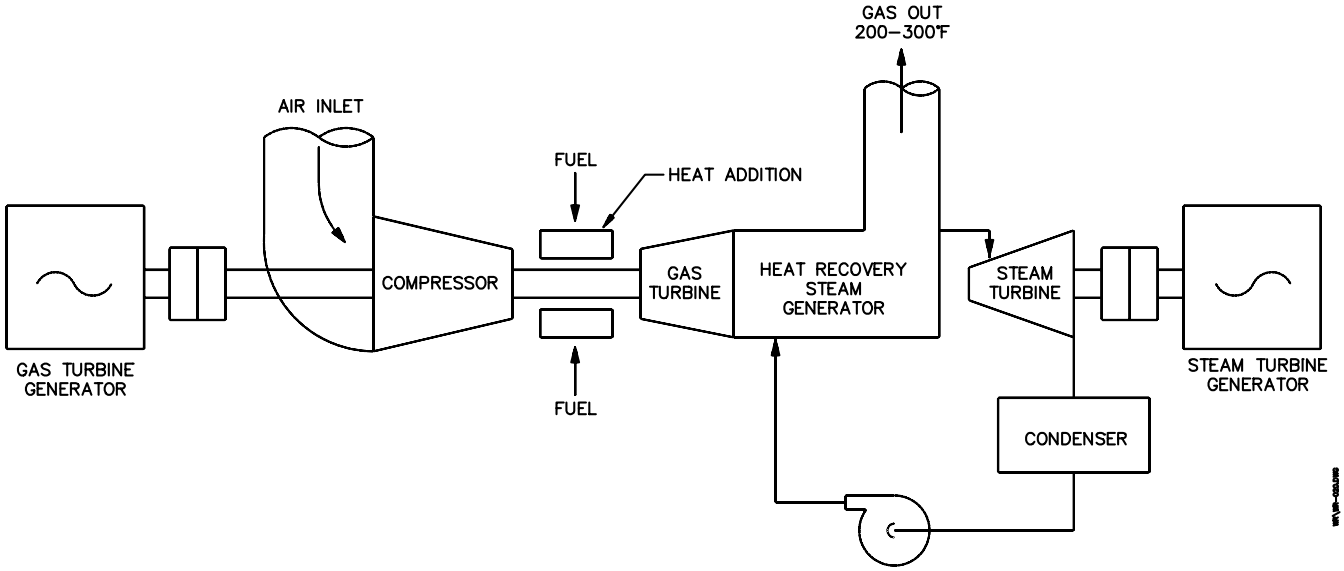
FOSSIL CONSULTING SERVICES, INC
6325 WOODSIDE COURT, SUITE 350, COLUMBIA, MD 21046
(410) 312-6240 fcs@fossilconsulting.com

CC100 - INTRODUCTION TO COMBINED CYCLE POWER PLANTS

This 3-day course has been developed to improve the effectiveness of the operations and maintenance activities of combined cycle power plants. Get the "Big Picture" first, next learn how the individual components function, and then put it all together into the power plant design that has revolutionized the electric generating industry.

The course has been designed for new plant operators, supervisors, management, and other personnel who are involved in safely and effectively operating and maintaining combined cycle power plants. It will provide the attendee with a thorough understanding of the fundamentals of the individual components and the operating relationships between the components when joined into a Combined Cycle Power Plant.



OBJECTIVES:

Upon successful completion of this course the participant should be able to:

- Describe the thermodynamic principles associated with combined cycle power plants.
- Describe the principles and theory of combined cycle power plant design and operation.
- Describe the principles and theory of combustion turbine design and operation.
- Describe the principles and theory of heat recovery steam generator (HRSG) design and operation.
- Describe the principles and theory of steam turbine design and operation.
- Describe the principles and theory of generator design and operation.
- Describe the balance of plant systems associated with combined cycle power plants.
- Describe the steps in a cold start-up of a combined cycle power plant.
- Describe the factors involved in developing and implementing a maintenance program for a combined cycle power plant.
- Discuss factors affecting combined cycle power plant performance.

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COURSE ENROLLMENT

This course is offered for "on-site" presentation in three versions:

1. Generic Version – This course is presented using our standard, generic Introduction to Combined Cycle Power Plant text at your facility.

2. Custom Version 1 (Partial Customization) - This course is presented using our standard generic Introduction to Combined Cycle Power Plant text; but the presentation is customized using site and unit specific materials. FCS will provide the client with a detailed list of required reference materials. FCS will use these materials to provide a plant and unit specific student handout. The unit specific handout is used during the presentation.

3. Custom Version 2 (Fully Customized Training Manual) – Prior to the course presentation, FCS personnel will visit the site to gather reference materials, photograph key plant equipment, and discuss plant procedures and operating concerns with plant personnel. FCS will develop a unit specific training manual that covers the same topics included in the outline. This customize training manual will be used during the course presentation and will be provided in an editable electronic form so that additional copies can be printed and the materials can be further customized should changes at your plant warrant.

Contact Hal Grace, in Jacksonville, FL at (904) 272-9537 or at hgrace@fossilconsulting.com for information regarding technical content and pricing

CONTINUING EDUCATION UNITS

FCS is authorized to provide Continuing Education Units for successful completion of its training courses and seminars. 1.9 CEU will be awarded for successful completion of this session.

