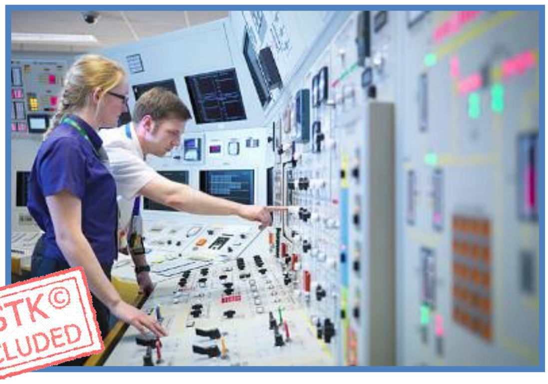
Haward Technology Middle East

COURSE OVERVIEW EE0090
Economic Dispatch of Power Plants



3.0 CEUs (30 PDHs) AWARD

H-STK© INCLUDED

Course Title
Economic Dispatch of Power Plants

Course Reference
EE0090

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

Course Date/Venue

Session(s)	Date	Venue
1	January 20-24, 2025	Ajman Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
2	April 20-24, 2025	Al Khobar Meeting Room, Hilton Garden Inn, Al Khobar, KSA
3	July 06-10, 2025	Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE
4	October 19-23, 2025	TBA Meeting Room, Taksim Square Hotel, Istanbul, Turkey

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.

A major challenge for all power utilities is to not only satisfy the consumer demand for power, but to do so at minimal cost. Any given power system can be comprised of multiple generating stations, each of which has its own characteristic operating parameters. The cost of operating these generators does not usually correlate proportionally with their outputs, therefore the challenge for power utilities is to try to balance the total load among generators that are running as efficiently as possible.

Further, the power station has incremental operating costs for fuel and maintenance; and fixed costs associated with the station itself that can be quite considerable. Things get even more complicated when utilities try to account for transmission line losses, and the demand fluctuation within shorter time. In all of these cases, however, the basic objective is to operate the system as inexpensively as possible.

The economic dispatch program optimally allocates load demand specifying real power and reactive power to be generated by a power plant among various power generators in a manner so that each of the power generators are operated within its optimal operating conditions as defined by a reactive capability curve. Allocating a power demand with consideration of the reactive capability curves of the power generators results in optimal generation of real power and reactive power as specified by the load demand. Alternatively, the economic dispatch program allocates load demand specifying real power and reactive power to be delivered by a power grid among various power plants wherein one or more of the various power plants have capacity limits exhibited by reactive capability curves. The classic problem is the economic dispatch of the generation systems to achieve minimum operating cost. This problem area has taken on a subtle twist as the public has become increasingly concerned with environmental matters, so that "economic dispatch" now includes the dispatch of systems to minimize pollutants and conserve various forms of fuel, as well as to achieve minimum costs. In addition, there is a need to expand the limited economic optimization problem to incorporate constraints on system operation to ensure the "security" of the system, thereby preventing the collapse of the system due to unforeseen conditions.

The purpose of this course is to introduce and explore a number of engineering and economic matters involved in planning, operating, and controlling power generation and transmission systems in electric utilities. This course is designed to provide a good overview of the economic dispatch problem in power generation. It covers Power generation characteristics, Economic dispatch problem, Thermal unit economic dispatch and methods of solution, Optimization with constraints, Using dynamic programming for solving economic dispatch and other optimization problems, Transmission system effects, The unit commitment problem and solution methods, Generation scheduling in systems with limited energy supplies, Production cost models, Automatic generation control, Interchange of power and energy, Power system security techniques, Least-squares techniques for power system estimation, and Optimal power flow techniques and illustrative applications.

Course Objectives

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

- Apply and gain an in-depth knowledge on economic dispatch of power plants
- Identify the characteristics of power generation units and introduce them to the economic dispatch of thermal units and the methods of solution
- Discuss the transmission system effects, unit commitment and the generation with limited energy supply
- Implement the production cost models and be able to adapt the control of generation
- Explain the interchange of power and energy and their types and discuss the factors affecting the power system security
- Estimate power systems and calculate the optimal power flow

- Use new techniques for solving old problems and new problem areas that are arising from changes in the system development patterns, regulatory structures, and economics
- Solve complicated problems, involving both economic analysis and network analysis and illustrate the solving techniques with relatively simple problems

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 will be valuable to 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

Abu Dhabi	**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.
Al Khobar	**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.
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. This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), 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

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.

