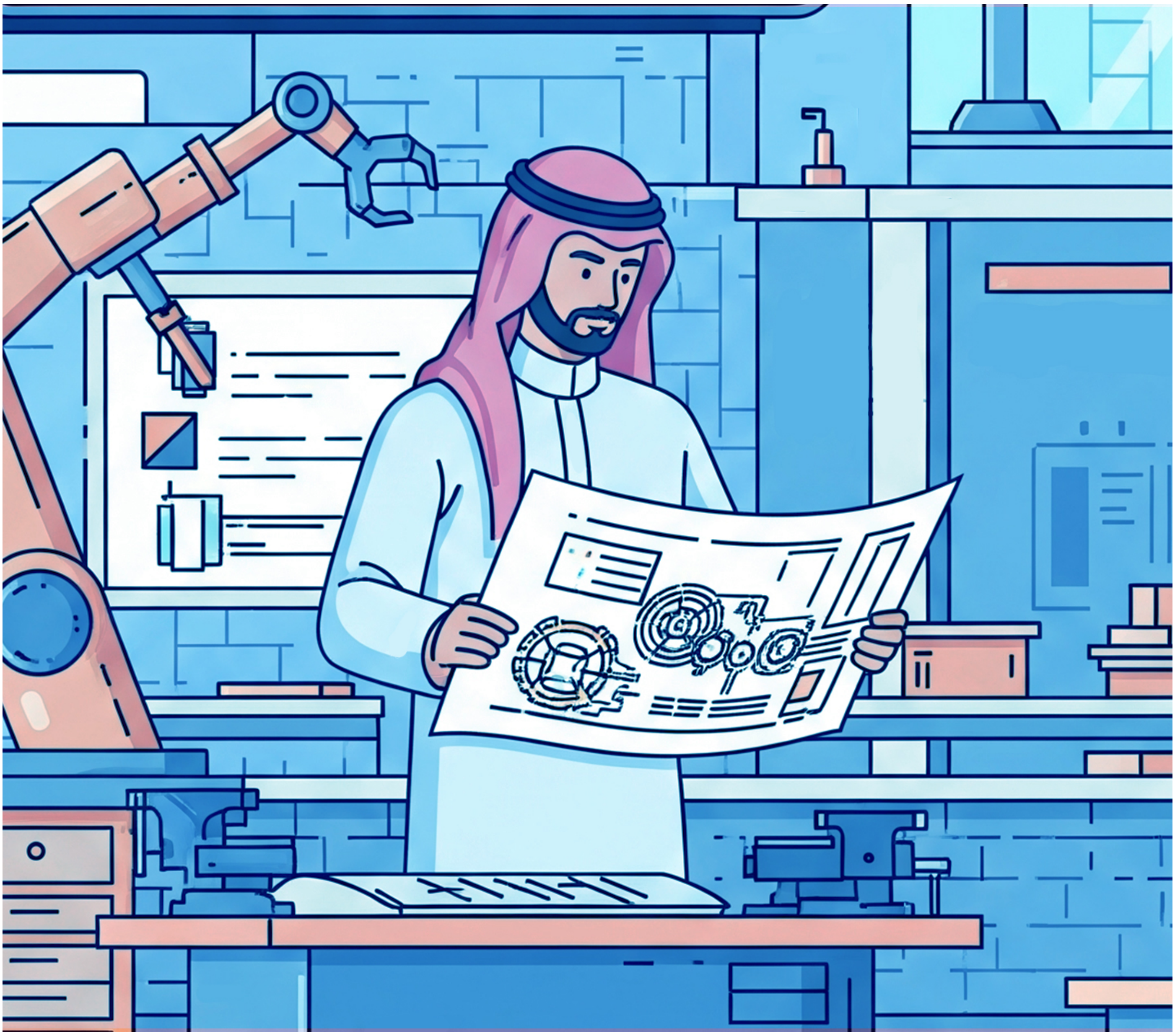
THE LEADING TRAINING PROVIDER



Mechanical Engineering

Thermal plants Heat Rate and Methods of Reducing Fuel Cost

Course Introduction

The heat rate of a plant is the amount of fuel energy input needed (Btu, higher heating value basis) to produce 1 kWh of net electrical energy output. It is the metric most often used in the electric power generation industry to track and report the performance of Thermal Power Plants. The average, annual operating Heat Rate of coal-fired Power Plants is approximately 10,400 Btu/kWh. The design heat rate of a facility is based on full-load operation with no boiler blowdown, whereas most reported heat rates of operating facilities include performance during off peak loads and include boiler blowdown.

Because operating units report heat rates that include performance at all levels, the numbers are usually significantly higher than the design heat rate. In order to Improve the Performance of a Thermal Power Plant, it is necessarily to adopt heat rate improvement and performance monitoring. Thermal Plant heat rate is a key economic issue in operation of thermal plants. The efficient utilization of fuel in Electric Power Production and desalination plants is the main target of this course. Only by monitoring the performance we can determine whether it is cost effective to continue operating the plant or alternatively maintenance and/or part renewal is necessary. In addition, to improve heat rate, different plant losses must be identified and understood and innovative methods to decrease these losses taken. This course is devoted to study and optimize the cost of unit energy in power and desalination plants.

Target Audience

- Automotive Engineer
- Boiler Engineer
- Ceramics Engineer
- Equipment Engineer
- High-Pressure Engineer
- Marine Engineer
- Mechanical Design Engineer
- Mechanical Engineer
- Naval Architect

