

# How Power Plants Work

## Course 111: How Power Plants Work

Covers the basic steam generation system, how thermal energy is converted into electrical energy, components of the system, and design features for gaining thermal efficiency. Includes handling of water, fuel, and wastes, and the operating features of a power plant.

TPC Training is accredited by IACET to offer **0.5 CEU** for this program.



### Lesson 1: Steam—The Primary Force

#### Topics

Energy for Power Plants; Converting Energy to Electricity; The Importance of Air in Combustion; Removing Ashes and Flue Gases; Heating the Air; Boiler Design; Controlling the Water Level; Feedwater Heater; The Economizer

#### Objectives

- Describe the basic concepts involved in converting energy to electricity through a steam power plant.
- Explain why air is important in combustion and describe how air is heated.
- Describe the basic design of a boiler.
- List the methods commonly used to create efficiency in a boiler.

### Lesson 2: How Heat is Converted to Power

#### Topics

The Turbine; The Generator; Using Exhausted Steam; Producing a Vacuum; Using the Condensate; Improved Coal Handling; Boiler Efficiency

#### Objectives

- Describe the components of an elementary turbine.
- List the uses of exhaust steam.
- Explain how a vacuum is produced in a boiler system.
- Describe how condensate is formed in a boiler system and how it can be used to create a closed cycle system.
- Explain how boiler efficiency is related to steam temperature and pressure.
- Calculate absolute temperature values using Fahrenheit and Celsius readings.

### Lesson 3: Power Plant Efficiency

#### Topics

Thermodynamic Efficiency; Pumps; Feedwater Heating; Air Heating; The Superheater; Circulation Problems in High-Pressure Boilers; Minimum Temperatures in the System; Minor Refinements; Condenser Performance

#### Objectives

- List the kinds of pumps used in a boiler system and explain the function of each.
- Describe common processes by which boiler feedwater can be heated, and explain these increase boiler efficiency.
- Explain the process by which air is heated in a boiler system.
- Explain the purpose of a superheater.

### Lesson 4: Handling Water, Fuel, and Wastes

#### Topics

Water Requirements; Physical Properties of Water; Chemical Properties of Water; Water Softening and Purification; Cooling Water; Water Disposal Problems; Air Cooling; Fossil Fuel Handling and Wastes; Flue Gases; Particle Removal; Problem Transfer; Looking to the Future

#### Objectives

- List the two main uses for water in a power plant.
- Describe the physical and chemical properties of water.
- Explain the past and present methods used to purify water for use in a power plant.
- Explain the common handling procedures for flue gases and solid wastes, and describe the problems involved in disposing of these wastes.
- List some of the ways in which power plant waste problems might be resolved in the future.

### Lesson 5: Power Plant Operation and Control

#### Topics

Operating Features of a Power Plant; Power Plant Controls; Temperature Measurement; Pressure Measurement; Special Measurements; Other Power Sources; Nuclear Power

#### Objectives

- Give a detailed description of the arrangement of a modern steam generating plant and explain the progression of the steam cycle from one end to the other.
- Compare and contrast the common instruments for measuring temperature.
- Compare and contrast the common instruments for measuring pressure.
- List some of the special measurement devices that are important in a steam generating plant.
- List the alternate power sources described in the lesson.
- Explain the concept of nuclear power and describe the operation of a nuclear power plant.