



NATIONAL ENERGY TECHNOLOGY LABORATORY



Bituminous Baseline Performance and Cost Interactive Tool *Documentation*

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**BITUMINOUS BASELINE PERFORMANCE AND COST
INTERACTIVE TOOL
*DOCUMENTATION***

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List of Acronyms and Abbreviations

\$/kW	Dollar per kilowatt
Btu/kWh	British thermal unit per kilowatt hour
CC	Carbon capture
CO ₂	Carbon dioxide
CoP	ConocoPhillips
gal/MWh	Gallon per megawatt hour
GEE	GE Energy
Hg	Mercury
HHV	Higher heating value
IGCC	Integrated gasification combined cycle
lb/hr	Pounds per hour
lb/MMBtu	Pounds per million British thermal units
lb/MWh	Pounds per megawatt hour
lb/TBtu	Pounds per trillion British thermal units
LCOE	Levelized cost of electricity
mills/kWh	Mills per kilowatt hour (1 mill = tenth of a cent)
MP	Multiple Plants
MW	Megawatt
NGCC	Natural gas combined cycle
NO _x	Oxides of nitrogen
PC Sub	Pulverized coal subcritical
PC Sup	Pulverized coal supercritical
PM	Particulate matter
SO ₂	Sulfur dioxide
tonnes/year	Metric ton per year
tons/year	Ton per year
TS&M	CO ₂ transport, storage, and monitoring

Introduction to the Tool

The Bituminous Baseline Performance and Cost Interactive Tool illustrates key data from the Cost and Performance Baseline for Fossil Energy Plants – Bituminous Coal and Natural Gas to Electricity report¹. The tool provides an interactive summary of the full report and serves as an electronic desk reference for quickly obtaining plant cost and performance data and for comparing and contrasting several technologies. This document serves as a general user's guide for navigating through the tool and to briefly explain the data. Further explanation of the data and methodology can be found in the full report mentioned above. This tool and the full report evaluate twelve cases for electricity production from fossil fueled plants. Table 1 shows the study matrix for the twelve cases.

Table 1 - Matrix for the Twelve Cases

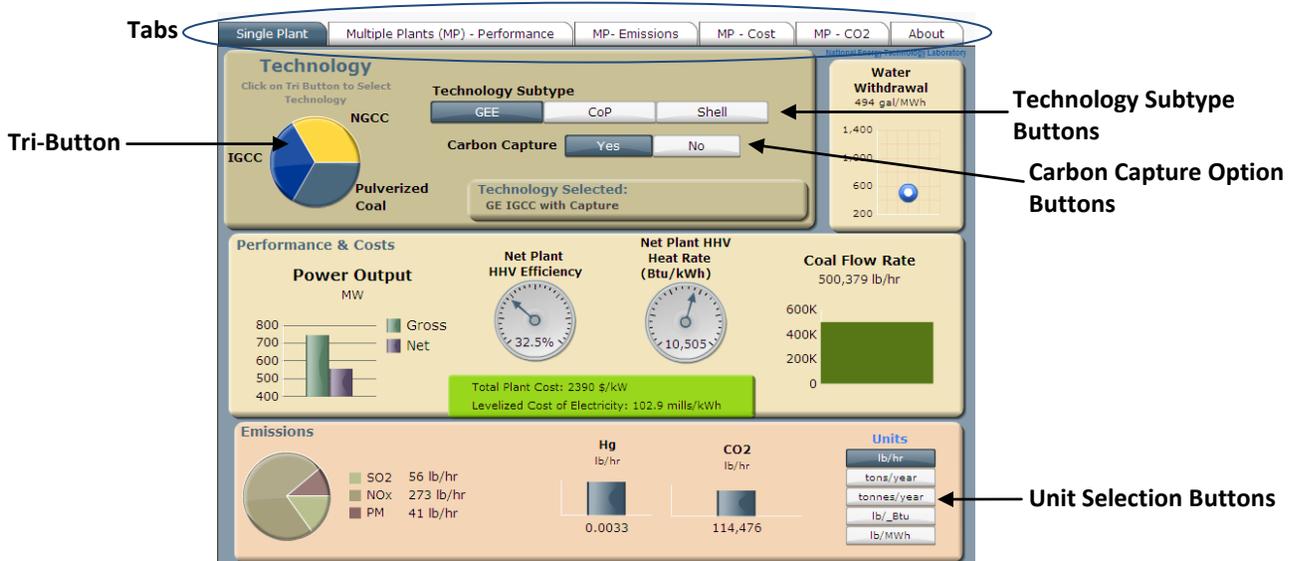
Fuel	Technology	Subtype	Carbon Capture
Bituminous Coal	IGCC	GEE	No
Bituminous Coal	IGCC	GEE	Yes
Bituminous Coal	IGCC	CoP	No
Bituminous Coal	IGCC	CoP	Yes
Bituminous Coal	IGCC	Shell	No
Bituminous Coal	IGCC	Shell	Yes
Bituminous Coal	Pulverized Coal	Subcritical	No
Bituminous Coal	Pulverized Coal	Subcritical	Yes
Bituminous Coal	Pulverized Coal	Supercritical	No
Bituminous Coal	Pulverized Coal	Supercritical	Yes
Natural Gas	NGCC	Advanced F-Class	No
Natural Gas	NGCC	Advanced F-Class	Yes

