Biomass Aggregation

The Missing Link

Northeast Sun Grant Conference

Cornell University

November 13, 2007

Overview

Who is Mesa Engineering?

What is Biomass Aggregation?

The Supply Wheel

The BIOMASS Model

Biomass Aggregation Loop

Current and Future Aggregation Projects

Mesa Reduction Engineering – What We Do

Mesa Reduction Engineering & Processing, Inc. was founded in 1997 to develop patented size reduction and fuel blending technologies for use in power generation projects.

Mesa is a Biomass Energy Services Firm providing Field to Facility Solutions.

Mesa has three focus areas; Biomass Supply/Aggregation, Material Handling System Design, and Consulting/Engineering.

Expertise include performing supply chain development for biomass projects for both public and private entities.

Team building – bringing together a wide network of resources to fully maximize unique attributes of each project.

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Biomass Aggregation

The Overlooked Part of the Supply Chain

What is Aggregation? Aggregation is The Collection of Units or Parts Into a Mass Or Whole.

Integrates the Environmental, Energy and Economic Goals for Renewable Energy.

Unlike Proven Reserves in the Fossil World, An Aggregation System Is Dealing With Variable Reserves in the Biomass World.

Mesa's focus is on Combining Biomass Production and Conversion By:
Economic Modeling – Looking at All Of the Steps In The Process
Field Trials and Testing – Validate Modeling Accuracy and Value Chain Assumptions.
Developing the Systems – Integrate Equipment Capable of Delivering Feedstock.

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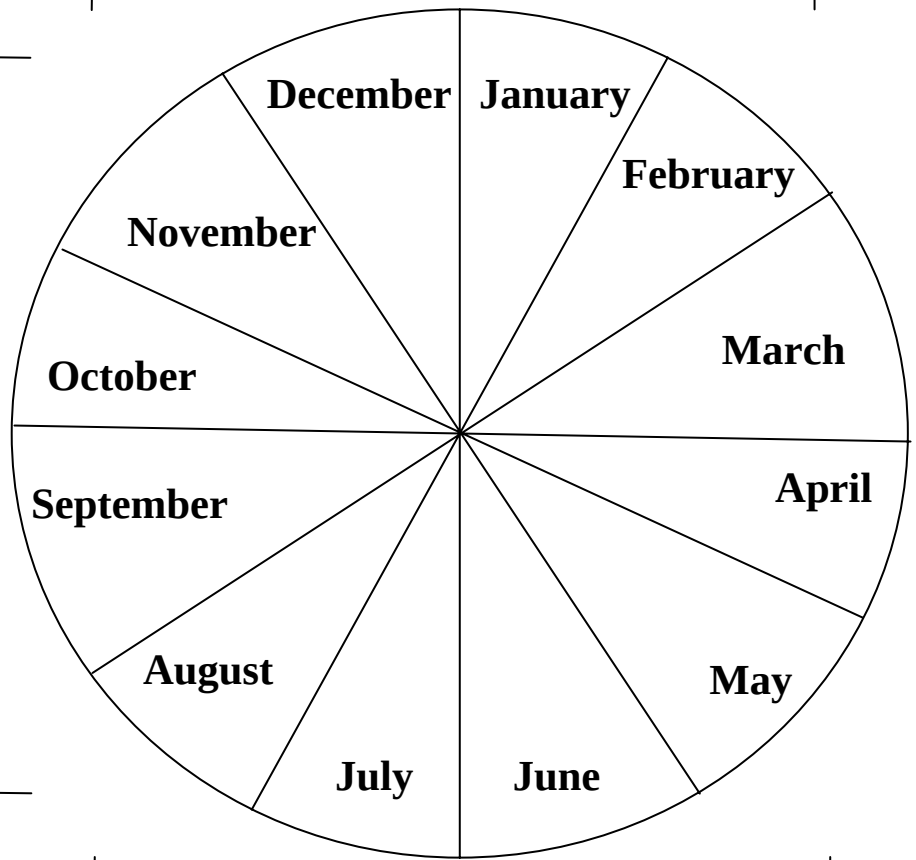
Biomass Supply Wheel

Successful Aggregation System Fills the Wheel

Dedicated Woody Crops/Sustainable Forestry

2nd Cuttings
Herbaceous
Sorghum
Agricultural
Residues



Over Winter
Intercropping

1st Cuttings, Sustainable Harvesting

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“BIOMASS” Model

Biomass Integrated Oversight Management Analysis System Software

BIOMASS Looks at All of the Steps in the Supply Chain.