- Pipeline Engineer
- Power Engineer
- Rotating Equipment Engineer
- Senior Mechanical Engineer
- Turbine Engineer
- Validation Engineer

Learning Objectives

- Learn what cycle parameters affect Heat rate
- Illustrate the financial benefits of Lowering Heat Rate
- Illustrate Heat Rate Improvement Options
- Illustrate Heat Rate Audit
- Calculation of Cost Due to Heat Rate Deviations
- Capital and Maintenance Projects affecting cost of unit energy
- Innovative methods in minimizing steam losses
- Learn methods for improving gas turbine heat rate
- What to consider for improved Boiler performance
- What to consider of improved Steam Turbine performance
- Quantified Benefits of Implementing Recommendations

Course Outline

- **01 DAY ONE**

  Module (01) Types of Power Plants

  - 1.1 Gas Turbine Power Plants
  - 1.2 Steam Power Plants
  - 1.3 Combined Cycle Power Plants
  - 1.4 Comparison of Cost of Unit Energy

Module (02) Plants Components

- ◦ 2.1 Gas Turbine components and fuel consumption.
- ◦ 2.2 Boiler details and combustion of fuel
- ◦ 2.3 Steam Turbine Components and details
- ◦ 2.4 Heat Recovery Boiler
- ◦ 2.5 Condenses
- ◦ 2.6 Feed Heaters Types and Details

- **02 DAY TWO**

Module (03) Thermal Plant Economics

- ◦ 3.1 Generation Cost; Capital Cost and Running Cost
- ◦ 3.2 Economic factors of Thermal Power Plants.
- ◦ 3.2.1 Capacity Factor 3.2.2 Load Factor
- ◦ 3.2.3 Use Factor 3.3.4 Reserve factor
- ◦ 3.3 Reduction of operating variable cost through the heat rate improvements.
- ◦ 3.4 What is Heat Rate?
- ◦ 3.5 Plant Heat Rate
- ◦ 3.6 Why is Heat Rate Important?
- ◦ 3.7 Heat Rate Deviation
- ◦ 3.8 Cost of Heat Rate Deviations
- ◦ 3.9 Heat rate variation of plants with aging
- ◦ 3.10 Financial Loss of increased heat rate for specific power operating power plants.
- ◦ 3.11 Technology impact on Improvements of newly built plants compared to previously built plants