Using the Tool

Tabs

The Tool has 6 screen tabs located at the top of the screen. These tabs are used to navigate through the tool and are used to organize the data into several categories. Figure 1 shows the location and list of the tabs.

Figure 1 - Single Plant Screen with Tab Header Showing



The tab header will always be visible in all screens. Table 2 lists the tabs and provides a brief description on the content of each tab.

Table 2 - List of Tabs and Content

Tab Title	Content/function
Single Plant	Presents single plant data
Multiple Plants (MP) - Performance	Compares multiple plant performance data such as water withdrawal, heat rate, efficiency, gross output, and net output. Individual total plant cost and levelized cost of electricity are also presented.
MP - Emissions	Compares multiple plants emissions data such as CO ₂ , SO ₂ , NO _x , PM, and Hg
MP - Cost	Compares multiple plants costs such as total plant costs and levelized costs of electricity. The levelized cost of electricity is broken down in to capital, fixed, variable, fuel, and CO ₂ TS&M costs.
MP – CO ₂	Compares the avoided cost of capturing CO ₂ for multiple plants
About	Provides general information on the tool, a link to the Cost and Performance Baseline report, and key notes relevant to the data listed

Single Plant Tab

The *Single Plant* tab displays data for a single plant based on the selected technology. This tab provides a quick specification sheet for the selected plant. There are twelve plant configurations to choose from. To select one of the configurations, first select the general technology by clicking on one of the sections in the **Tri-Button**. Next, select the specific technology by clicking on one of the given *Technology Subtype* buttons. Finally, choose if the plant will incorporate carbon capture technologies for capturing CO₂. Figure 1 shows the *Tri-Button*, *Technology Subtype*, *Carbon Capture* options, and *Unit* select button locations.

The next two areas in the *Single Plant* tab are the performance and emissions areas. The user may select the units for the emissions data by clicking on one of the units buttons on the lower right hand side. Table 3 lists the performance and emissions data available in the *Single Plant* tab and any notes that may pertain to the data.

Table 3 - Performance and Emissiond Data in Single Plant Tab

Data	Notes
Gross Power Output in MW	
Net Power Output in MW	
Net Plant HHV Efficiency	Percentage
Net Plant Heat Rate	Units in Btu/kWh
Coal or Natural Gas Fuel Flow Rate	
Total Plant Cost	

Levelized Cost of Electricity	LCOE based on an 80% capacity factor for IGCC cases and 85% capacity factor for the PC and NGCC cases
Water Withdrawal	Based on net generation – gal/MWh _{net}
SO ₂ , NOx PM, Hg, and CO ₂ Emissions	The units in for the emissions can be changed by clicking on the Units button on the right hand side. The space in lb/_Btu is a place hold for lb/MBtu or lb/TBtu.