Summary Table – Calculates Output from Each Module.

Establishment Module – Evaluates the Establish, Maintenance, and Growing.

Harvesting Module – Evaluates Different Techniques to Gather Biomass.

Transportation Module – Evaluates Moving the Biomass from the Source.

Processing Module – Evaluates Energy Requirements Scenarios.

“BIOMASS” Model

Biomass Integrated Oversight Management Analysis System Software Summary Module

Enterprise Unit (acres)	1.0				Truck Capacities	
Personal Property Tax Rate($/$m)	$0.00			Transprt1, Baled (Tons)		25.0
Insurance Rate ($/$m)	$6.00			Transprt2, Loose Chop (Tons)		15.0
Interest rate (%)	7.0%			Transprt3, Modulized (Tons)		14.0
General Overhead Rate (%)	7.0%			Transprt4, Pelleted (Tons)		30.0
Labor wage rate ($/hr.)	$7.50					
Yield (Tons/acre)	10.0					
Stand life (years)	10.0					
Cropland rental value ($/acre)	$25.0					
Mileage from Farm (miles)	25.0					
Fuel prices ($/gal.)	Diesel	Gasoline	L.P.	ELECT.($/KWhr)		
Farm Prices	$2.00	$2.50	$2.00	$0.09223		
Establishment method (1 or 2)	2					
Transport method (1, 2, 3, or 4)	1					
Total Delivered Biomass Cost						
Per enterprise unit		**$501.00**				
Per acre		**$501.00**				
Per ton		**$50.10**				
Total Processing And Handling Cost						
Per Delivered Ton		$5.00				
Total Feedstock Cost Per Ton		$55.10				

The Holy Grail
Integrated Biomass Conversion Facility

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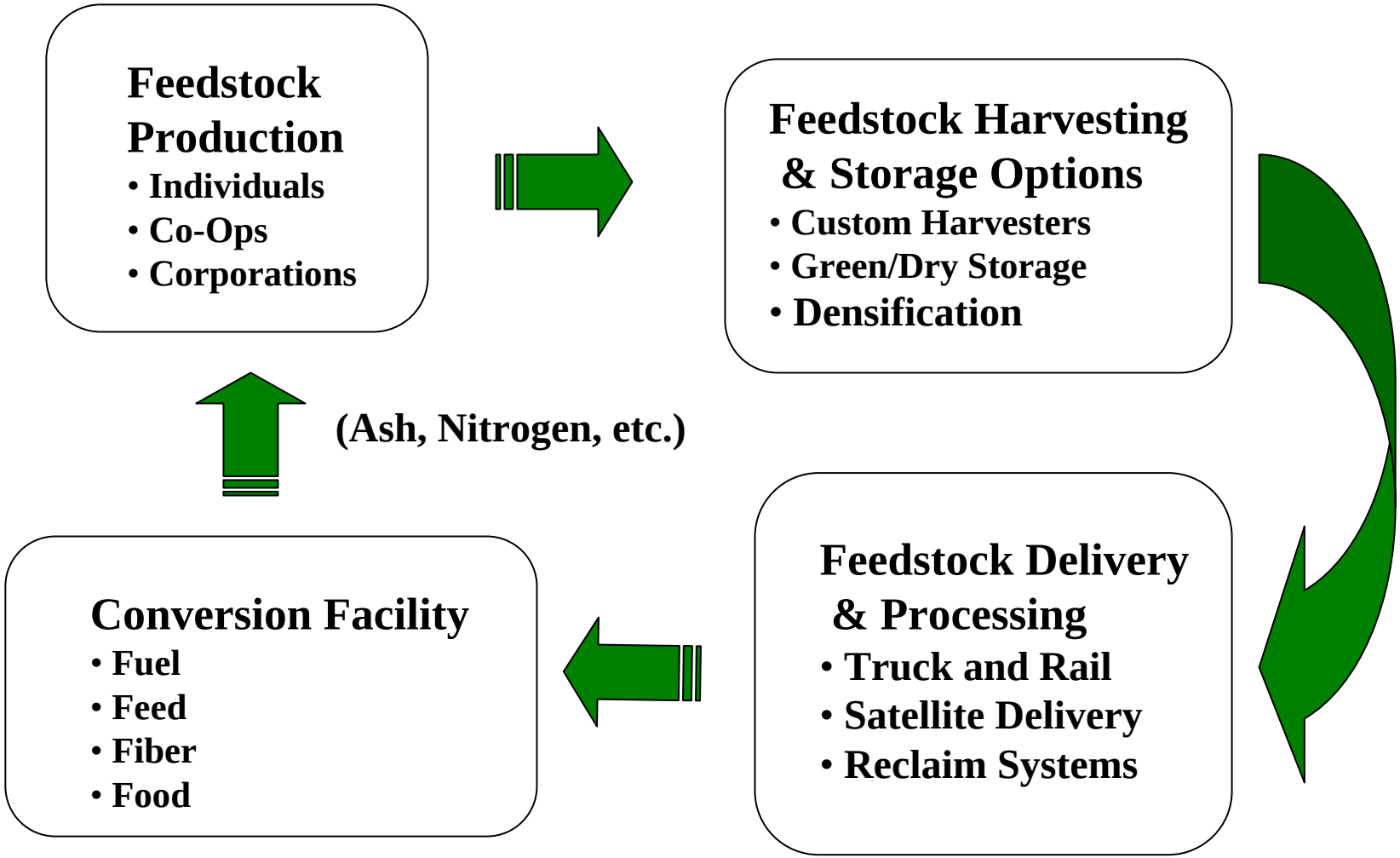
Biomass Aggregation Loop



