NETL Life Cycle Inventory Data
Process Documentation File

Process Name: Corn Stover Cultivation Assembly, Construction

Reference Flow: 1 pcs of Equipment Assembly per kg Biomass

Brief Description: Assembly process that apportions the construction requirements of equipment used for the combined land preparation and cultivation of corn grain and corn stover biomass. Equipment includes tractors, tillers, and seeders.

Section I: Meta Data

Geographical Coverage: US **Region:** Midwest

Year Data Best Represents: 2009

Process Type: Basic Process (BP)

Process Scope: Gate-to-Gate Process (GG)

Allocation Applied: No

Completeness: All Relevant Flows Recorded

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 Pollutants	☐ Other
Releases to Water:	☐ Inorganic Emissions	☐ Organic Emissions	☐ Other
Water Usage:	☐ Water Consumption	☐ Water Demand (throughput)	
Releases to Soil:	☐ Inorganic Releases	☐ Organic Releases	☐ Other

Adjustable Process Parameters:

Tractor Lifetime	*The assumed lifetime of the tractor, in years*
Tiller Lifetime	*The assumed lifetime of the tiller, in years*
Seeder Lifetime	*The assumed lifetime of the seeder, in years*
Farm Size	*The assumed size of the farm, in acres*

Corn Grain Production Yield	*The production rate of corn grain biomass, in kg per year.*
Corn Stover Production Yield	*The production rate of corn stover biomass, in kg per year.*

Tracked Input Flows:

Diesel Tractor, 165 Horsepower [Installation]	*Total number of tractors needed over the lifetime of the energy conversion facility (plant), normalized to 1 kg of biomass*
Tiller, 5,015 lbs, Tractor Propelled [Installation]	*Total number of tillers needed over the lifetime of the energy conversion facility (plant), normalized to 1 kg of biomass*
Seeder, 21,900 lbs, Tractor Propelled [Installation]	*Total number of seeders needed over the lifetime of the energy conversion facility (plant), normalized to 1 kg of biomass*

Tracked Output Flows:

Equipment Assembly [Installation]	*Fraction of equipment needed to produce 1 kg of biomass*

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage1_C_Assembly_Corn_Stover_Cultivation_2010.02.xls*, which provides additional details regarding relevant calculations, data quality, and references.

Goal and Scope

The scope of this unit process covers the elements required for the components needed for the land preparation and cultivation of corn and corn stover biomass under Life Cycle (LC) Stage #1 as described below and in **Figure 1**. Tractors, tillers, and seeders are needed during the land preparation and cultivation of corn and corn stover. This unit process determines the fraction of each machine that should be allocated to each kilogram of corn or corn stover biomass produced.

Construction data, including the mass of raw materials required to construct each piece of equipment, are calculated in separate unit processes. Therefore, the following unit processes are considered embedded in this assembly unit process: *DF_Stage1_C_Diesel_Tractor_165_HP_2009.01.doc*,

DF_Stage1_C_Tiller_5015_lbs_TractorPropelled_2009.01.doc, and *DS_Stage1_C_Seeder_21900_lbs_TractorPropelled_2009.01.doc*. For discussion of the environmental emissions associated with the manufacture of raw materials used in the construction of the corn and corn stover land preparation and cultivation components, as well as other pertinent information, please refer to these separate unit processes.

Boundary and Description

Figure 1 provides an overview of the boundary of this unit process. As it shows, the tractor, tiller, and seeder are constructed in separate, embedded unit processes. All emissions and environmental effects are accounted for upstream from this unit process, as discussed in greater detail in the documentation for each embedded unit process.

This unit process has five variable parameters, which can be adjusted to match the scenarios being examined. The tractor, tiller, and seeder all have an assumed lifetime of 15 years based on the assumptions presented in the DS. Depending upon the intensity of usage for these items, or based on additional data, the assumed lifetime may be increased or decreased as relevant. NETL currently suggests yields of 3,829 and 1,001 kg/acre-year for corn grain and corn stover, respectively, for this Life Cycle Analysis (LCA). These values may be adjusted based on study assumptions and more recent or relevant biomass production data.

For this LCA, corn stover is the feedstock of interest, but the yield rate of corn is included in this unit process to ensure that equipment construction requirements for the tractor, tiller, and seeder are assigned to both corn and corn stover; if only the yield rate of corn stover was included in this unit process, the environmental burdens for the construction of the tractor, tiller, and seeder would be overstated for corn stover. The corn does not leave the system boundaries until the downstream unit process of corn harvesting, and thus the use of co-product allocation is not necessary for this unit process.

Relevant properties of equipment used for the calculation of input and output flows for this unit process are shown in **Table 1**. **Table 2** provides a summary of the modeled input and output flows. Additional details showing calculation methods for input and output flows, and other relevant information, are contained in the associated DS.

