COURSE OVERVIEW EE0970T1
Electrical System Restoration, Methodologies & Implementation

Course Title
Electrical System Restoration, Methodologies & Implementation

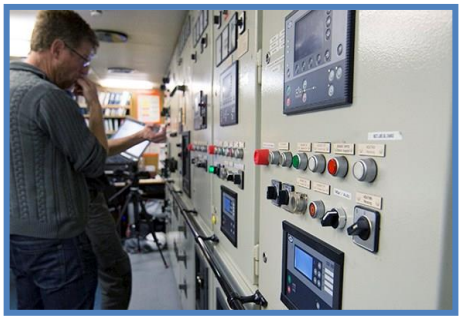
Course Reference
EE0970T1

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Date/Venue

Session(s)	Date	Venue
1	January 28-February 01, 2024	The Mouna Meeting Room, The H Dubai Hotel, Sheikh Zayed Rd - Trade Centre, Dubai, UAE
2	February 18-22, 2024	Kizkulesi, Crown Plaza Istanbul Asia Hotels & Convention Center, Istanbul, Turkey
3	March 03-07, 2024	Oryx Meeting Room, Doubletree By Hilton Doha-Al Sadd, Doha, Qatar

Course Description



This practical and highly-interactive course includes real-life case studies and exercises where participants will be engaged in a series of interactive small groups and class workshops.

Power system loads continue to grow in size and complexity. Reliability expectations continue to rise. Power systems themselves become larger and more complex in response to growing load and customer expectations. Indeed, power systems have become more difficult to analyze and operate. Recent power system blackouts have heightened the concern for power system security and, therefore, reliability. Major blackouts of electric power systems in which many customers are left without power are rare events. However, the effects of blackouts, for instance, can be catastrophic. It has been observed that protective system failures are a contributing factor in a large proportion of these blackouts during system disturbances.

Nowadays, power systems are operating with lower and lower security margins. This is due to the prioritization of the electricity market deregulation, the load consumption increase, the difficulties to build new facilities such as transmission lines and large power plants, etc.

Consequently, the vulnerability of power systems becomes a very important issue and the probability of large blackout tends to increase, as confirmed by the various incidents experienced in the past. Therefore, mastering the knowledge of different topics related to blackout inception and power system instability has become essential for researches and engineers involved in power system planning, operation and control.

This course is designed to help power system professionals, planners and engineers gain ground on the power system blackout and restoration. This course provides an up-to-date description of the restoration methodologies and implementation strategies practiced internationally. Participants will learn how to identify precursors for blackouts and will practice the steps necessary to prevent them from occurring. The course will focus on mechanisms of blackouts, instability phenomena, modelling and analysis tools, preventive and curative measures and finally service restoration.

Course Objectives

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

- Apply and gain a comprehensive knowledge on restoration and troubleshooting of power system blackouts
- Determine the blackout concerns and review recent blackouts, its causes and lessons learned from these incidents
- Identify the various instability mechanisms and transients and analyze the cold inrush current effects on blackout
- Recognize the role of induction motors in triggering blackouts
- Evaluate the functions of angle and voltage stability control in power system blackouts and become acquainted with the process of assessing security margins with respect to voltage instability
- Implement the blackout preventive measures and identify the process of wide-area monitoring and control
- Discuss the power system restoration including the analytical tools for power system restoration, system operations challenges, protection relays issues during restoration and the heuristic approaches to distribution system restoration
- Determine the special considerations in system restoration such as black start capabilities, tie line utilization during power system restoration and the usage of HVDC links in power system restoration
- Employ the new approaches in power system restoration namely knowledge-based systems, real time considerations, MARS, etc
- Use a structured approach on system restoration planning in consideration to the tools, guidelines, techniques and procedures for system restoration plan implementation

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, sample video clips of the instructor's actual lectures & practical sessions during the course conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of power system blackouts restoration and troubleshooting for power system analysts and engineers, including generation and transmission planners, protection engineers, ISO/RTO technical staff and operations supervisors. Others who will benefit include power developers and marketers, power exchange personnel, regulatory staff and economic and management consultants.