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Biomass Comes In Many Forms

MILL RESIDUES

WOOD WASTES

AGRICULTURAL RESIDUES

SORGHUM SUDAN

SWITCHGRASS

Switchgrass Establishment On Abandoned Pasture

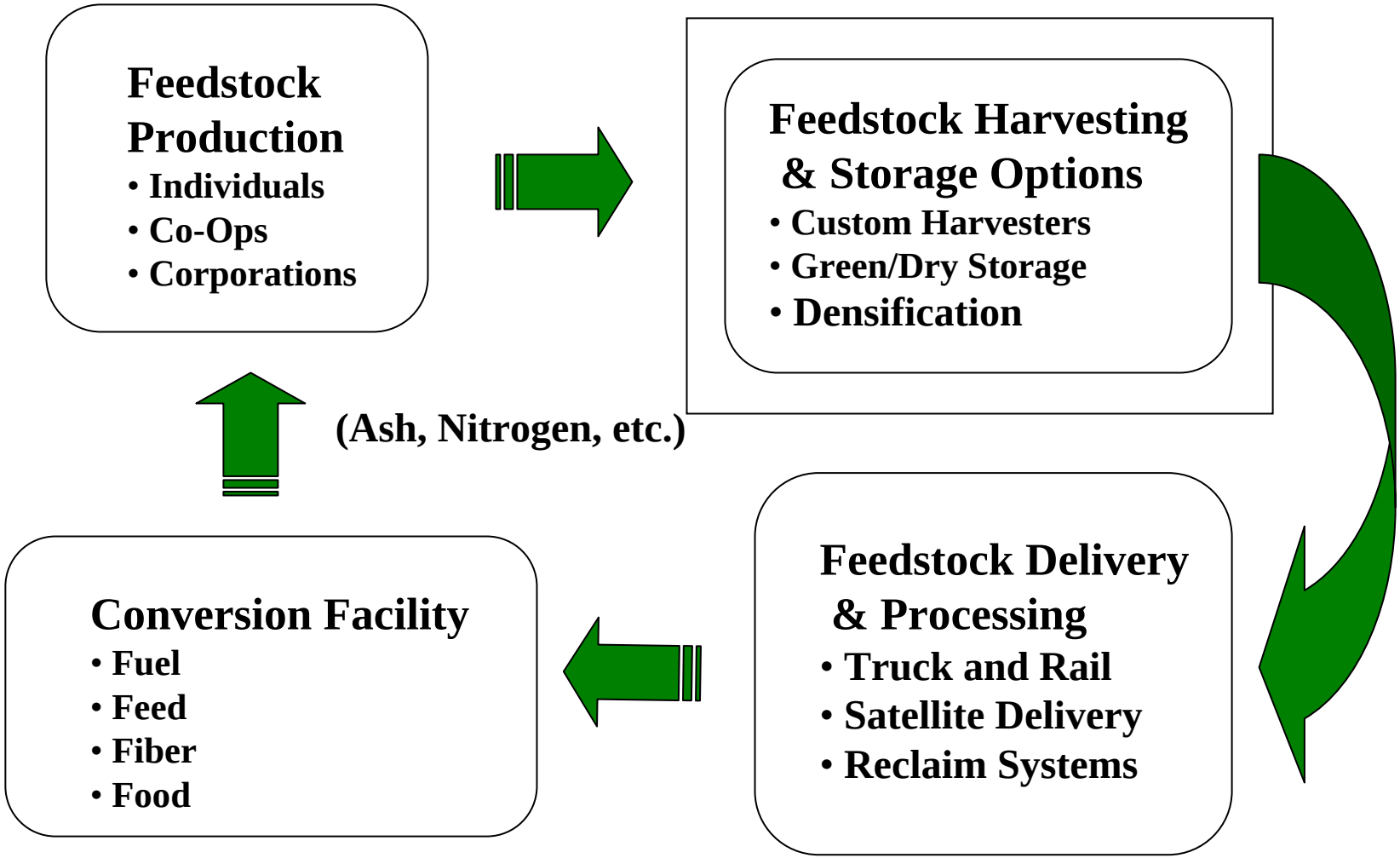
Plowing Preparation

Seed Loading

Planter Internals

No Till Seed Drill

Biomass Aggregation Loop



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High Density Balers

