



# Generation Operations



## Background

The module is delivered through the OES-NA Virtual Classroom portal. This course is intended to provide system operators with necessary training to understand the concepts of controlling generation on the Bulk Electric System.

## Course Level

Not Applicable

## Target Audience

The class is intended for: new operators to the system that will have the responsibility of generation control; transmission operators who want to expand their knowledge of generation control; individuals who desire the overall philosophy of controlling generation and its impacts to the Bulk Electric System; and those individuals trying to understand generation control as part of NERC Certification Preparation.

## NERC Continuing Education Hours

**TOTAL:** 12.5 CEHs  
**Standards:** 5.0 CEHs  
**Ops Topics:** 12.5 CEHs  
**Sim:** 0.0 CEHS

## NERC Emergency Training Requirement

12.5 hours of Emergency Training

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## Module Content

The course includes fourteen lessons which cover the following:

**Lesson 1: Generation Equipment:** Energy Transformation, Fuel Types, Capacity, Fossil Fuel Units, Hydroelectric Units, Nuclear Units, Combustion Turbines, and Other Renewable Power

**Lesson 2: Steam Plants:** Boiler Sub-Systems, Fuels, Coal, Coal Delivery Methods, Conveyor Systems, Coal Feeders, Pulverizers, Burners, Oil Usage, Oil Delivery Methods, and Oil related equipment

**Lesson 3: Environment and Water:** Flue Gas, Ash Systems, Ash Removal, Bottom Ash Removal, Environmental Impacts, Flue Gas Scrubbing Systems, Water Systems, Water Quality and Implications, Demineralization Process, Feedwater Systems, Boiler Types, and Water Cycles

**Lesson 4: Turbines and Generators:** Turbines, Turbine Configurations, Steam Injection, Turbine Blades, Turbine Seals, Lubrication, Generator Components, Generator Cooling, Excitation System, Capability Curves, and Issues for Concern

**Lesson 5: Other Generators:** Nuclear Generation, Reactors Types, Fission & Fusion Process, Combustion Turbines, Simple Cycle versus Combined Cycle, Start-up Costs and Timing, Hydro Generation, Hydro Facility Types, Fuel Limitations, Wind Power, Wind Power Issues, Capabilities & Fuel, Solar Power, Capabilities & Fuel, Geothermal Power, Geothermal Issues, and Capabilities & Fuel

**Lesson 6: Generation Control:** Balancing Area Operation, Types of Load, Energy Balance, Mismatches, Area Control Error, ACE Calculation, System Inertia, Frequency Response, CPS Standards, Generators in Parallel, Speed Droop, and Control Modes

**Lesson 7: System Operations & Dispatching:** Dispatching Steps, Forecasting Load, Load Curves, Unit Availability and Capability, Costs of Generating Electricity, Heat Rate, Constraints – Fuel, Environmental, & Transmission, Scheduling Requirements, Reserves – Operating, Regulation, & Contingency, Resource Analysis, Incremental MW, Loading Considerations, LMP, and Control Implications

**Lesson 8: BAL-001-0: Real Power Balancing Control Performance:** Purpose, Applicability, Requirements, Measures, and Compliance Elements

**Lesson 9: BAL-002-0: Disturbance Control Performance:** Purpose, Applicability, Requirements, Measures, and Compliance Elements

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**Lesson 10: BAL-003-0: Frequency Response and Bias:** Purpose, Applicability, Requirments, Measures, and Compliance Elements

**Lesson 11: BAL-004-0: Time Error Correction:** Purpose, Applicability, Requirments, Measures, and Compliance Elements

**Lesson 12: BAL-005-0: Automatic Generation Control:** Purpose, Applicability, Requirments, Measures, and Compliance Elements

**Lesson 13: BAL-006-1: Inadvertent Interchange:** Purpose, Applicability, Requirments, Measures, and Compliance Elements

**Lesson 14: EOP-002-2: Capacity and Energy Emergencies:** Purpose, Applicability, Requirments, Measures, and Compliance Elements

### Delivery Schedule

Because the module is delivered on an individual basis via the Internet, individuals have the ability to set their own pace and schedule for completion of the module. Registered students are provided with 6 months from the time of registration to complete the module.

### Student Requirements

- Students must sign-in using their individual log-in and password to access the module.
- Students are required to provide their NERC SO Certification # and other applicable contact information during the module registration process.
- Students must complete all module material prior to attempting the final assessment.
- Students must successfully earn a 70% grade on the final activity assessment.
- Students must submit a course evaluation form. (Level of completion is not measured, but full completion is desired)

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