JUPITER PRIME
Consulting • Training • Advisory
جوبيتر برايم للاستشارات والتدريب

COURSE BROCHURE

# Thermodynamics for Plant Engineers and Technicians Training Course

30 May – 3 June 2027
Sharm El-Sheikh

# Thermodynamics for Plant Engineers and Technicians Training Course

**Ref:** 3187_121160 **Date:** 30 May – 3 June 2027 **Location:** Sharm El-Sheikh **Fees:** 5500 GBP

Thermodynamics for Plant Engineers and Technicians is a 1-week training course for junior engineers and shift technicians in power stations and process sites, and each participant builds a plant energy balance and cycle performance worksheet for a real unit. Rising fuel costs, tighter emission limits and ageing equipment make clear energy reasoning a daily operating skill. Jupiter Prime Training delivers this thermodynamics for plant engineers and technicians course.

## Why Thermodynamics for Plant Engineers and Technicians Matters Now

Fuel prices make every lost kilojoule visible, emission limits tie stack losses and heat rate to permits, and retiring operators take their feel for boilers and turbines with them. A site whose staff can close an energy balance spots fouling, leaks and poor setpoints early; one that cannot pays in fuel and outages. The course rests on the first and second laws, property tables and cycle analysis applied to real equipment.

## Who Gains Most from Thermodynamics for Plant Engineers and Technicians

- Operators judging whether boilers, turbines and condensers run efficiently
- Maintenance technicians deciding whether exchangers, valves or traps waste energy
- Junior performance engineers calculating heat rate and losses for reports
- Utility technicians looking after compressors, chillers and cooling water
- Graduate engineers moving into commissioning and plant support

Shift crews from one unit gain most when several members attend together and leave sharing one vocabulary for energy flows.

## Thermodynamics for Plant Engineers and Technicians Capabilities

Participants move from reading gauges to tracing where energy enters, leaves and degrades inside each piece of equipment.

- Apply mass and energy balances to boilers, turbines, pumps and exchangers — daily performance reporting
- Calculate steam and gas properties from tables and charts — setpoint and condition checks
- Assess entropy generation and irreversibility in a component — repair and upgrade priorities
- Calculate steam cycle and gas turbine cycle efficiency and heat rate — operations supervisors
- Test refrigeration and heat pump performance against design coefficients — utility engineers
- Communicate energy losses in plain terms — shift leaders and maintenance planners

## Key Thermodynamics for Plant Engineers and Technicians Terms

- Enthalpy — the energy content of a flowing fluid, combining internal energy and flow work.
- Entropy — a property measuring how far energy has degraded; friction and mixing raise it.
- Control volume — a boundary drawn around equipment so every flow of mass, heat and work can be counted.
- Heat rate — the fuel energy needed per unit of electricity sent out; lower is better.
- Dryness fraction — the share of vapour in wet steam, affecting blade erosion and available enthalpy.
- Coefficient of performance — useful cooling or heating delivered per unit of compressor work.

## Thermodynamics for Plant Engineers and Technicians Day by Day

### Day 1: Energy, Systems and Plant Boundaries

- System and Control Volume Selection — Where To Draw Equipment Boundaries
- Forms of Energy, Heat and Work — Reading Plant Energy Flows Correctly
- Units, Pressure and Temperature Scales — Avoiding Gauge and Absolute Errors
- First Law for Closed Systems — Tank Heating and Compression Checks
- Plant Walkdown Energy Sketch — Mapping Inputs and Losses on a Unit

### Day 2: Properties of Steam and Gases

- Steam Tables and Saturation Data — Setting Drum and Deaerator Conditions
- Wet Steam and Dryness Fraction — Judging Turbine Exhaust Moisture Risk
- Temperature Entropy and Enthalpy Entropy Charts — Visualising Process Paths
- Ideal Gas Relations and Specific Heats — Combustion Air and Flue Gas Estimates
- Throttling and Mixing Calculations — Valve Losses and Desuperheater Sizing

### Day 3: Steady Flow Balances and the Second Law

- Steady Flow Energy Equation — Turbine, Pump and Compressor Work Checks
- Heat Exchanger and Condenser Balances — Detecting Fouling and Air Ingress
- Boiler Efficiency by Direct and Loss Methods — Fuel Saving Priorities
- Entropy Generation and Isentropic Efficiency — Ranking Component Degradation
- Available Energy and Irreversibility — Where Upgrades Return the Most

### Day 4: Power and Refrigeration Cycles

- Steam Power Cycle With Reheat and Feedheating — Heat Rate Drivers
- Gas Turbine Cycle and Ambient Effects — Output Loss on Hot Days
- Combined Cycle and Heat Recovery Steam Generators — Stack Temperature Choices
- Vapour Compression Refrigeration Cycle — Chiller Coefficient and Charge Checks
- Cooling Tower and Psychrometric Basics — Approach Range and Makeup Water

## Day 5: Practising the Plant Energy Balance and Cycle Performance Worksheet

- Unit Data Gathering and Instrument Checks — Trusting Field Readings
- Property Lookup and Balance Closure on Site Data — Day 2 and Day 3 Applied
- Cycle Efficiency Comparison Against Design — Day 4 Heat Rate Gaps
- Loss Ranking and Improvement Options — Peer Review Across Two Sectors
- Plant Energy Balance and Cycle Performance Worksheet — Completed Unit Analysis

## Applying Thermodynamics for Plant Engineers and Technicians After the Course

- Close a monthly energy balance on one boiler, condenser or chiller and track how its losses change with load and season.
- Lead a shift briefing that compares measured turbine or compressor isentropic efficiency with design and names the likely cause of any gap.

## Thermodynamics for Plant Engineers and Technicians Questions FAQ

### What is thermodynamics for plant engineers and technicians, and why does it matter now?

It is the practical use of energy balances, properties and cycle analysis on real equipment. It matters because fuel costs and emission limits demand that newer staff explain losses with numbers.

### Which roles gain most from thermodynamics for plant engineers and technicians?

Operators, maintenance technicians, junior performance engineers and utility technicians gain most, because they judge equipment efficiency every shift.

### How does thermodynamics for plant engineers and technicians differ from a fluid flow or heat transfer course?

It focuses on energy balances, entropy and whole cycles rather than pipe flow, pressure drop or exchanger surface design.

### What do you bring back from thermodynamics for plant engineers and technicians?

You bring back a completed energy balance and cycle analysis for a unit you choose, with a method you can repeat on other equipment.

## Thermodynamics for Plant Engineers and Technicians: The Way Forward

The plant energy balance and cycle performance worksheet first informs which component deserves attention at the next maintenance window. Operators, performance engineers and planners use it to compare readings with design and to agree priorities. After its first use, revisit the loss ranking with seasonal data, since cooling water and ambient air shift cycle performance through the year in refinery and power settings alike.