



NETL Life Cycle Inventory Data

Process Documentation File

Process Name: Synergistic Production of Transport Fuels from Coal
Reference Flow: 1 kg or MWh of Primary product
Brief Description: Coal-to-liquids (CTL) synthesis using Illinois No. 6 coal via dedicated Fischer-Tropsch facilities or with (F-T) integration with an Integrated Gasification Combined Cycle power plant.

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:

None.

Tracked Input Flows:

Hard Coal (Illinois No 6) [Intermediate]

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

Water [Water]

*[Resource] Process water***Tracked Output Flows:**

FT Diesel [Valuable substances]	<i>Reference flow</i>
FT Gasoline [Valuable substances]	<i>Coproduct</i>
FT jet fuel from CBTL Facility [Valuable substances]	<i>Reference flow</i>
FT Naphtha [Valuable substances]	<i>Coproduct</i>
Electricity [Electric power]	<i>Reference flow or coproduct</i>
FT Sulphur [Valuable substances]	<i>Co product</i>
Carbon dioxide [Inorganic intermediate products]	<i>Captured carbon dioxide sent to sequestration</i>

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage3_O_CTL_Synergistic_2013.01.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 coal-to-liquids (CBTL) via Fischer-Tropsch (FT) synthesis using Illinois No. 6 as the feedstock. The gasifier and associated systems vary according to the product slate. Carbon capture is accomplished through either a combination of water-gas shift reactor and a Rectisol® unit or WGS reactor and dual-stage Selexol® units. The reference flow of this unit process is: 1 kg or MWh of primary product.

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.

Two approaches were considered: (1) a dedicated CTL facility that produces a small amount of electricity or (2) a CTL facility that's integrated with an integrated gasification combined cycle power plant that produces a large amount of electricity with a small amount of diesel or naphtha. Both approaches have baseline cases, a CTL facility with diesel/naphtha liquids outputs and an IGCC facility with no liquids output.

There are three variants of the dedicated CTL facility that vary primarily by the product slate: Base Case 1 - diesel and naphtha, Case 1 diesel and gasoline, and Case 2 jet fuel (kerosene) and naphtha. All three variants are configured for roughly 50,000 barrels per day of liquids output. The FT diesel, gasoline, and jet are completely fungible in today's fueling infrastructure and can be used as a drop-in fuel, while the FT naphtha is assumed to be sold for use as an ethylene cracker feedstock

There are two variants of the IGCC facility. Base case 2 produces only electricity, while Case 3 produces electricity and roughly 5,000 barrels per day of FT diesel and naphtha.

All facilities use a Shell Global Solutions (Shell) entrained flow, dry-fed gasifier with Illinois No. 6 coal as the only feedstock. Water is used for various processing needs. The boundaries of this unit process are shown in **Figure 1**.

