



NETL Life Cycle Inventory Data

Process Documentation File

Process Name: IGCC Power Plant, Construction
Reference Flow: 1 Pcs of IGCC Power Plant (NETL baseline)
Brief Description: Material input for the construction of the NETL baseline integrated gasification combined cycle (IGCC) plant with or without carbon capture and sequestration (CCS)

Section I: Meta Data

Geographical Coverage: USA **Region:** Midwest
Year Data Best Represents: 2005
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

Tracked Input Flows:

Concrete, ready mix, R-5-0 [Valuable substances] *[Technosphere] Amount of concrete required to construct a single IGCC power plant*

Steel cold rolled (St) [Metals] *[Technosphere] Amount of steel required to construct a single IGCC power plant*

Steel pipe [Metals]	<i>[Technosphere] Amount of steel pipe required to construct a single IGCC power plant</i>
Cast iron part [Metal parts]	<i>[Technosphere] Amount of cast iron required to construct a single IGCC power plant</i>
Aluminum sheet [Metals]	<i>[Technosphere] Amount of aluminum required to construct a single IGCC power plant</i>

Tracked Output Flows:

IGCC 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) *Stage-3-C-IGCC_Power_Plant_baseline.xls*, which provides additional details regarding relevant calculations, data quality, and references.

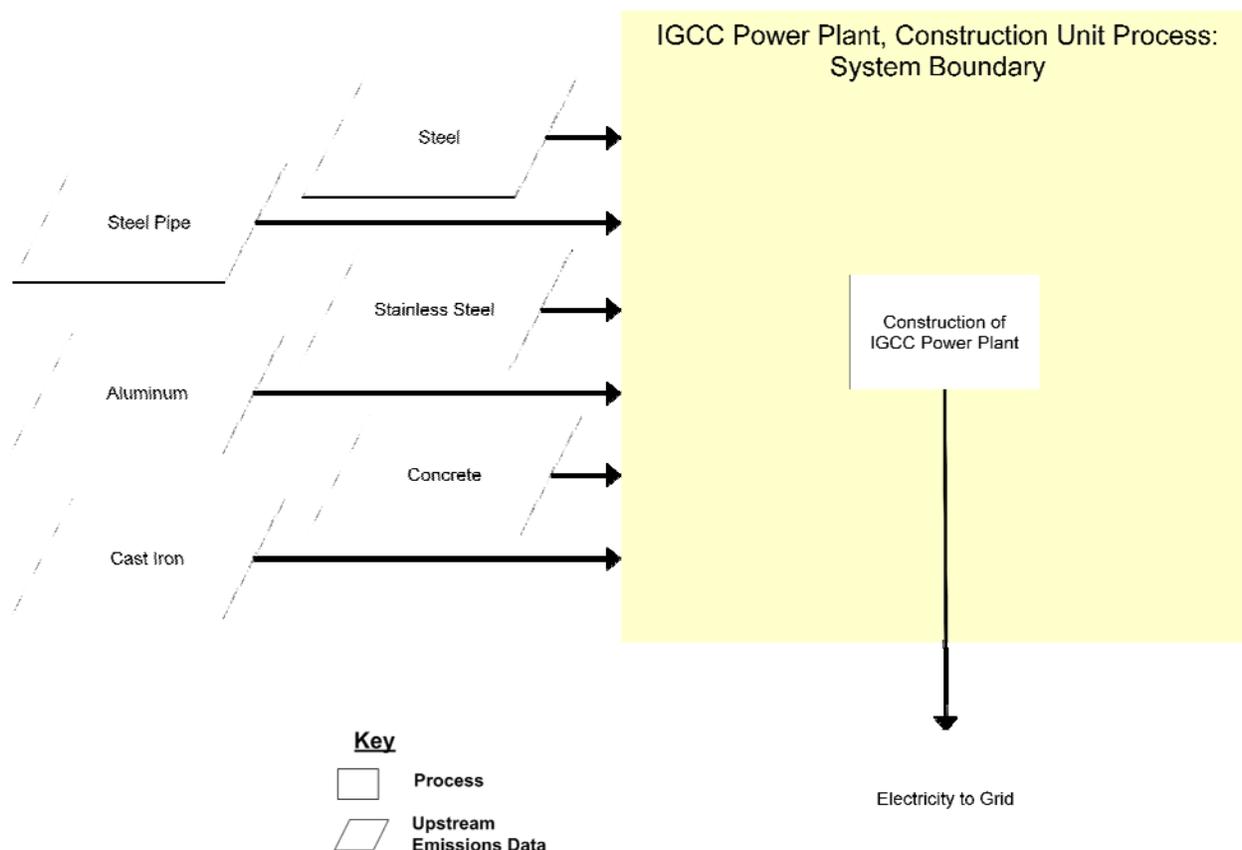
Goal and Scope

This unit process provides a summary of relevant input and output flows associated with the construction of an integrated gasification combined cycle (IGCC) 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 IGCC power plant. The reference flow of this unit process is: 1 Pcs of IGCC Power Plant.