Module 04: Heat Rate Calculations and effect of cycle parameters

- ◦ 4.1 The heat engine and energy conversion process
- ◦ 4.2 Heat rate
- ◦ 4.3 A simple turbine cycle with an open heater
- ◦ 4.4 Power and desalination plant turbine heat rate
- ◦ 4.5 Difference between Plant and turbine heat rate

- **03 DAY THREE**

Module 05: Steam Plant Heat Rate & Economics Effect of steam parameters:

- ◦ 5.1 Effect of increasing pressure on available energy
- ◦ 5.2 Effect of increasing steam temperature on available Energy
- ◦ 5.3 Effect of increasing steam pressure & temperature both on available energy
- ◦ 5.4 Effect of changing reheat pressure

- 5.5 Effect of changing reheat temp
- 5.6 Effect of changing condenser exhaust pressure
- 5.7 Economic case study
- 5.8 Factors affecting the exhaust vacuum in the condensing type turbines
- 5.9 Effect of parameters deviation on heat rate.
- 5.10 Effect of out of service feed heater on plant heat rate.

- **04 DAY FOUR**

  Module 06: Effect of Steam Turbine Losses

  - 6.1 Fluid Friction
  - 6.2 Leakage
  - 6.3 New Techniques in minimizing leakage
  - 6.3.1 Guardian Rings
  - 6.3.2 Vortex Shedders
  - 6.3.3 Case Study
  - 6.3.4 Brush Seals
  - 6.4 Moisture Loss
  - 6.5 Leaving Loss
  - 6.6 Profile Losses
  - 6.7 Blade path deterioration: Steam Turbine Blade path Audit
  - 6.8 Performance improvement form polishing of turbine blading

- **05 DAY FIVE**

  Module 07: Heat Rates of Gas Turbine and Economics

  - 7.1 Different gas turbine cycles
  - 7.2 Determining ISO Power and ISO Heat Rate
  - 7.3 Correcting for Ambient Temperature, Altitude, Humidity, Inlet and Exhaust Pressure Losses, Mechanical Transmission Losses and Turbine Deterioration.
  - 7.4 Part load heat rate
  - 7.5 Methods of Increasing Power Output
  - 7.6 Gas Turbine Inlet Air Cooling
  - 7.6.1 Evaporative cooler
  - 7.6.2 Fogging system
  - 7.6.3 Mechanical refrigeration system (direct type)
  - 7.6.4 Mechanical refrigeration system (indirect type)
  - 7.6.5 Mechanical refrigeration with ice storage
  - 7.6.6 Mechanical refrigeration system with chilled water storage
  - 7.6.7 Single stage Lithium Bromide Absorption chiller
  - 7.7.8 Two stage Lithium Bromide Absorption chiller
  - 7.7 Performance Evaluation of Different Inlet Air Cooling Systems:

- 7.8 Capital Cost Comparisons of Inlet Cooling Systems
- 7.9 Performance Evaluation
- 7.10 Modified gas turbine cycles:
- 7.10.1 Evaporative regenerative gas turbine cycle
- 7.10.2 Inter cooled recuperative gas turbine cycle (ICRGT).
- 7.10.3 Steam injected gas turbine cycle (STIG).
- 7.10.4 Humid air turbine (HAT).
- 7.11 Effect of Fouling on compressor Performance

Confirmed Sessions

FROM	TO	DURATION	FEES	LOCATION
June 16, 2025	June 20, 2025	5 days	4950.00 $	Austria - Vienna
Sept. 8, 2025	Sept. 12, 2025	5 days	4250.00 $	UAE - Dubai
Dec. 22, 2025	Dec. 26, 2025	5 days	4250.00 $	UAE - Dubai
Dec. 7, 2025	Dec. 11, 2025	5 days	4250.00 $	Oman - Muscat