Multiple Plants (MP) – Performance Tab

The *Multiple Plants (MP) – Performance* tab contains three subsections within the tab which look at water use, heat rate/efficiency, and gross/net output for the twelve plants. Use the list builder to select from 1 to 12 plants. See the List Builders section on how to create and organize lists. The relative water withdrawal is calculated from the net output of the plant.

MP – Emissions Tab

The *MP – Emissions* tab allows the user to look at CO₂, SO₂, NOx, PM, and Hg emissions for the twelve plants. For each of the five emissions, the user can select one of the five specific units: lb/hr, ton/year, tones/year, lb/MMBtu, and lb/MWh. The relative unit, lb/MWh is calculated from the net output of the plant. Use the list builder to select from 1 to 12 plants. See the List Builders section on how to create and organize lists.

MP – Cost Tab

The *MP – Cost* tab allows the user to look at the Total Plant Costs and LCOE for the twelve plants. When the LCOE button is selected, an additional five buttons will appear on the lower right corner. These buttons control the visibility of the capital, fix, variable, fuel, and CO₂ TS&M costs segments of the overall LCOE. “On” adds the segment and “Off” removes the segment from the graph. The avoided cost is calculated by the following equation:

$$Avoided\ Cost = \frac{(COE_{with\ removal} - LCOE_{w/o\ removal})\ \$/MWh}{(Emissions_{w/o\ removal} - Emissions_{with\ removal})\ tons/MWh}$$

The LCOE with CO₂ removal includes the costs of capture and compression as well as TS&M costs. Use the list builder to select from 1 to 12 plants. See the List Builders section on how to create and organize lists.

MP – CO2 Tab

The *MP – CO2* tab allows the user to look at the avoided cost of capturing the CO₂ for the six plants with carbon capture. Units are in \$/ton of CO₂. Use the list builder to select from 1 to 6 plants. See the List Builders section on how to create and organize lists.

About Tab

The About tab provides general information on the tool and it provides a link to the Cost and Performance Baseline report and this documentation. A few general key notes relevant to the data listed on this page.

List Builders

The four Multiple Plants (MP) tabs use list builders for selecting the technologies and sending the selections to the graphs. To use a list builder and active a graph, first select a technology in the *Source* box and click on the *Add* button to move the section to the *Destination* box. An alternative to using the *Add* button is to double click on the selection. The selections in the *Destination* box can be reordered by dragging them up or down. The order of the selections in the *Destination* box is the order in which they will be graphed. Press the *Update* button to graph the selections in the *Destination* box. To remove a selection from the *Destination* box, select the entry and click on the *Remove* button (or just double click on the selection). Then click on the update button to re-graph. To select and move more than one technology, click on the first technology, hold the shift key down and then click on the last technology in the row. All group of technologies selected will now be highlighted. Next, press the *Add* or *Remove* buttons to move the selected group to the desired box. Note that you must click on the *Update* button anytime you make changes to the *Destination* box in order for you graph to update.

Reading Values Off of Charts

The majority of the data is presented as bar and line charts. Exact values can be read off of the charts by hovering with the mouse pointer over the bar or area for those graphs that do not have the numeric values directly added to the chart. A box will pop up with the data name and value.

Data Source and Reference

¹ DOE/NETL, Cost and Performance Baseline for Fossil Energy Plants – Bituminous Coal and Natural Gas to Electricity, DOE/NETL 20071281.
http://www.netl.doe.gov/energy-analyses/pubs/Bituminous%20Baseline_Final%20Report.pdf