Recommendations*
1215 – 1230	*Break*
1230 – 1330	***Voltage Imbalance & Flicker*** *Sources of Imbalance and Flicker • Effects on Equipment and Motors • Monitoring and Mitigation • Case Examples from Utility Operations*
1330 – 1420	***PQ Issues in Distributed Energy Systems*** *Impact of DGs and Renewables on PQ • Inverter-Based Resources and Harmonics • Voltage Regulation and Ride-Through • Integration and Coordination Challenges*
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: Wednesday, 06th of August 2025

0730 – 0830	***Root Cause Analysis for PQ Issues*** *Problem-Solving Framework • Fault Tree and Fishbone Diagrams • Tools: 5-Whys, Pareto Analysis • Systematic Troubleshooting Steps*
0830 – 0930	***Harmonic Filters & Reactors*** *Passive versus Active Harmonic Filters • Tuned Filters and Detuned Reactors • Sizing and Installation Considerations • Case Study on Harmonic Mitigation*
0930 – 0945	*Break*
0945 – 1100	***Uninterruptible Power Supplies (UPS) & Conditioners*** *Types of UPS Systems • PQ Conditioning Capabilities • Selection and Maintenance • Integration into Critical Loads*
1100 – 1215	***Power Factor Correction Strategies*** *Static versus Dynamic Correction • Use of Automatic Capacitor Banks • Avoiding Overcompensation and Resonance • PQ Improvements Post-PFC*
1215 – 1230	*Break*
1230 – 1330	***Surge Protection & Grounding Techniques*** *Surge Types and Protective Devices • Best Practices in Grounding Systems • Bonding and Shielding Methods • Coordination of SPDs*
1330 – 1420	***Voltage Regulation & Stabilization*** *Tap-Changing Transformers • Voltage Regulators and Boosters • Load Tap Changers (LTC) Operations • Coordination with PQ Improvement*
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: Thursday, 07th of August 2025

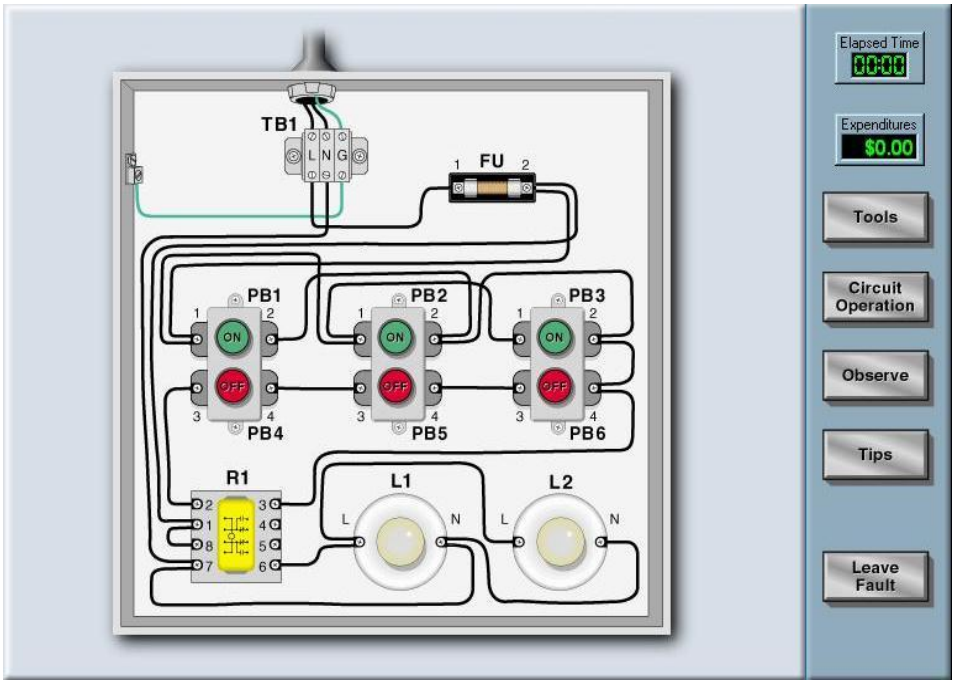
0730 – 0830	***Power Quality in Transmission & Distribution*** *Key Challenges in HV and MV Systems • Substation PQ Management • Switching Transients and Arc Suppression • Role of SCADA and Digital Relays*
0830 – 0930	***Power Quality in Industrial Plants*** *PQ Issues in Motors, VFDs and Drives • Arc Furnaces and Welding Machines • PQ Solutions for Sensitive Loads • Industrial Case Study*
0930 – 0945	*Break*
0945 – 1100	***PQ Impacts of Renewable Integration*** *Solar PV and Wind Power Disturbances • Inverter Operation and Harmonics • Anti-Islanding and Grid Codes • Real-Time Control Strategies*
1100 – 1215	***Smart Grid & PQ Monitoring*** *Role of Smart Meters in PQ • Communication and Data Aggregation • PQ Analytics Platforms • Grid Edge Device Integration*
1215 – 1230	*Break*
1230 – 1330	***Case Studies in Problem Solving*** *Transformer Overheating Due to Harmonics • Voltage Sag During Fault Events • Harmonic Resonance in Capacitor Banks • PQ Audit-Led System Upgrade*
1330 – 1420	***Economic Impact of Power Quality Issues*** *Downtime and Process Disruption Costs • Energy Efficiency and PQ Correlation • ROI of PQ Improvement Projects • Cost-Benefit Analysis Models*
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*