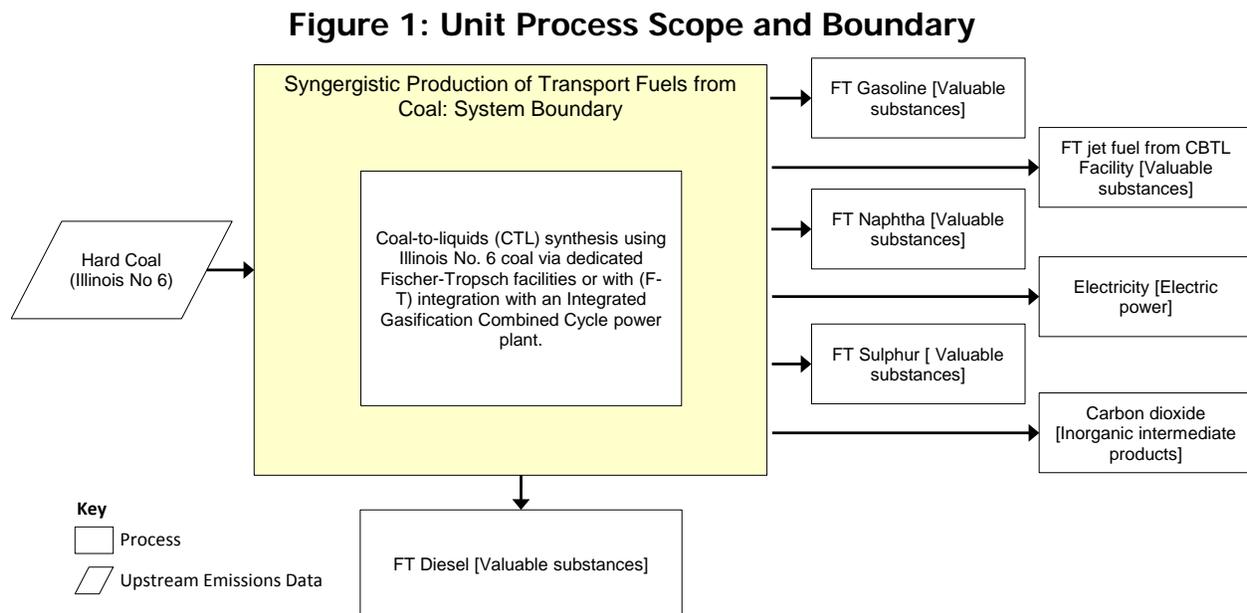


Table 1: Unit Process Input and Output Flows

Flow Name	Base Case 1	Case 1	Case 2	Base Case 2	Case 2	Units (Per Reference Flow)
Inputs						
Hard Coal (Illinois No 6) [Intermediate]	4.47E+00	5.03E+00	3.47E+00	9.30E+02	1.12E+03	kg
Water [Water]	2.66E+02	3.08E+02	2.09E+02	6.13E+01	6.82E+01	kg
Outputs						
FT Diesel [Valuable substances]	1.00E+00	1.00E+00	0.00E+00	0.00E+00	1.83E+01	kg
FT Gasoline [Valuable substances]	0.00E+00	5.07E-01	0.00E+00	0.00E+00	0.00E+00	kg
FT jet fuel from CBTL Facility [Valuable substances]	0.00E+00	0.00E+00	1.00E+00	0.00E+00	0.00E+00	kg
FT Naphtha [Valuable substances]	3.77E-01	0.00E+00	2.56E-02	0.00E+00	6.90E+00	kg
Electricity [Electric power]	2.62E-05	3.77E-05	2.69E-05	1.00E+00	1.00E+00	MWh
FT Sulphur [Valuable substances]	1.12E-01	1.26E-01	3.11E-01	1.06E+01	1.28E+01	kg
Carbon dioxide [Intermediate products]	5.62E+00	6.76E+00	4.41E+00	8.90E+02	9.91E+02	kg
Carbon dioxide [Inorganic emissions to air]	3.37E-01	2.50E-01	3.11E-01	9.91E+01	1.12E+02	kg
Wastewater [Water]	4.87E+01	5.73E+01	3.88E+01	1.11E+01	1.24E+01	kg
Nitrogen oxides [Inorganic emissions to air]	4.22E-03	6.42E-03	4.03E-03	2.44E-01	2.52E-01	kg
Dust (unspecified) [Particle emissions to air]	9.00E-03	1.01E-02	6.85E-03	3.52E-02	3.64E-02	kg
Mercury (+II) [Heavy metals to air]	7.14E-07	8.04E-07	5.56E-07	2.83E-06	2.93E-06	kg
Sulphur dioxide [Inorganic emissions to air]	0.00E+00	0.00E+00	0.00E+00	1.08E-02	1.12E-02	kg

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

Embedded Unit Processes

None.

References

NETL, 2013

National Energy Technology Laboratory. (2013). Synergistic Production of Transport Fuels (Diesel, Jet, Gasoline) from Coal. DOE/NETL-150/TBD.



Section III: Document Control Information

Date Created: October 9, 2013

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

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Original/no revisions

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