INSTRUCTORS

Harold Grace brings 30+ years experience to Fossil Consulting Services. He has provided Combined Cycle Power Plant training to over 500 individuals over the past several years. Prior to FCS, Mr. Grace was Vice President of HPC Technologies in Bradenton Florida. Prior to that he was Manager - Turbine Generator Services, for General Physics, where he was responsible for turbine generator training, engineering and consulting services. Mr. Grace was also employed by GE for 18 years in a number of capacities including Field Engineer, Senior Project Manager, Service Supervisor, Service Manager, and Manager of Power Generator Jacksonville Service Shop. He is a licensed Chief Engineer with the National Institute for the Uniform Licensing of Power Engineers, Inc (NIULPE), Ohio State Association of Power Engineers, Inc., a NIULPE Technical Instructor, Licensed Examiner, and is Chairman/President - NIULPE of Florida. Mr. Grace is a member of and Vice Chairman for the ASME Combined Cycle Power Plant Committee.

Mike McClintock has 30+ years of experience in the power generation industry, which includes 11 years with gas and steam turbine manufacturers and 19 years in development of plant operations and maintenance training programs and short courses. He has done erection, startup and maintenance of steam and gas turbines in a variety of plants. He has managed, developed and presented training for plant operations and maintenance personnel on steam and gas turbine operations and maintenance. His experience covers GE, Westinghouse, Allis Chalmers/Siemens, Pratt & Whitney, ABB, Dresser-Rand, Hitachi, Toshiba, and Mitsubishi equipment. He has successfully developed and presented courses on plant heat rate improvement for operators and engineering personnel. Mike is a licensed Professional Engineer in Maryland.

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COURSE OUTLINE

I. Introduction
- A. Introduction of Instructors
- B. Review Course Outline
- C. Discuss Course Text
- D. Class Participation
- E. Class Structure
- F. Course Objectives

II. Thermodynamic Principles
- A. Types of Energy
- B. Laws of Thermodynamics
  1. First & Second Laws
  2. T/S Diagrams
- C. Water and Steam
  1. Properties of Water
  2. Steam Tables
  3. Mollier Diagrams
- D. Heat Transfer
  1. Conduction, Convection, Radiation
  2. Energy Balance & Heat Transfer
- E. Combustion Theory
  1. Principles of Combustion
  2. Requirements for Complete Combustion
  3. Combustion Products
  4. Fuel Heating Value

III. Introduction to Combustion Turbines
- A. Turbine Function
- B. Component Description
  1. Turbine Flow
  2. Air Inlet Equipment
  3. Compressor Section
  4. Combustion Section
  5. Turbine Section
  6. Exhaust Section
  7. Bearings
  8. Compressor Rotor
  9. Turbine Rotor

IV. Combustion Turbine Systems
- A. Lube Oil System
- B. Hydraulic Supply
- C. Cooling and Sealing Air
- D. Fuel Gas System
- E. Fuel Oil System
- F. Fuel Forwarding System
- G. NOx Control System
- H. Atomizing Air System
- I. Inlet Guide Vane System
- J. Compressor Cleaning Sys.
- K. Inlet System
- L. Starting System
- M. Protection System
- N. HVAC System
- O. Electrical Distribution
- P. Gas Turbine Operations
  1. Pre-Start Inspections
  2. Normal Start Up
  3. Normal Ops. Checks
  4. Normal Shutdown
  5. Emerg. Procedures

V. Heat Recovery Steam Generators (HRSG)
- A. Overview
- B. Water and Steam Circuits
  1. Pressure Systems
  2. Gas Flow Path
- C. Major Components
- D. Auxiliary Equipment
  1. Deaerator
  2. Safety Valves
  3. Water Gauges and Indicators
- E. System Controls
  1. Drum Level Controllers
  2. Steam Temp. Ctl.
- F. Operational Procedures
  1. Pre-Ops. Checkout
  2. Initial filling
  3. Cold Start-up
  4. Warm Start-up
  5. Shutdown

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VI. Steam Turbines
- A. Turbine Principles
  1. Nozzles
  2. Buckets/Blades
- B. Turbine Construction
  1. Turbine Casings
  2. Stationary Blades and Diaphragms
  3. Turbine Seals
  4. Turbine Rotors/Spindles
  5. Turbine Buckets/Blades
  6. Pedestals/Standards
  7. Bearings
- C. Main Steam Valves
- D. Turbine Systems
  1. Lube Oil System
  2. Steam/Gland Seal System
  3. EHC Hydraulic System
- E. Turbine Supervisory Instrumentation
- F. Turbine Operation
  1. Pre-Start Inspections
  2. Starting and Loading Instructions
  3. Normal Ops. Checks
  4. Normal Shutdown
  5. Emerg. Procedures

VII. Generators
- A. Electrical Fundamentals
- B. AC Generators
- C. Generator Construction
- D. Generator Operations
  1. Pre-Start Insp.
  2. Synchronizing
  3. Normal Ops. Checks
  4. Normal Shutdown
  5. Abnormal Operation
- E. Generator Systems
- F. Excitation

VIII. Balance of Plant Systems
- A. Water Treatment System
- B. Closed Cooling Water System
- C. Circulating Water System
- D. Condensate System
- E. Feedwater System
- F. Compressed Air System
- G. Fuel Gas Supply System

IX. Integrated Plant Operation
- A. Pre-Start Inspections
- B. Normal Start Up
- C. Normal Ops. Checks
- D. Normal Shutdown
- E. Emerg. Procedures

XI. Combined Cycle Plant Performance
- A. Performance Calculations
- B. Performance Monitoring & Trending
- C. Performance Optimization

XI. Course Conclusion
- A. Review &Exam
- B. Closing Remarks