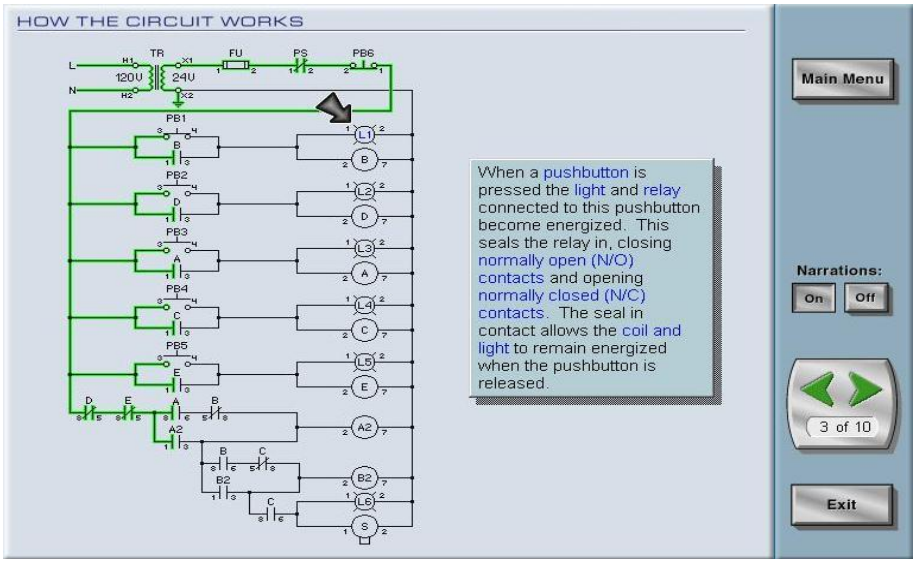
Day 5: Friday, 08th of August 2025

0730 – 0830	***Simulation of Power Quality Disturbances*** *Using Simulation Software (e.g., ETAP, PowerFactory) • Model Creation for PQ Scenarios • Disturbance Simulation and Waveform Analysis • Interpretation of Results*
0830 – 0930	***Interactive Problem-Solving Workshop*** *Group-Based PQ Issues Troubleshooting • Data Analysis and Root Cause Detection • Recommended Mitigation Strategies • Presentation of Findings*
0930 – 0945	*Break*
0945 – 1100	***Designing PQ Solutions for Critical Systems*** *End-User Specific Mitigation Plans • PQ Strategy for Substations • Emergency Power Systems • Coordination with Network Protection*
1100 – 1215	***Reporting & Communication of PQ Findings*** *Structuring a Technical PQ Report • Data Visualization for Stakeholders • Writing Executive Summaries • Regulatory and Compliance Documentation*
1215 – 1230	*Break*
1230 – 1345	***Power Quality Assessment & Certification*** *Self-Assessment Checklist • PQ Audit Templates • Certification Requirements • Summary of Compliance Status*
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 simulator "Simutech Troubleshooting Electrical Circuits V4.1", Power World" and "ETAP software".





