NETL Life Cycle Inventory Data
Process Documentation File

Process Name: NGCC Power Plant, Construction

Reference Flow: 1 pcs. of NGCC Power Plant (NETL baseline)

Brief Description: Material input for the construction of the NETL baseline NGCC plant with or without CCS

Section I: Meta Data

Geographical Coverage: US **Region:** United States

Year Data Best Represents: 2000

Process Type: Manufacturing Process (MP)

Process Scope: Gate-to-Gate Process (GG)

Allocation Applied: No

Completeness: Individual Relevant Flows Captured

Flows Aggregated in Data Set:

☑ Process ☐ Energy Use ☐ Energy P&D ☐ Material P&D

Relevant Output Flows Included in Data Set:

Releases to Air:	☐ Greenhouse Gases	☐ Criteria Air	☐ Other
Releases to Water:	☐ Inorganic	☐ Organic Emissions	☐ Other
Water Usage:	☐ Water Consumption	☐ Water Demand (throughput)	
Releases to Soil:	☐ Inorganic Releases	☐ Organic Releases	☐ Other

Adjustable Process Parameters:

CCS	*[binary] If CO2 in flue gas is routed to CO2 recovery, value = 1. If CO2 in flue gas is released to atmosphere, value = 0.*

Tracked Input Flows:

Concrete, ready mix, R-5-0 [Valuable substances]	*[Technosphere] Amount of concrete required to construct a single NGCC power plant*
Steel cold rolled (St) [Metals]	*[Technosphere] Amount of steel required to construct a single NGCC power plant*
Steel pipe [Metals]	*[Technosphere] Amount of steel pipe required to construct a single NGCC power plant*
Cast iron part [Metal parts]	*[Technosphere] Amount of cast iron required to construct a single NGCC power plant*
Aluminum sheet [Metas]	*[Technosphere] Amount of aluminum required to construct a single NGCC power plant*
Stainless steel (cold rolled) [Metals]	*[Technosphere] Amount of stainless steel required to construct a single NGCC power plant*

Tracked Output Flows:

NGCC Power Plant (NETL baseline) [construction processes] *Reference flow*

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage_3_C_NGCC-Power-Plant-Baseline.xls*, which provides additional details regarding relevant calculations, data quality, and references.

Goal and Scope

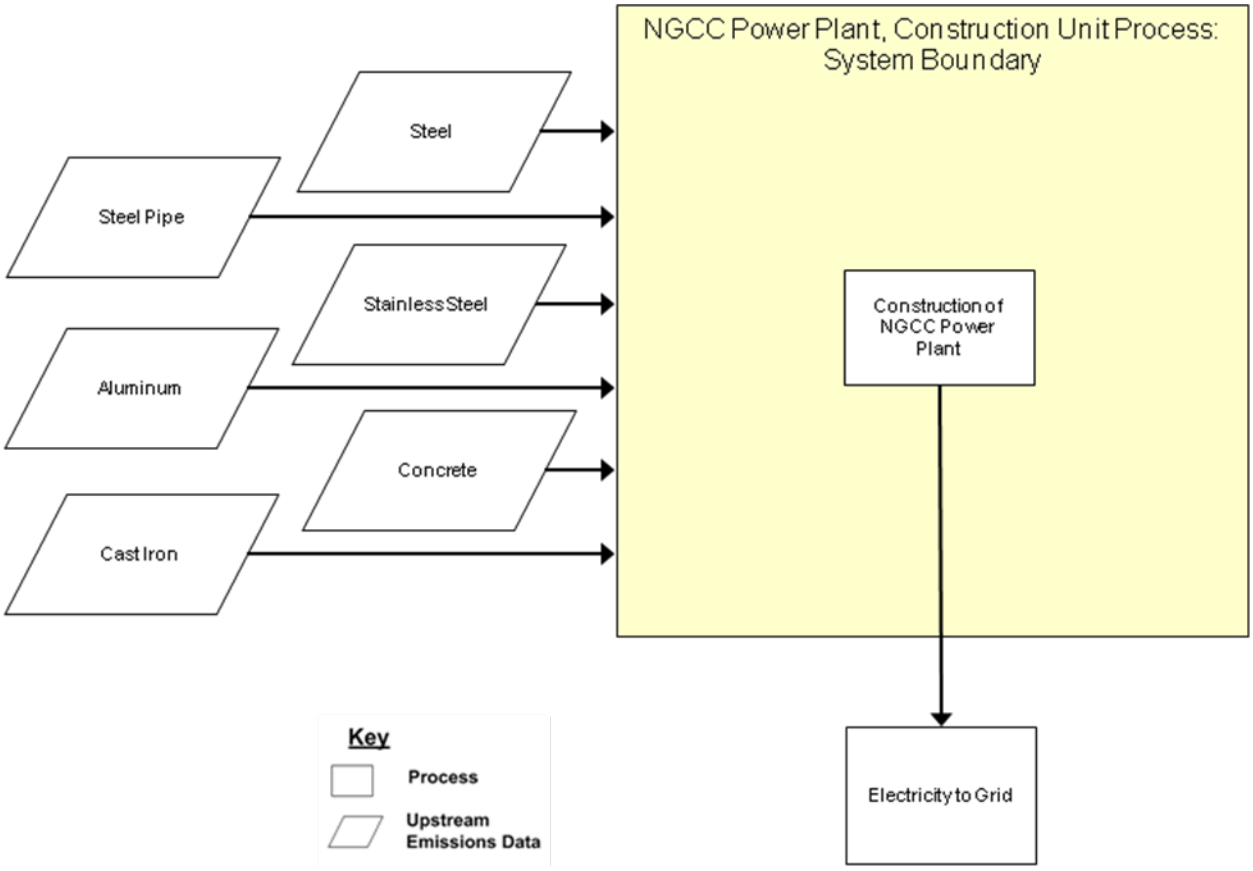
This unit process provides a summary of relevant input and output flows associated with the construction of a natural gas combined cycle (NGCC) power plant. This process can be used for scenarios with and without carbon capture and sequestration (CCS). Key inputs include concrete, steel, steel pipe, stainless steel, aluminum, and cast iron. The key output is one NGCC power plant. The