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 Fee

Dubai	**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.
Istanbul	**US$ 6,000** per Delegate + **VAT**. This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Doha	**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.

Accommodation

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

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: -

- 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.

- 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.

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. Ehab Mohamed, BSc, CompEX, ETAP, is a **Senior Electrical & Instrumentation Engineer** with **30 years** of extensive industrial experience within **Power & Water Utilities** and Other **Energy Sectors**. He specializes in **Power System Equipment**, **Electrical Drawing**, **Electrical Forecasting**, **Transmission Networks**, **Distribution Networks**, **Certified Cyber Security Practitioner**, **Power System Blackouts**, **Power System During Emergency** and **Blackouts**, **Electric Power System** Operation, Electrical Transient Analysis Program (**ETAP**), **Electrical** Installation & Maintenance, **Electrical** Inspection & Testing, **HV/LV** Equipment, **High Voltage Electrical Safety**, **LV & HV Electrical** System, **HV** Equipment Inspection & Maintenance, **HV Switchgear** Operation & Maintenance, **LV Distribution Switchgear & Equipment**, **Substation** Design & Commissioning, **Substation** Maintenance Techniques, **Switchgear** Operation & Maintenance, **Circuit Breakers & Switchgears** Inspection, **Power System** Control & Stability, Industrial **UPS** Systems & **Battery** Power Supplies, **Power Generation & Transmission**, **Power System Protection & Relaying**, **Electric Power** Calculation, **Power Systems Protection**, Distributed Control System (**DCS**) Applications & Troubleshooting, **SCADA & Industrial Communication**, Process Logic Controller (**PLC**), **Load Flow** Calculation, **Cable** Installation, **Transformer** Maintenance, Short Circuit & Protection Coordination, **Harmonic** Analysis Studies, **Earthing & Grounding**, **Power Factor Correction**, **Power System Protection & Relaying**, **Electric Motors & Variable Speed Drives**, **Power Generation**, **Electrical Fault** Detection & Remedies, Electrical **Control Circuits** & Equipment, **Hazardous Area** Classification, **Electrical Hazards**, **Explosion Proof Ex Equipment**, **Hazardous Area Classification & Intrinsic Safety**, **Motor** Testing & Maintenance, Modern **Power System Protective Relaying**, **Generators** and **Transformer**. Further, he is well-versed in **Process Control & Instrumentation**, Practical **Industrial Data Communications & Telecommunications**, **Renewable Energy**, **Preventive Maintenance** Management System, **Condition-based Maintenance**, Engines Oil Quality System, Root Cause Analysis (**RCA**), Computerized Maintenance Management System (**CMMS**) and Rig Modification Request (**RMR**) and is very skillful in various softwares like the Office 365, Outlook 365, Visio, ETAP, AutoCAD, RAMS, HRMS, Microsoft BI for Dashboard and Online Reports, Siemens TIA, ABB Drive, Wizard, Window, Composer Suite, SharePoint, NOV Rig Sense all versions, Cond Master Ruby for Condition Monitoring and OSIsoft Data Analytics. He is currently the **Engineering Manager** (Electrical & Controls) in **Weatherford Drilling International**.

During his career life, Mr. Ehab has gained his expertise and thorough practical experience and handling challenging positions such as being the **Engineering Manager**, **Product Manager**, **Acting Project Manager**, **Lead Operation Engineer**, **Plant Engineer**, **Electrical Project Engineer**, **Project Engineer**, **Field Support Engineer**, **Lead Electrical & Automation Engineer**, **Lead Electrical Engineer**, **Field Support Engineer**, **Application Engineer**, **Allen Bradley Rockwell Engineer**, **Lead Technical Assessor**, **Team Leader**, **Principal Teacher**, **Global Field Support Technician**, **Foreman**, **Technical Consultant**, **Technical Trainer** and **Staff Lecturer** for various companies such as the **Weatherford** Drilling International Inc., Daleel Petroleum Company (**DAPECO**), NDSC Drilling Contractor, NOKHBA Energy, Abraj Drilling, American Standard Polymer and Acrylic Plant, Future Technologies Ltd, Industrial Technical College, Ministry of Higher Education and El-Masria Trading & Technical Services.

