NETL Life Cycle Inventory Data
Process Documentation File

Process Name:	CTL Diesel, Pathways
Reference Flow:	1 kg of diesel
Brief Description:	Coal-to-liquids (CTL) via Fischer-Tropsch synthesis using Illinois No. 6 coal as a feedstock using advanced technologies

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Section I: Meta Data

Geographical Coverage:	United States **Region:** Midwest
Year Data Best Represents:	2013
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_air	*[kg/kg] kg CO_2 emission to air per kg diesel*
CO2_saline	*[kg/kg] kg CO_2 captured per kg diesel*
Diesel	*[kg/kg] kg diesel produced*
Elec	*[MWh/kg] MWh power exported per kg diesel*

Naphtha

[kg/kg] kg naphtha produced per kg diesel

I6

[kg/kg] kg Illinois No. 6 coal per kg diesel

Tracked Input Flows:

Hard Coal (Illinois No 6) [Intermediate]

[Technosphere] Illinois No. 6 coal feedstock to CTL plant

Tracked Output Flows:

FT Diesel [Valuable substances]   *Reference flow*
FT Naphtha [Valuable substances]   *Co-product*
Electricity [Electric power]   *Co-product*
Carbon dioxide [Inorganic intermediate product]   *Sent to sequestration*

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage3_O_CTL_Diesel_2013.1.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 coal-to-liquids (CTL) via Fischer-Tropsch (FT) synthesis using Illinois No. 6 coal as a feedstock. The gasifier system is a dry-feed, single-stage, entrained flow system similar to Shell Global Solutions commercial design. The system is optimized for diesel production over naphtha. Carbon capture is enhanced by a water-gas shift reactor that converts CO to CO_2 and a dual-stage Rectisol® unit that removes CO_2 prior to FT synthesis. This unit process includes scenarios for vented CO_2 and CO_2 captured for sequestration. The reference flow of this unit process is 1 kg of diesel

Boundary and Description

This unit process provides a summary of relevant input and output flows associated with coal-to-liquids (CTL) via Fischer-Tropsch (FT) synthesis using Illinois No. 6 coal as a feedstock. The gasifier system is a dry-feed, single-stage, entrained flow system similar to Shell Global Solutions commercial design. The system is optimized for diesel production over naphtha. Carbon capture is enhanced by a water-gas shift reactor that converts CO to CO_2 and a dual-stage Rectisol® unit that removes CO_2 prior to FT synthesis.

The only input to this unit process is Illinois No. 6 coal, the feedstock. The CTL product produces diesel, naphtha, electricity, and carbon dioxide that can be sent to a saline aquifer sequestration site. The reference flow of this unit process is 1 kg of diesel. All input and output flows are expressed on the basis of this reference flow. The boundaries of this unit process are shown in **Figure 1**.

Figure 1: Unit Process Scope and Boundary
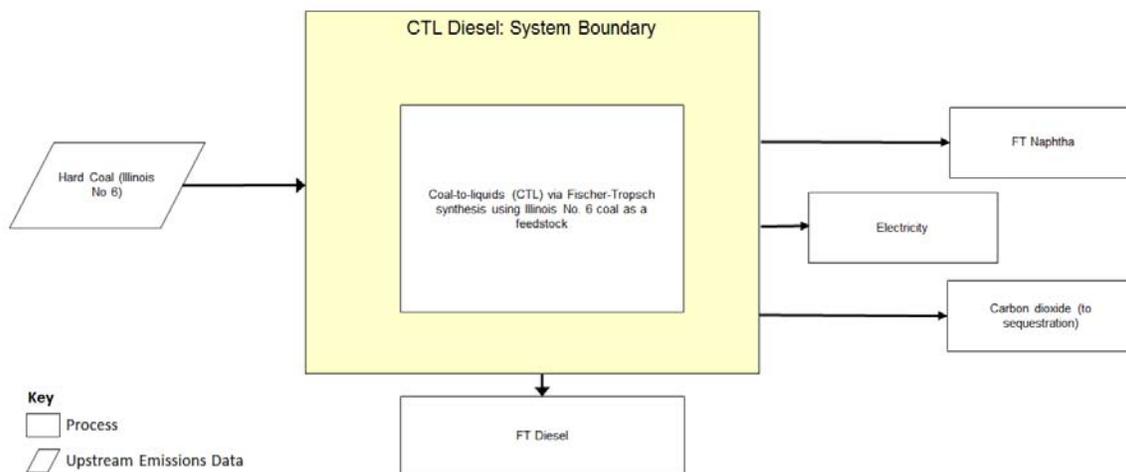
This unit process includes data for six cases. These cases include three tiers of technology (a reference configuration, a second generation configuration, and an "all-in transformational configuration"). Each of these three configurations has a case with CO_2 sequestration and a case with CO_2 venting. All cases use Illinois No. 6 coal as a feedstock. **Table 1** summarizes the six cases.

DF_Stage3_O_CTL_20130510_Diesel_2013.1.docx

Table 1: CTL Case Descriptions

Case Name	Case Description	Coal Feedstock	CO$_2$ Captured for Sequestration?
Case A	CTL reference configuration	Illinois No. 6	Yes
Case AV	Venting CTL Reference Configuration	Illinois No. 6	No
Case B	All-In Second Generation CTL Configuration	Illinois No. 6	Yes
Case BV	Venting All-In Second Generation CTL Configuration	Illinois No. 6	No
Case C	All-In Transformational CTL Configuration	Illinois No. 6	Yes
Case CV	Venting All-In Transformational CTL Configuration	Illinois No. 6	No

DF_Stage3_O_CTL_20130510_Diesel_2013.1.docx

Table 2: Unit Process Input and Output Flows

Flow Name	Case A	Case AV	Case B	Case BV	Case C	Case CV	Units (Per Reference Flow)
Inputs							
Hard Coal (Illinois No 6) [Intermediate]	4.86	4.89	5.04	5.05	5.01	4.99	kg
Outputs							
FT Diesel [Valuable substances]	1.00	1.00	1.00	1.00	1.00	1.00	kg
Carbon dioxide [Inorganic emissions to air]	0.88	7.11	0.78	7.49	0.91	7.36	kg
FT Naphtha [Valuable substances]	0.42	0.42	0.42	0.42	0.42	0.42	kg
Electricity [Electric power]	5.98E-04	1.19E-03	2.40E-03	3.10E-03	3.48E-03	3.78E-03	MWh
Carbon dioxide [Inorganic intermediate products]	6.17	0.00	6.69	0.00	6.49	0.00	kg

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

Embedded Unit Processes

None.

References

NETL, 2013   NETL. (2013). CTL Pathway Study. DOE /NETL-341/051013.

Section III: Document Control Information

Date Created: August 22, 2013

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Revision History:

Original/no revisions

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

NETL (2013). NETL Life Cycle Inventory Data – Unit Process: CTL Diesel. U.S. Department of Energy, National Energy Technology Laboratory. Last Updated: August 2013 (version 01). www.netl.doe.gov/LCA (http://www.netl.doe.gov/LCA)

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