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# **Fossil Energy Power Plant Desk Reference**

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# Preface

The goal of Fossil Energy (FE) research, development, and demonstration (RD&D) is to ensure the availability of ultra-clean, abundant, low-cost, domestic electricity to fuel economic prosperity and strengthen energy security. A broad portfolio of technologies is being developed within the Clean Coal Program to accomplish this objective. Ever increasing technological enhancements are in various stages of the research “pipeline,” and multiple paths are being pursued to create a portfolio of promising technologies for RD&D and eventual deployment.

To benchmark the progress of Clean Coal RD&D, it is essential to establish a baseline for comparing the performance of today’s fossil energy plant technologies: Pulverized Coal (PC) Combustion, Integrated Gasification Combined Cycle (IGCC), and Natural Gas Combined Cycle (NGCC). NETL commissioned an in-depth analysis to estimate the performance and cost of state-of-the-art power plants taking into account the technological progress in recent years as well as dramatic escalation in labor and material costs. This desk reference provides a brief summary of the performance and cost estimates presented in the report titled, “Cost and Performance Baselines for Fossil Energy Plants, Vol. 1, DOE/NETL-2007/1281.” The plants use either bituminous coal or natural gas to generate electricity using technology that is available today or within the next couple of years for a planned start-up in 2010. All cases analyzed in the study were also designed with CO<sub>2</sub> capture, so that the cost and performance penalties could be estimated and benchmarked.

A key objective of this study was to provide an accurate, independent assessment of the cost and performance of the subject fossil energy plants. Accordingly, while input was sought from various technology vendors, the final assessment of performance and cost was determined independently, and may not represent the views of the technology vendors. The extent of collaboration with technology vendors varied from case to case, with minimal or no collaboration obtained from some vendors.

Steady-state simulations using the Aspen Plus (Aspen) modeling program were used to generate mass and energy balance data to assess system performance and size equipment. Performance and process limits were based upon published reports, information obtained from vendors and users of the technology, cost and performance data from design/build utility projects, and/or best engineering judgment. Capital and operating costs were estimated by WorleyParsons based on simulation results and through a combination of vendor quotes, scaled estimates from previous design/build projects, or a combination of the two.

This desk reference summarizes the results at the three levels listed below, allowing the user to drill down to the level of detail desired.

## Overview

A top-level overview is provided of all three technologies, with and without CO<sub>2</sub> capture.

### **Technology-Level**

The technology-level summaries drill down one level, to compare like-technologies both with and without CO<sub>2</sub> capture:

- IGCC Technology (*GE Energy, ConocoPhillips E-Gas, Shell*)
- PC Combustion Technology (*sub- and super-critical*)
- NGCC Technology

### **Plant-Level**

Plant-level summary sheets drill down an additional level, to describe each case in terms of the technical, economic, and environmental design basis. A plant description is outlined in some detail for each case, including mass and heat balance, efficiency, capital and operating costs, cost-of-electricity (COE), and cost of avoided CO<sub>2</sub> (if capture is included).

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**Fossil Energy Power Plant  
Desk Reference  
Bituminous Coal and Natural Gas to Electricity**

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NGCC Plant Cases

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