Mr. Ehab has a **Bachelor's** degree in **Electrical Engineering**. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership of Management** (**ILM**), a **Certified CompEx Inspector & Installer**, a **Certified Allen Bradley Rockwell Engineer** and a member of the Institution of Engineering & Technology (**IET**). Moreover, he holds a certification in Electrical Power Calculation (**ETAP**) and has delivered numerous trainings, courses, workshops, seminars 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 – 0745	*Registration & Coffee*
0745 – 0800	*Welcome & Introduction*
0800 – 0815	***PRE-TEST***
0815 – 0930	***Overview of Blackout Concerns***
0930 – 0945	*Break*
0945 – 1030	***Overview Blackout Causes***
1030 – 1230	***Review of Recent Blackouts, Causes and Lessons Learnt*** *Self-organizing Criticality and the Edge of Chaos*
1230 – 1245	*Break*
1245 – 1330	***Instability Mechanisms & Transients***
1330 – 1400	***Cold Inrush Current Effects on Blackout***
1400 – 1420	***Induction Motors Role in Triggering Blackout***
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 – 0930	***Angle Stability Control***
0930 – 0945	*Break*
0945 – 1115	***Voltage Stability Control*** *Reactive Capability Limitation of Synchronous Machines*
1115 – 1230	***Voltage Stability Control (cont'd)*** *Optimizing Generator Reactive Power Resources*
1230 – 1245	*Break*
1245 – 1420	***Assessing Security Margins with Respect to Voltage Instability***
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

0730 – 0830	***Blackout Preventive Measures - Overview***
0830 –0930	***Wide-Area Monitoring and Control***
0930 – 0945	*Break*
0945 – 1115	***Blackout Prevention by General & Network Voltage Control***
1115 – 1230	***Blackout Prevention by Compliance with Reliability Standards***
1230 – 1245	*Break*
1245 – 1420	***Blackout Prevention by Loads Voltage Stabilization*** *Static VAR Compensators • Voltage Stabilizers • AGC Implementation • Role of HVDC Systems in System Stability*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4

0730 – 0930	***Restoration Overview*** *Power System Restoration-First Task Force Report • Analytical Tools for Power System Restoration-Conceptual Design • System Operations Challenge • Protection Relays Issues During Restoration • Overvoltage Control During Restoration • Effects of Cold Load Pickup at the Distribution Substation Transformer*

0930 – 0945	*Break*
0945 – 1115	***Restoration Overview (cont'd)*** *Power System Restoration Issues • Asymmetry Issues in Power System Restoration • Steam Plant Startup and Control in System Restoration • A Framework for Power System Restoration Following a Major Power Failure • A Hierarchical Interactive Approach to Electric Power System Restoration • Heuristic Approaches to Distribution System Restoration*
1115 – 1230	***Special Considerations in System Restoration*** *Power System Restoration-The Second Task Force Report • System Restoration and Black Start Capabilities • Tie Line Utilization During Power System Restoration • Using HVDC Links in Power System Restoration*
1230 – 1245	*Break*
1245 – 1420	***New Approaches in Power System Restoration*** *Knowledge-Based Systems • Real Time Considerations • Guiding a Power System Restoration with an Expert System • Expert System Requirements for Power System Restoration • A New Algorithm for Service Restoration in Distribution Systems • MARS: Decision Support for Restoration after Local Disturbances*
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*