- **High Density Balers Optimize Dedicated Energy Crop and Agricultural Residue Handling.**

- **Offer Greater Cubic Foot Density Per Bale.**

- **Switchgrass Bales Weigh 1,200 Pounds.**

- **Maximize Over the Road Truck Capacities.**

Bale Innovations

The First 4,000 Pound Bale

Storage and Moisture Trials – Impact on Biomass Degradation

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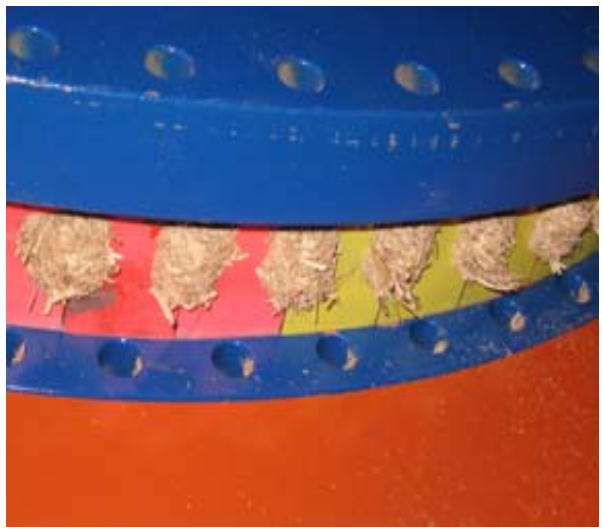
Wood Chip Production