reference flow of this unit process is: 1 pcs. of NGCC Power Plant (NETL baseline).

Boundary and Description

Figure 1 provides an overview of the boundary of this unit process. Emissions related to the physical assembly of the NGCC power plant are not included in this study. Upstream emissions from the production of raw materials used for the construction of the power plant (e.g., concrete) are calculated outside the boundary of this unit process, based on proprietary profiles available within the GaBi model.

Figure 1: Unit Process Scope and Boundary



Data for power plant construction were taken from six studies that listed two to four major materials for construction. The materials for the construction of the plant, according to the various studies were concrete, steel, steel pipes, stainless steel, cast iron, and aluminum (EPRO, 2006; Koornneef et al., 2008; Meier et al., 2000; Peterson, 2008; Spath et al., 2000; Tahara et al., 1997). As needed, the amount of each construction material given in the studies was divided by the net output for the plant serving as the basis in each study to put materials on a per MW net plant capacity basis. The material usage rates were then averaged and converted to kilograms. The

averaged material usage rates were multiplied by the net plant capacity for the NETL baseline plants (555.080 MW non-CCS and 473.570 MW w/ CCS) to give total construction quantities for one constructed NGCC power plant (NETL, 2010). The smaller total construction quantity for the plant with CCS is reasonable since the gross power output for the plant with CCS is smaller than that of the non-CCS plant (564.7 MW non-CCS and 511.0 MW with CCS). The material usage is expected to be similar for the plants when the construction materials are placed on a per MWh basis in the GaBi model.

Table 1: Unit Process Input and Output Flows

Flow Name	Value w/o CCS	Value w/ CCS	Units (Per Reference Flow)
Inputs			
Concrete, ready mix, R-5-0 [Valuable substances]	3.90E+07	3.38E+07	kg
Steel cold rolled (St) [Metals]	1.86E+07	1.60E+07	kg
Steel pipe [Metals]	4.66E+06	3.97E+06	kg
Cast iron part [Metal parts]	1.40E+05	1.20E+05	kg
Aluminum sheet [Metas]	1.20E+05	1.03E+05	kg
Stainless steel (cold rolled) [Metals]	N/A	4.18E+04	kg
Outputs			
NGCC Power Plant (NETL baseline) [construction processes]	1	1	pcs.

* **Bold face** clarifies that the value shown *does not* include upstream environmental flows.

Embedded Unit Processes

None.

References

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Koornneef, J., van Keulen, T., Faaij, A., & Turkenburg, W. (2008). Life cycle assessment of a pulverized coal power plant with post-combustion capture, transport and storage of CO2. *International Journal of Greenhouse Gas Control, 2*(4), 448-467. doi: 10.1016/j.ijggc.2008.06.008

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NETL. (2010). *Cost and Performance Baseline for Fossil Energy Plants, Volume 1: Bituminous Coal and Natural Gas to Electricity Report*. (DOE/NETL-2010/1397). Pittsburgh, PA: National Energy Technology Laboratory Retrieved June 5, 2012, from http://www.netl.doe.gov/energy-analyses/pubs/BitBase_FinRep_Rev2.pdf

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Tahara, K., Kojima, T., & Inaba, A. (1997). Evaluation of CO2 payback time of power plants by LCA. *Energy Conversion and Management, 38, Supplement*(0), S615-S620. doi: 10.1016/s0196-8904(97)00005-8

Section III: Document Control Information

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