NETL Life Cycle Inventory Data
Process Documentation File

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

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 CO2 emission to air per kg diesel*
CO2_saline	*[kg/kg] kg CO2 captured for sequestration 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*

Sulfur   *[kg/kg] kg sulfur produced 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]   *Coproduct*
Electricity [Electric power]   *Coproduct*
Carbon dioxide [Inorganic intermediate products] *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_Baseline4_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. 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. In addition to diesel and naphtha, electricity and captured CO_2 are also produced. 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 reference flow of this unit process is 1 kg of diesel. All inputs and outputs are expressed on the basis of this reference flow.

This unit process includes two scenarios: a scenario with CO_2 captured for sequestration and a process with CO_2 vented to the atmosphere.

Figure 1 shows the boundaries of this unit process.

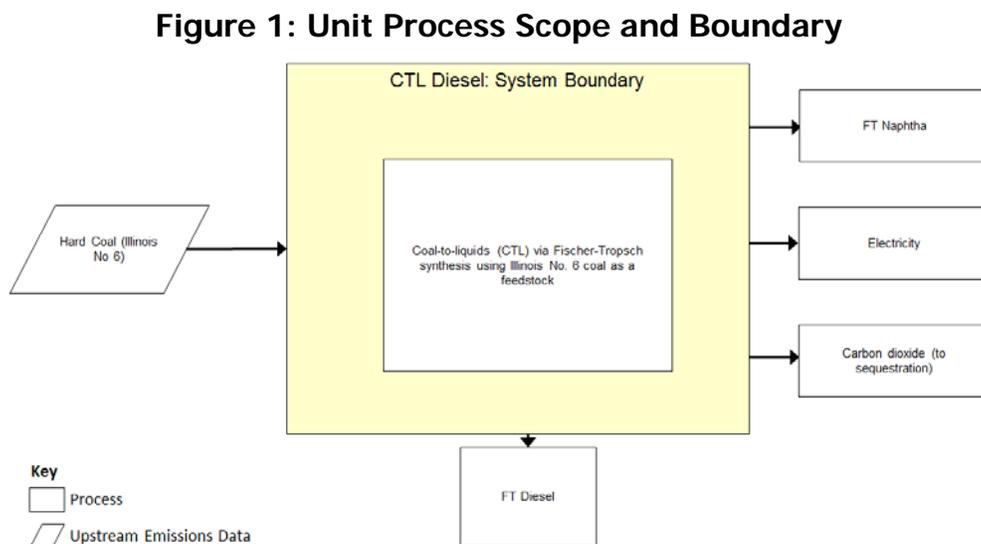## Figure 1: Unit Process Scope and Boundary

Table 1 summarizes the scenarios included in this unit process. **Table 2** shows the inputs and outputs for each scenario, on the basis of the reference flow of 1 kg of diesel that is produced by the CTL plant.

DF_Stage3_O_CTL_Diesel_Baseline4_2013.1.docx

Table 1: CTL Scenarios Included in this Unit Process

Scenario Name	Feedstock	CO₂ Capture?
CO$_2$ Sequestration Case	Illinois No. 6 Coal	Yes
CO$_2$ Vent Case	Illinois No. 6 Coal	No

Table 2: Unit Process Input and Output Flows

Flow Name	Value		Units (Per Reference Flow)
Inputs			
Hard Coal (Illinois No 6) [Intermediate]	**4.42**	4.42	kg
Outputs			
FT Diesel [Valuable substances]	**1.00**	1.00	kg
Carbon dioxide [Inorganic emissions to air]	**0.50**	6.06	kg
FT Naphtha [Valuable substances]	**0.38**	0.39	kg
Electricity [Electric power]	**2.62E-05**	5.41E-04	MWh
Carbon dioxide [Inorganic intermediate products]	**5.56**	0	kg
Sulfur	0.11	0.11	kg

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

Embedded Unit Processes

None.

References

NETL, 2013   NETL. (2013). Cost and Performance Baseline for Fossil Energy Plants, Volume 4: Coal-to-Liquids via Fisher-Tropsch Synthesis.

Section III: Document Control Information

Date Created: August 23, 2013

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