Whole Tree Wood Chipper

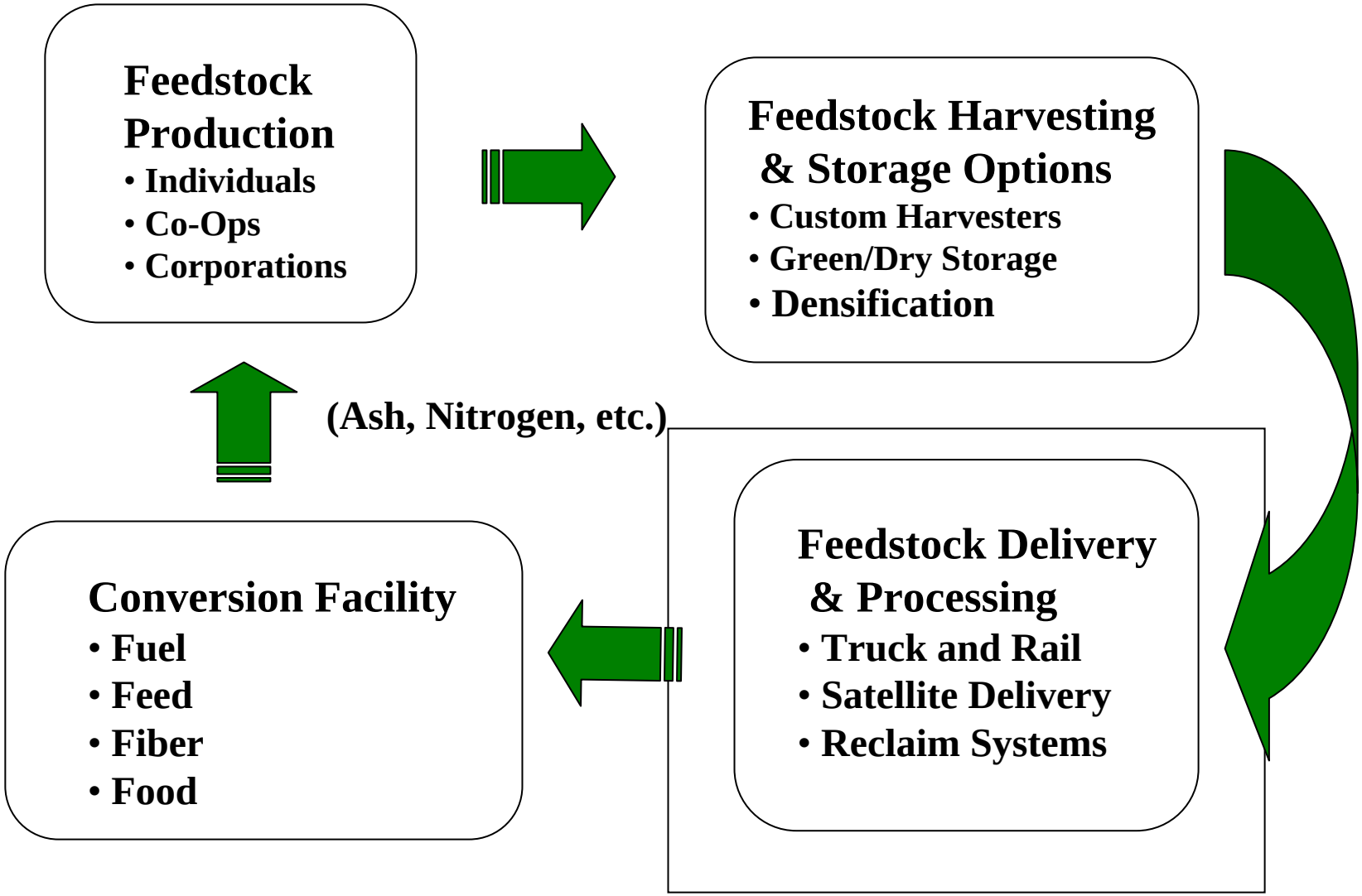
Portable Wood Chip Plant

- **Precision Equipment to Produce Uniform Wood Chips**
- **Produces Fuel Chips or High Quality Paper or Pellet Chips**
- **Processes Small Diameter to 30” Plus Log Sizes**

Cubing Densification
Miscanthus Cubing in the UK



Biomass Aggregation Loop



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Storage And Transportation Systems