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:

Dr. Ahmed El-Sayed, PhD, MSc, BSc, is a **Senior Electrical & Instrumentation Engineer** with almost **35 years** of extensive experience within the **Oil**, **Gas**, **Power**, **Petroleum**, **Petrochemical** and **Utilities** industries. His experience widely covers in the areas of **Protection Relay Application**, **Maintenance & Testing**, **Information Confidentiality**, **Data Confidentiality** Classification, **IT Risk Management** Concepts, **NEC** (National Electrical Code), **NESC** (National Electrical Safety Code), **Electrical Safety**, **Electrical Hazards Assessment**, **Electrical Equipment**, **Personal Protective Equipment**, Lock-Out & Tag-Out (**LOTO**), Confined Workspaces, Alerting Techniques, Electrical Transient Analysis Program (**ETAP**), Power **Quality**, Power **Network**, Power **Distribution**, **Distribution Systems**, **Power Systems Control**, **Power Systems Security**, Power **Electronics**, Electrical **Substations**, **UPS** & **Battery System**, **Earthing & Grounding**, Power **Generation**, **Protective Systems**, **Electrical Generators**, **Power** & **Distribution Transformers**, **Electrical Motors**, **Switchgears**, **Transformers**, **AC** & **DC Drives**, **Variable Speed Drives** & **Generators**, **Generator Protection**, **GE Gas Turbines**, PLC, SCADA, DCS, Process Control, Control Systems & Data Communications, Instrumentation, Automation, Valve Tuning, SIS, SIL, ESD, Alarm Management Systems, Engine Management System, Bearing & Rotating Machine, Fieldbus Systems and Fiber Optics Technology. He is currently the **Systems Control Manager** of **Siemens** where he is in-charge of Security & Control of Power **Transmission Distribution** & **High Voltage** Systems and he further takes part in the Load Records Evaluation & Transmission Services Pricing.

During his career life, Dr. Ahmed has been actively involved in different Power System Activities including Roles in Power System Planning, Analysis, Engineering, **HV Substation** Design, Electrical Service Pricing, Evaluations & Tariffs, Project Management, Teaching and Consulting. His vast industrial experience was honed greatly when he joined many International and National Companies such as **Siemens**, **Electricity Authority** and **ACETO** industries as the **Instrumentation & Electrical Service Project Manager**, **Energy Management Engineer**, **Department Head**, **Assistant Professor**, **Project Coordinator**, **Project Assistant and Managing Board Member** where he focused more on dealing with Technology Transfer, System Integration Process and Improving Localization. He was further greatly involved in manufacturing some of **Power System** and **Control & Instrumentation Components** such as Series of Digital Protection **Relays**, MV **VFD**, **PLC** and **SCADA** System with intelligent features.

Dr. Ahmed is well-versed in different electrical and instrumentation fields like **ETAP**, Load Management Concepts, **PLC** Programming, Installation, Operation and Troubleshooting, **AC Drives** Theory, Application and Troubleshooting, Industrial Power Systems Analysis, AC & DC **Motors**, Electric Motor **Protection**, **DCS SCADA**, **Control** and Maintenance Techniques, Industrial Intelligent Control System, **Power Quality** Standards, Power Generators and Voltage Regulators, Circuit Breaker and Switchgear Application and Testing Techniques, **Transformer** and **Switchgear** Application, Grounding for Industrial and Commercial Assets, Power Quality and **Harmonics**, **Protective Relays** (O/C Protection, Line Differential, Bus Bar Protection and **Breaker Failure Relay**) and Project Management Basics (PMB).

Dr. Ahmed has **PhD**, **Master** & **Bachelor** degrees in **Electrical Engineering** from the **University of Wisconsin Madison**, **USA** and **Ain Shams University**, respectively. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/ Assessor/Trainer** by the **Institute of Leadership and Management** (**ILM**), an active member of IEEE and ISA as well as numerous technical and scientific papers published internationally in the areas of Power Quality, Superconductive Magnetic Energy Storage, SMES role in Power Systems, Power System **Blackout** Analysis, and Intelligent Load Shedding Techniques for preventing Power System Blackouts, HV **Substation Automation** and Power System Stability.