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 the construction of the power plant were taken from five studies, each of which listed the amounts of between three and five major materials for construction. These five studies included data on seven operating, proposed, or hypothetical IGCC plants. The materials for the construction of the plant, according to the various studies, were concrete, steel, steel pipes, iron, and aluminum (ConocoPhillips, 2005; ELCOGAS, 2000; Fiaschi et al., 2010; Sears, 2008; Spath et al., 1999). 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 non-CCS plant capacity, 622.05 MW (NETL, 2010), to provide a bulk material usage. The bulk usage rates are the inputs to the UP.

The non-CCS bulk material usages were considered applicable to the case with CCS because the main difference between the two cases is a different Selexol process (one-stage vs. dual stage), which is considered negligible, and because the gross power outputs for the plants are essentially the same. When this UP is used in a GaBi model, the two cases will be differentiated when the construction



materials are placed on a per MWh basis according to their different net outputs, 622.05 MW for non-CCS and 543.25 MW with CCS (NETL, 2010).

The data for the rail spur was taken from information from the American Railway Engineering Association (ICRR 2007). The weight of rail, in lb/yd, was converted to kg/mile and then multiplied by 25, the assumed length of the rail spur from the main line to the power plant. The rail was assumed to be constructed of cold rolled steel.

Table 1: Unit Process Input and Output Flows

Flow Name	Value	Units (Per Reference Flow)
Inputs		
Concrete, ready mix, R-5-0 [Valuable substances]	1.42E+08	kg
Steel cold rolled (St) [Metals]	2.08E+07	kg
Steel pipe [Metals]	2.84E+06	kg
Cast iron part [Metal parts]	4.04E+05	kg
Aluminum sheet [Metals]	2.61E+05	kg
Outputs		
IGCC Power Plant (NETL baseline) [construction processes]	1.00	

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

Embedded Unit Processes

None.

References

- ConocoPhillips. (2005, June 15, 2005). *E-Gas Technology for Coal Gasification*. Paper presented at the Sixth Partnership Activity. Retrieved August 22, 2012, from http://narucpartnerships.org/Documents/Terre_Haute_Wabash_Coal_Gasification_Plant.pdf
- ELCOGAS. (2000). *IGCC Puertollano: A Clean Coal Gasification Power Plant*. Spain: ELCOGAS Retrieved August 22, 2012, from <http://www.elcogas.es/images/stories/5-tecnologia-gicc/thermie.pdf>
- Fiaschi, D., & Lombardi, L. (2010). *Integrated Gasifier Combined Cycle Plant with Integrated CO₂ – H₂S Removal: Performance Analysis, Life Cycle Assessment and Exergetic Life Cycle Assessment*.
- 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
- Sears, R. (2008). *Edwardsport IGCC Project Update*. Paper presented at the 2008 GTC Conference, Washington, D. C. Retrieved August 22, 2012, from <http://www.gasification.org/uploads/downloads/Conferences/2008/16SEARS.pdf>
- Spath, P. L., Mann, M. K., & Kerr, D. R. (1999). *Life Cycle Assessment of Coal-fired Power Production*. (NREL/TP-570-25119). Golden, CO: National Renewable Energy Laboratory Retrieved August 21, 2012, from <http://www.nrel.gov/docs/fy99osti/25119.pdf>



Section III: Document Control Information

Date Created: September 20, 2012

Point of Contact: Timothy Skone (NETL), Timothy.Skone@NETL.DOE.GOV

Revision History:

Original/no revisions

How to Cite This Document: This document should be cited as:

NETL (2012). NETL Life Cycle Inventory Data – Unit Process: IGCC Power Plant, Construction. U.S. Department of Energy, National Energy Technology Laboratory. Last Updated: September 2012 (version 01). www.netl.doe.gov/energy-analyses (<http://www.netl.doe.gov/energy-analyses>)

Section IV: Disclaimer

Neither the U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) nor any person acting on behalf of these organizations:

- A. Makes any warranty or representation, express or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this document, or that the use of any information, apparatus, method, or process disclosed in this document may not infringe on privately owned rights; or
- B. Assumes any liability with this report as to its use, or damages resulting from the use of any information, apparatus, method, or process disclosed in this document.

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by NETL. The views and opinions of the authors expressed herein do not necessarily state or reflect those of NETL.