Simutech Troubleshooting Electrical Circuits V4.1

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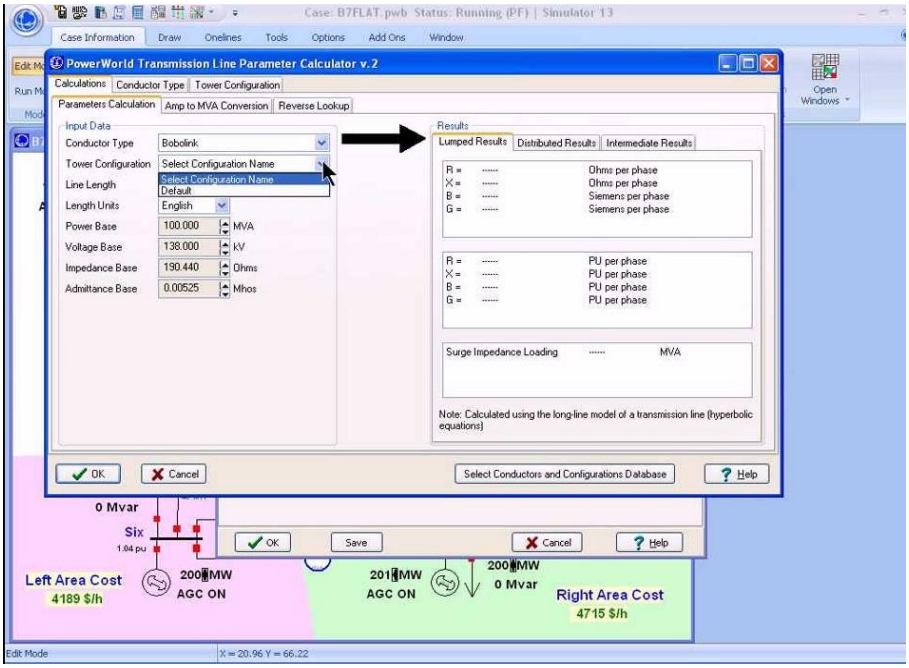
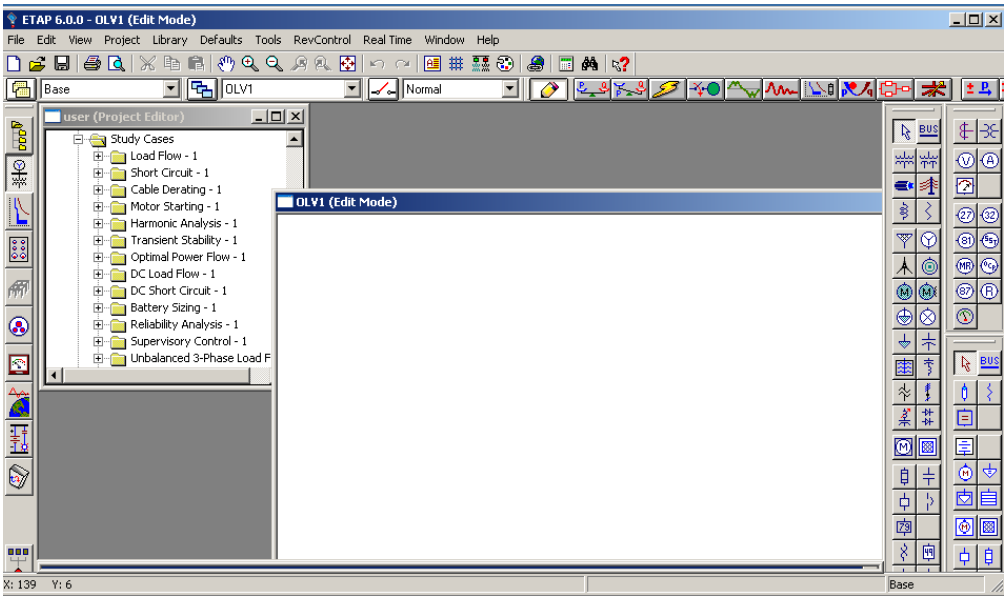


Power World Simulator



ETAP Software Simulator

Course Coordinator

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