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 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Characteristics of Power Generation Units*** *Characteristics of Steam Units • Variations in Steam Unit Characteristics • Cogeneration Plants • Typical Generation Data*
0930 – 0945	*Break*
0945 – 1100	***Economic Dispatch of Thermal Units and Methods of Solution*** *The Economic Dispatch Problem • Thermal System Dispatching with Network Losses Considered • The Lambda-Iteration Method • Gradient Methods of Economic Dispatch*
1100 – 1245	***Economic Dispatch of Thermal Units and Methods of Solution (cont'd)*** *Newton's Method • Economic Dispatch with Piecewise Linear Cost Functions • Economic Dispatch Using Dynamic Programming • Base Point and Participation Factors*
1245 – 1300	*Break*
1300 – 1420	***Economic Dispatch of Thermal Units and Methods of Solution (cont'd)*** *Economic Dispatch Versus Unit Commitment • Optimization within Constraints • Dynamic-Programming Applications*
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 – 0930	***Transmission System Effects*** *The Power Flow Problem and Its Solution • Transmission Losses • Power Flow Input Data for Six-Bus System*
0930 – 0945	*Break*
0945 – 1100	***Unit Commitment*** *Constraints in Unit Commitment • Unit Commitment Solution Methods • Dual Optimization on a Nonconvex Problem*
1100 – 1245	***Generation with Limited Energy Supply*** *Take-or-Pay Fuel Supply Contract • Composite Generation Production Cost Function • Solution by Gradient Search Techniques*
1245 – 1300	*Break*
1300 – 1420	***Generation with Limited Energy Supply (cont'd)*** *Hard Limits and Slack Variables • Fuel Scheduling by Linear Programming*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

0730 – 0930	***Production Cost Models*** *Uses and Types of Production Cost Programs ● Probabilistic Production Cost Programs*
0930 – 0945	*Break*
0945 – 1100	***Production Cost Models (cont'd)*** *Sample Computation and Exercise ● Probability Methods and Uses in Generation Planning Problems*
1100 – 1230	***Control of Generation*** *Generator Model ● Load Model ● Prime-Mover Model*
1230 – 1245	*Break*
1245– 1420	***Control of Generation (cont'd)*** *Governor Model ● Tie-Line Model ● Generation Control*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4

0730 – 0930	***Interchange of Power and Energy*** *Economy Interchange between Interconnected Utilities ● Interutility Economy Energy Evaluation ● Interchange Evaluation with Unit Commitment ● Multiple-Utility Interchange Transactions*
0930 – 0945	*Break*
0945 – 1100	***Interchange of Power and Energy (cont'd)*** *Other Types of Interchange ● Power Pools ● Transmission Effects and Issues ● Transactions Involving Nonutility Parties*
1100 – 1230	***Power System Security*** *Factors Affecting Power System Security ● Contingency Analysis: Detection of Network Problems*
1230 – 1245	*Break*
1245 – 1420	***Power System Security (cont'd)*** *Calculation of Network Sensitivity Factors*
1420 - 1430	***Recap***
1430	*Lunch & End of Day Four*

Day 5

0730 – 0930	***Estimation in Power Systems*** *Power System Estimation ● Maximum Likelihood Weighted Least-Squares Estimation ● Estimation of an AC Network*
0930 – 0945	*Break*
0945 – 1100	***Estimation in Power Systems (cont'd)*** *Estimation by Orthogonal Decomposition ● Introduction to Advanced Topics in Estimation ● Application of Power Systems Estimation*
1100 – 1230	***Optimal Power Flow*** *Solution of the Optimal Power Flow ● Linear Sensitivity Analysis ● Linear Programming Methods ● Security-Constrained Optimal Power Flow ● Interior Point Algorithm ● Bus Incremental Costs*
1230 – 1245	*Break*

1245 – 1345	***Impacts of Free–Market Pricing on Economic Dispatch Decisions***
1345 – 1400	***Course Conclusion***
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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