



# NETL Life Cycle Inventory Data

## Process Documentation File

**Process Name:** Switchgrass Harvesting 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 Switchgrass harvesting. Equipment includes forage harvesters and balers.

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### Section I: Meta Data

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**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:** Individual 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 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:**

Harvester Lifetime *The assumed lifetime of the forage harvester in years*  
Baler Lifetime *The assumed lifetime of the baler 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 Forage Harvester, 615 Horsepower [Installation] *Total number of harvesters needed over the lifetime of the energy conversion facility (plant), normalized to the reference flow*



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Baler, 3110 lbs, Tractor-Propelled [Installation]

*Total number of harvesters 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*

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## Section II: Process Description

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### Associated Documentation

This unit process is comprised of this document, as well as the data sheet (DS) DS\_Stage1\_C\_Assembly\_Switchgrass\_Harvesting\_2010.02.xls, which provides additional details regarding calculations, data quality, and references as relevant.

### Goal and Scope

The scope of this unit process covers the elements required for the components needed for the harvesting of switchgrass under LC Stage #1 as described below and in **Figure 1**. Forage harvesters and balers are needed during the harvest to collect the switchgrass and prepare it for storage before shipment by truck (LC Stage #2) to the energy conversion facility (LC Stage #3). This unit process determines the fraction of each machine which should be allocated to each kilogram of switchgrass biomass produced.

Construction data, including the mass of raw material 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\_Baler\_3110\_lbs\_TractorPropelled\_2009.01.doc and DF\_Stage1\_C\_Forage\_Harvester\_615\_HP\_2010.01.doc. For discussion of environmental emissions associated with the manufacture of raw materials used in the construction of switchgrass harvesting 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 forage harvester and the baler 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 three variable parameters which can be adjusted to match the scenarios being examined. The forage harvester and baler both have an

assumed lifetime of 15 years based on the assumptions presented in the DS sheet. 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 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 the 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 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**

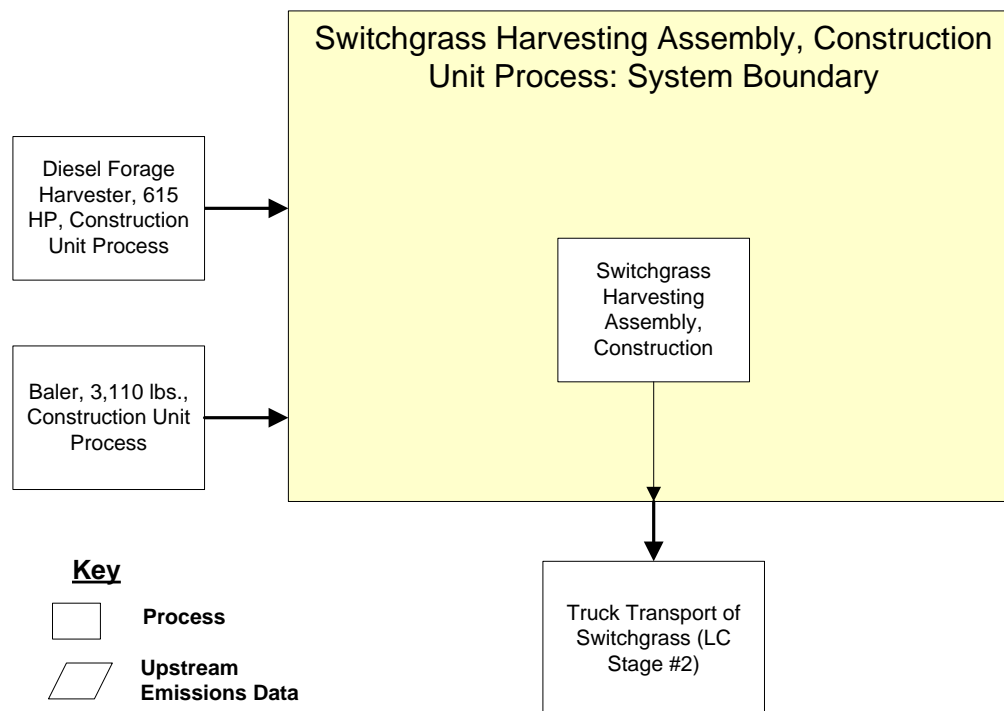


Table 1: Properties of Switchgrass Harvesting Assembly

Machine	Value	Unit	Source
Lifetime of Diesel Forage Harvester, 615 Horsepower	15	years	Assumption
Lifetime of Baler, 3110 lbs, Tractor-Propelled	15	years	Assumption
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)
<b>Inputs</b>		
<b>Diesel Forage Harvester, 615 Horsepower [Installation]</b>	<b>3.73587E-08</b>	<b>pcs</b>
<b>Baler, 3110 lbs, Tractor-Propelled [Installation]</b>	<b>3.73587E-08</b>	<b>pcs</b>
<b>Outputs</b>		
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\_Forage\_Harvester\_615\_HP\_2010.01.doc  
 DF\_Stage1\_C\_Baler\_3110\_lbs\_TractorPropelled\_2009.01.doc

### References

None.

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## Section III: Document Control Information

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**Date Created:** January 25, 2010  
**Point of Contact:** Timothy Skone (NETL), Timothy.Skone@NETL.DOE.GOV  
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13JUNE2012 Updated to revised parameter values.

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