NETL Life Cycle Inventory Data
Process Documentation File

Process Name:	Coal to Methanol
Reference Flow:	1 kg of methanol
Brief Description:	Calculates flows related to the production of methanol using coal as the primary feedstock

Section I: Meta Data

Geographical Coverage:	USA	**Region:** General Midwest	
Year Data Best Represents:	2014		
Process Type:	Energy Conversion (EC)		
Process Scope:	Gate-to-Gate Process (GG)		
Allocation Applied:	No		
Completeness:	All 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:

CO2	*[kg/kg] amount of carbon dioxide released per kg methanol produced*
fly_ash	*[kg/kg] amount of fly ash produced per kg methanol*
NG	*[kg/kg] amount of natural gas required to produce 1 kg of methanol*
slag	*[kg/kg] amount of slag produced per kg methanol*

sulfur	*[kg/kg] amount of sulfur emitted per kg methanol produced*
water_consumed	*[kg/kg] amount of water consumed during processing per kg methanol produced*
water_in	*[kg/kg] amount of water withdrawn per kg methanol produced*
wet_coal	*[kg/kg] amount of coal (before drying) consumed per kg methanol produced*

Tracked Input Flows:

natural gas [resource]
Water (Unspecified) [Water]   *[Resource]*
Powder River Basin coal   *[Resource]*

Tracked Output Flows:

methanol [intermediate]   *Reference flow*
Carbon dioxide [Inorganic emissions to air]   *Emission to air*
Water (wastewater) [Water]   *Renewable resources*
solid sulfur product   *secondary product*
fly ash [solid waste]   *solid waste*
slag [solid waste]   *solid waste*

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS__Stage3_O_Coal_to_Methanol_2015.01.xlsx*, 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 production of methanol using coal. The system gasifies coal to produce syngas used to make methanol. Natural gas is used to power a turbine for the energy required for the system. No excess power is produced to be sold to the grid. The reference flow of this unit process is 1 kg of methanol.

Boundary and Description

Methanol is produced from coal by gasifying coal to create syngas which is then converted to methanol. Coal gasification produces sulfur, solid waste as well as air emissions. The syngas to methanol process produces carbon dioxide as an emission to air. The scope and boundary are illustrated in **Figure 1**.

This unit process uses a 2014 NETL report for all data. The report models a natural gas to methanol plant which uses this process to produce approximately 10,000 metric tons of methanol per day. The plant also uses natural gas-powered turbines to provide all auxiliary power for the plant. The data from the model were used to calculate the default parameters shown in **Table 1**. The resulting inputs and outputs for the unit process are shown in **Table 2.**

Figure 1: Unit Process Scope and Boundary
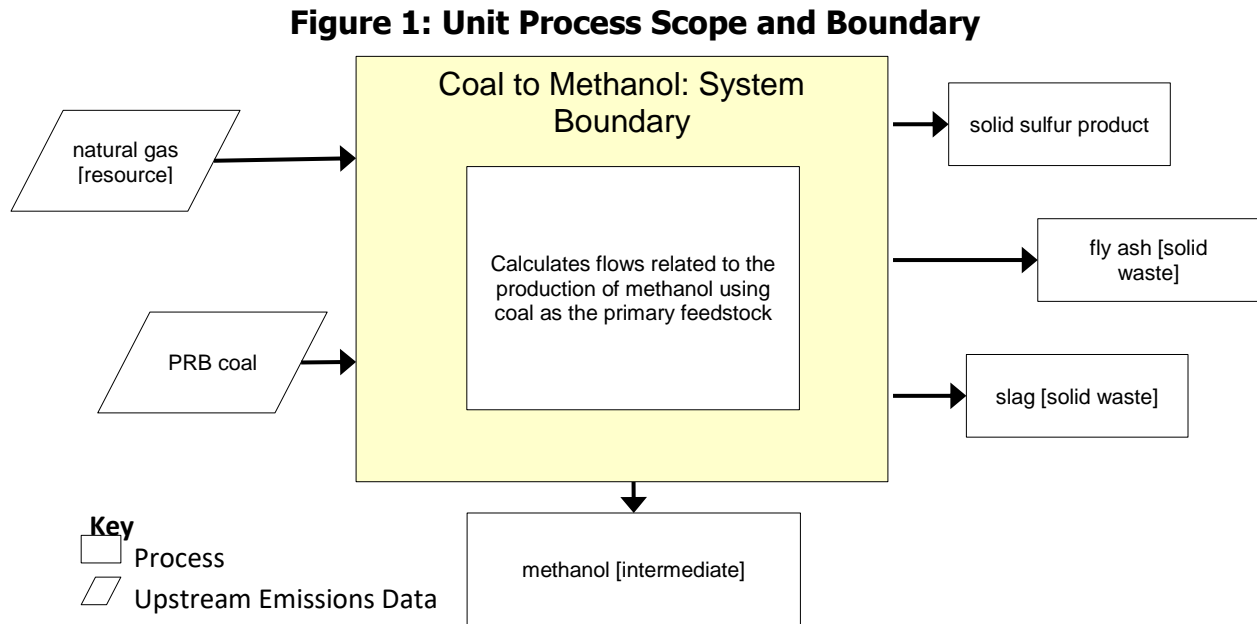
Table 1: Adjustable Parameter Default Values

Variable Name	Value	Unit (Per kg methanol produced)	Reference
CO2	1.70E+00	kg	NETL 2014
fly_ash	2.71E-02	kg	NETL 2014
NG	1.44E-02	kg	NETL 2014
slag	9.02E-02	kg	NETL 2014
sulfur	1.23E-02	kg	NETL 2014
water_consumed	2.66E+00	kg	NETL 2014
water_in	5.91E+00	kg	NETL 2014
wet_coal	1.72E+00	kg	NETL 2014

DF__Stage3_O_Coal_to_Methanol_2015.01.docx

Table 2: Unit Process Input and Output Flows

Flow Name	Value	Units (Per Reference Flow)
Inputs		
natural gas [resource]	**0.01**	**kg**
Water (Unspecified) [Water]	5.91	kg
FIND COAL TYPE	**1.72**	**kg**
Outputs		
methanol [intermediate]	**1.00**	
Carbon dioxide [Inorganic emissions to air]	1.70	kg
Water (wastewater) [Water]	3.25	kg
solid sulfur product	**0.01**	**kg**
fly ash [solid waste]	**0.03**	**kg**
slag [solid waste]	**0.09**	**kg**

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

Embedded Unit Processes

None.

References

NETL, 2014   National Energy Technology Laboratory (NETL), 2014. Baseline Analysis of Crude Methanol Production from Coal and Natural Gas https://www.netl.doe.gov/File%20Library/Research/Energy%20Analysis/Publications/Crude-Methanol-Report-Final-20141015.pdf (Accessed July 10, 2015)

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Section III: Document Control Information

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