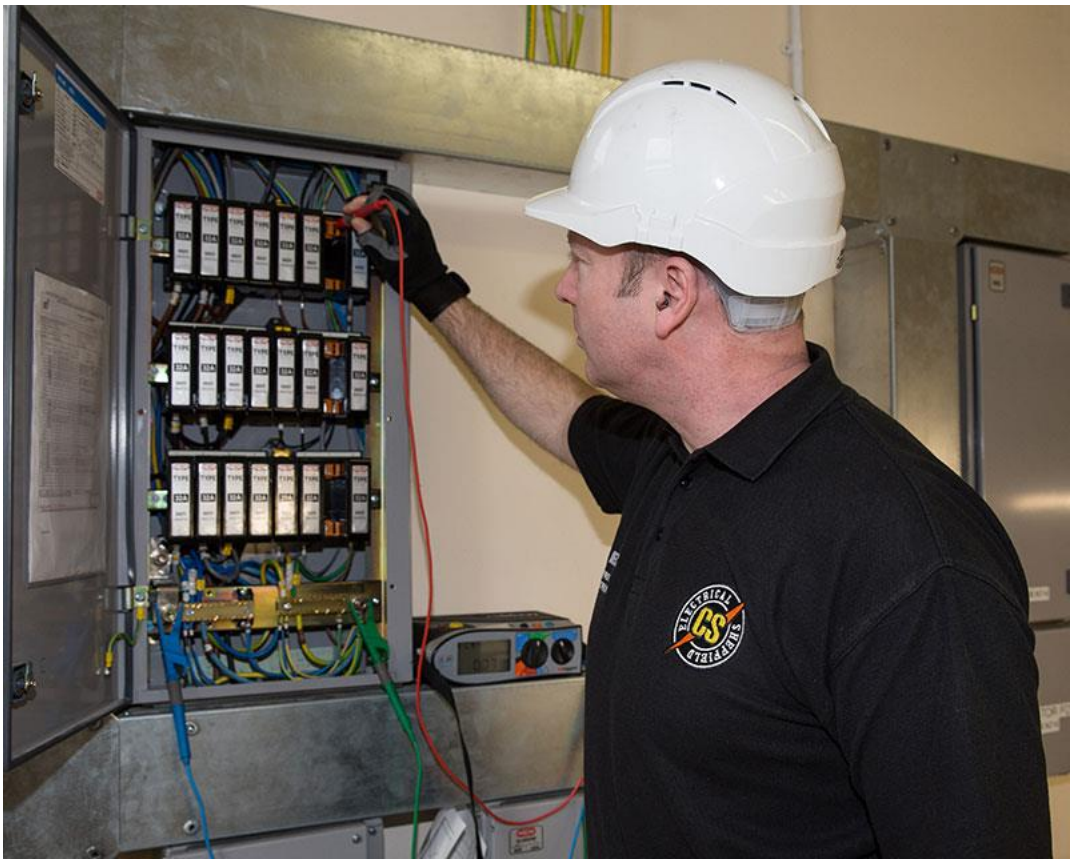
Day 5

0730 – 0930	***Blackout & Restoration Training*** *Development of a Large-Scale Dispatcher Training Simulator and Results • Dispatcher Training Simulators-Lessons Learned • The Uses of an Operator Training Simulator for System Restoration • An Advanced Transportable Operator Training Simulator*
0930 – 0945	*Break*
0945 – 1045	***Blackout & Restoration Training (cont'd)*** *Restoration Simulator Prepares Operators for Major Blackouts • Bulk Power System Restoration Training Techniques • Verification of an Advanced Power System Restoration Support System Using an Operator Training Simulator • Evaluating a Restoration Tool Using an Operator Training Simulator • System Restoration Guidelines: How to Set-up, Conduct and Evaluate a Drill*
1045 – 1230	***System Restoration Planning*** *Policies for Restoration of a Power System • Analytical Tool Requirements for Power System Restoration • System Restoration Plan Development for a Metropolitan Electric System • Role of Interactive and Control • Computers in the Development of a System Restoration Plan • System Restoration-Deploying the Plan • Power System Restoration Planning • A Systematic Method for Power System Restoration Planning • From Generic Restoration Actions to Specific Restoration Strategies • Estimating Restoration Duration*
1230 – 1245	*Break*

1245 – 1345	***Operators Perspective and Supporting Tools*** *Graphic Displays and Human Factors Engineering • Human Error Reduction Techniques • Risk Management Software*
1345 – 1400	***Summary, Course Conclusion, Open Forum & Closure***
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Practical Sessions

This practical and highly-interactive course includes real-life case studies and exercises:-



Course Coordinator

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