Bale Delivery Via Truck

Biomass Storage Reclaim Systems

Rail to Silo to Truck Systems

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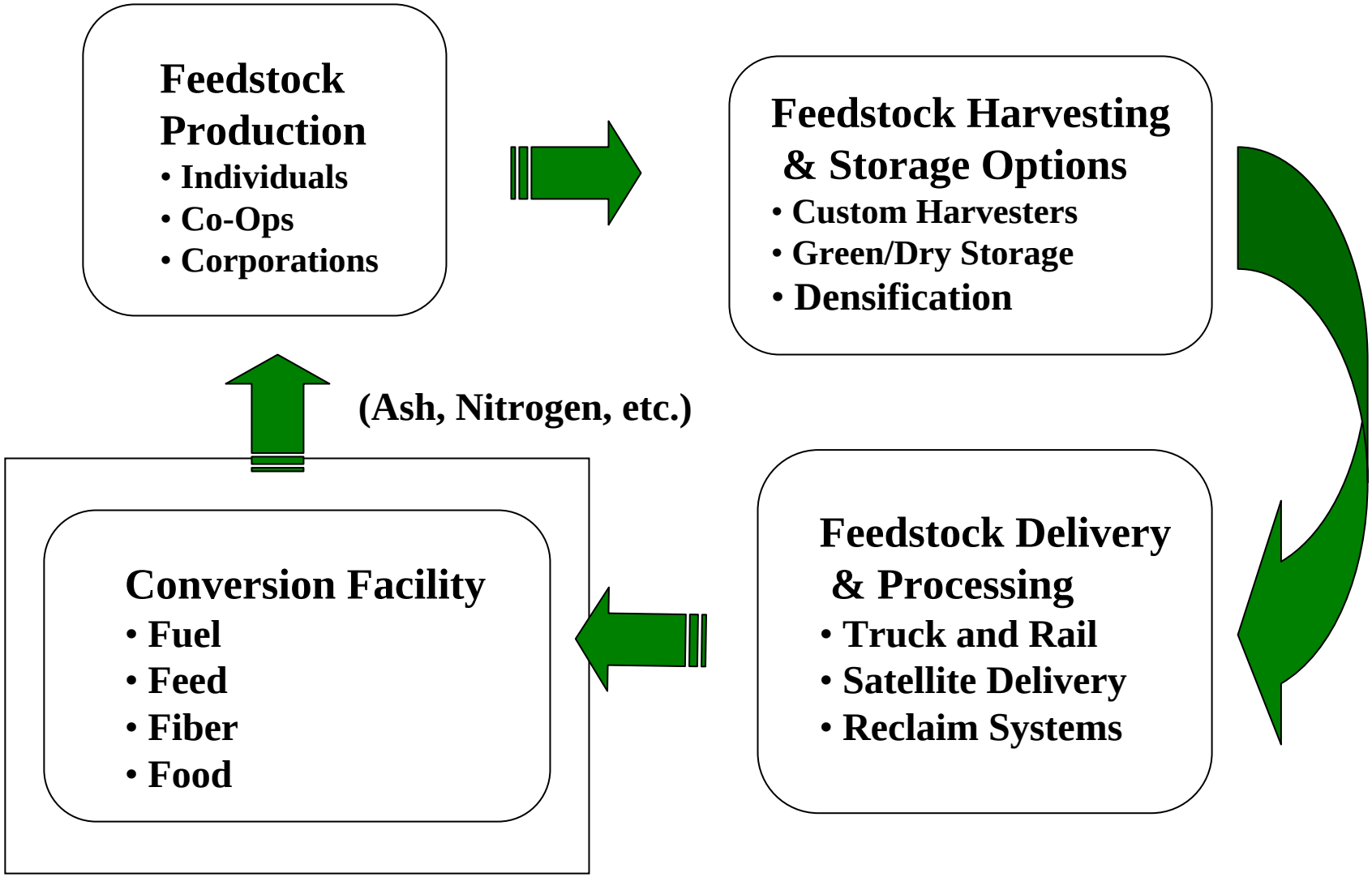
Conversion Facility Processing



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High Density Bale Grinding

← Go From Conventional Open Bale Grinding Equipment……..

….. To This Dust Free Bale Grinding Equipment →

AES Greenidge Biomass Processing

Biomass Processing Building

Wood Delivery

Yard Bin

Collision Mill Size Reduction

AES Greenidge Station

- Began co-firing work in 1996 as a member of the Salix Consortium.
- Greenidge Station was one of two cofiring demonstrations in New York participating in the Biomass Power for Rural Development Program.
- Unit 4 continues to support co-firing activities at Greenidge.
- Greenidge continues to lead renewable energy efforts in New York. Partnering with NYSERDA, USDOE, USDA, and USDOI.