Figure 1: Unit Process Scope and Boundary

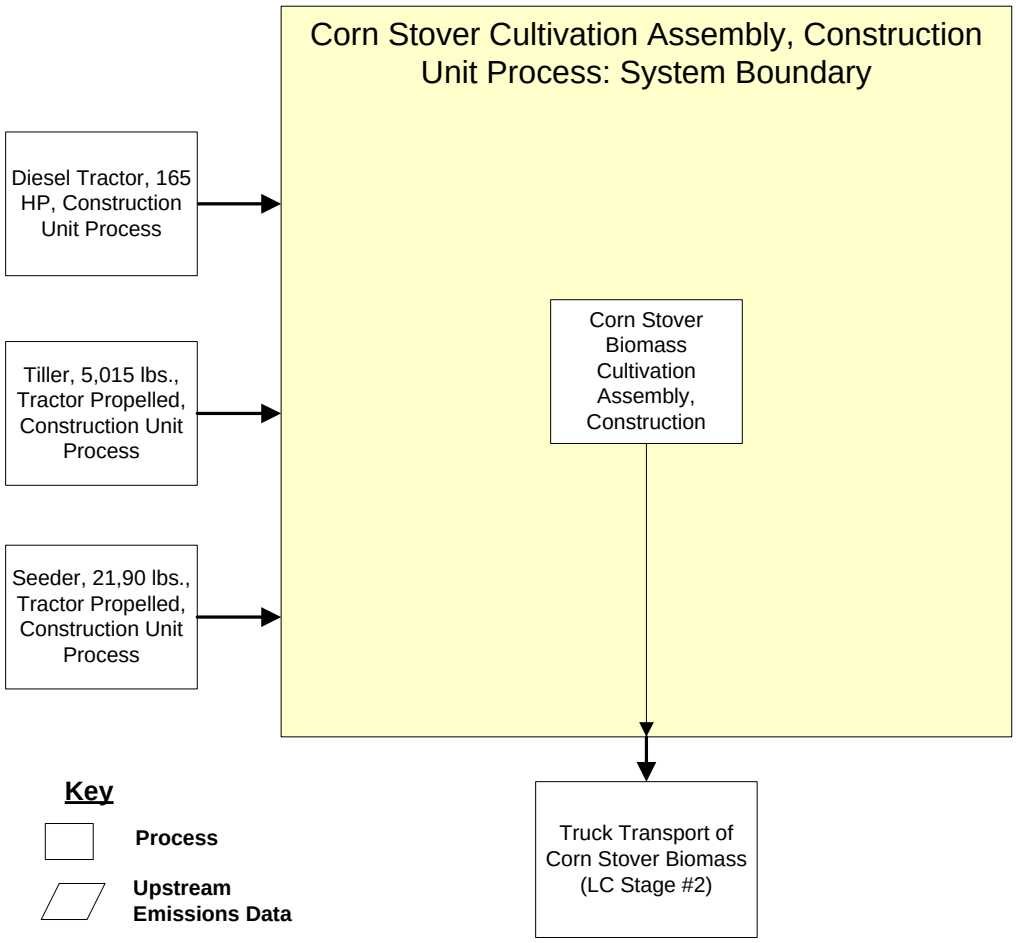

Table 1: Properties for Assembly of Corn and Corn Stover Cultivation Equipment

Machine	Value	Unit	Source
Lifetime of Diesel Tractor, 165 Horsepower	15	years	NETL Engineering Judgment
Lifetime of Tiller, 5,015 lbs, Tractor-Propelled	15	years	NETL Engineering Judgment
Lifetime of Seeder, 21,900 lbs, Tractor-Propelled	15	years	NETL Engineering Judgment
Farm Size	500	acres	NETL Engineering Judgment
Corn Grain Yield	3,829 (8,442)	kg/acre-yr (lbs/acre-yr)	NETL Engineering Calculation
Corn Stover Yield	1,001 (2,206)	kg/acre-yr (lbs/acre-year)	NETL Engineering Calculation

Table 2: Unit Process Input and Output Flows

Flow Name*	Value	Units (Per Reference Flow)
Inputs		
Diesel Tractor, 165 Horsepower [Installation]	**2.7607E-08**	**pcs**
Tiller, 5015 lbs, Tractor-Propelled [Installation]	**2.7607E-08**	**pcs**
Seeder, 21900 lbs, Tractor-Propelled [Installation]	**2.7607E-08**	**pcs**
Outputs		
Equipment Assembly per kg Biomass [Installation]	1	pcs

* **Bold face** clarifies that the value shown *does not* include upstream environmental flows. See also the documentation for embedded unit processes, as shown below.

Embedded Unit Processes

DF_Stage1_C_Diesel_Tractor_165_HP_2009.01.doc
DF_Stage1_C_Tiller_5015_lbs_TractorPropelled_2009.01.doc
DS_Stage1_C_Seeder_21900_lbs_TractorPropelled_2009.01.doc

References

None.

Section III: Document Control Information

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13JUNE2012	Updated to revised parameter values.

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