NETL Life Cycle Inventory Data
Process Documentation File

Process Name: Switchgrass 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 cultivation of switchgrass 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*
Switchgrass Yield	*The production rate of switchgrass biomass, in kg per year.*
Farm Size	*The assumed size of the farm, in acres*

Tracked Input Flows:

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

Tracked Output Flows:

Equipment Assembly per kg Biomass [Installation]	*Reference Flow*

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage1_C_Assembly_Switchgrass_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 used in the cultivation of switchgrass biomass under Life Cycle (LC) Stage #1, as described below and in **Figure 1**. Tractors, tillers, and seeders are needed during the cultivation of switchgrass. This unit process determines the fraction of each machine that would be apportioned to each kilogram of switchgrass biomass produced, based on the parameters as shown above and in the DS.

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 to be 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 switchgrass 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 of this unit process, as discussed in greater detail in the documentation for each embedded unit process.

This unit process has four 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. NETL currently suggests a yield of 3,569 kg/acre-year of switchgrass for this LCA. This value may be updated based on study assumptions and more recent or relevant biomass production data.

Relevant properties of switchgrass cultivation 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

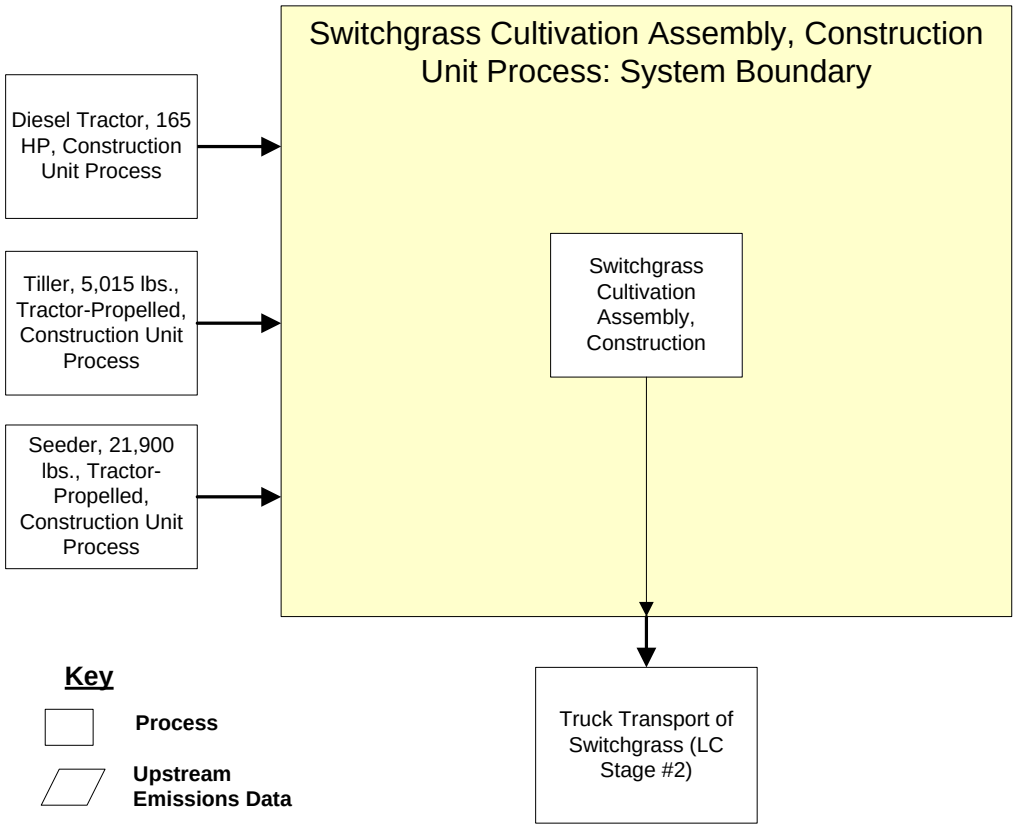

Table 1: Properties for Assembly of Switchgrass Cultivation Equipment

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
Switchgrass Yield	3,569 (7,867)	kg/acre-yr (lbs/acre-yr)	NETL Engineering Calculation

Table 2: Unit Process Input and Output Flows

Flow Name*	Value	Units (Per Reference Flow)
Inputs		
Diesel Tractor, 165 Horsepower	**3.73587E-08**	**pcs**
Tiller, 5,015 lbs, Tractor Propelled	**3.73587E-08**	**pcs**
Seeder, 21,900 lbs, Tractor Propelled	**3.73587E-08**	**pcs**
Outputs		
Switchgrass Biomass Cultivation Assembly	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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