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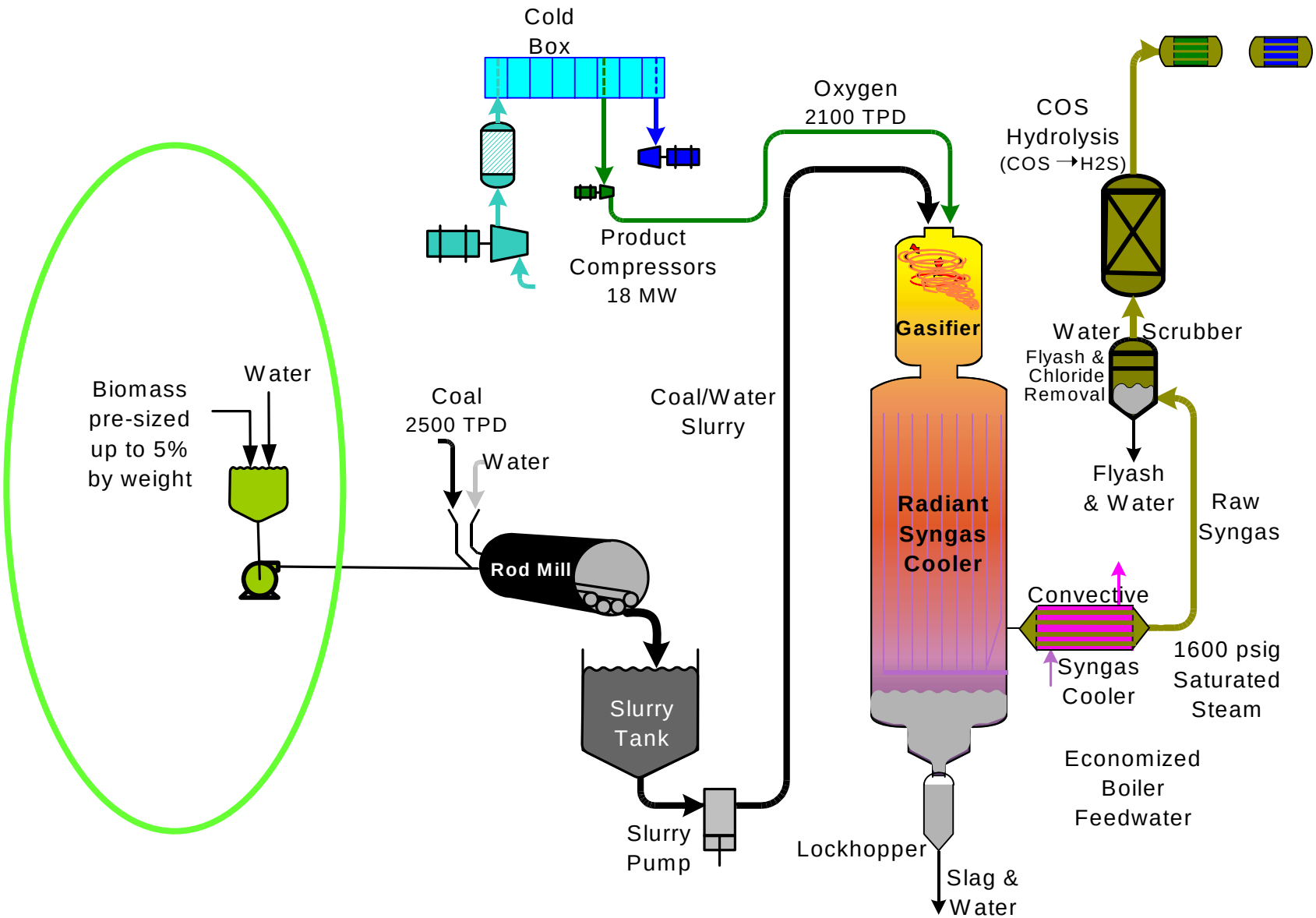
Polk Power Station

BIOMASS GASIFICATION CO-UTILIZATION



Grass Biomass Gasification Test

Summary

Biomass Aggregation – Overlooked Part of the Supply Chain

Supply Wheel – Keeping it Full is the Goal

Aggregation Loop – Streamline Each Step in the Process

Model Development – Lowest Delivered Cost with the Best Biomass Properties for Food, Feed, Fiber, and Fuel

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