High Level Overview of DOE Biomass Logistics II Project Activities

Biomass 2014: Growing the Future Bioeconomy
Washington, DC

July 29, 2014

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Presentation Objectives

• Provide high level review of DOE Logistics I project results

• Provide high level overview of DOE Logistics II project plans, activities, and objectives
Advanced Logistics Project #1

- Key equipment development
  - Improved Industrial Grade Baler
  - Bale Picking Truck
  - Self Loading Trailer
  - Single-pass Harvest Systems
  - Improved Header for Heavy Crops

- Self-Propelled Baler
- Bale Picking Truck (BPT)
- Heavy Crop Header
- Single Pass Baling
- Self-Loading Trailer (SLT)
Advanced Logistics Project #1 Results
BALES  Biomass Alliance for Logistics Efficiency and Specifications

Project Summary

• 3 Year Development and Demonstration Project, began Sept 2013
• Develop and demonstrate new and improved harvest and processing technologies that will reduce biomass supply chain costs while meeting quality specifications of biomass end users
Project Objectives

• Lower overall feedstock supply costs
  – Square and round bale supply chains
  – Full supply chain (harvest to “reactor throat”)
  – DOE Program Goal is $50/DT (CHST + processing)
    • Overall DOE Program Goal is $80/DT (CHST + processing + grower payment)

• Improve feedstock quality
  – Corn stover and switchgrass/warm season grasses (WSG)
  – Focus on dirt reduction in field and processing line
  – Develop and demonstrate new NIR-based tools

• Validate improvements & identify remaining gaps
  – Field testing, data collection & analysis, reporting

• Address key sustainability-related issues associated with biomass harvest & delivery
Key Project Tasks

• Task A. Harvest Equipment Development
• Task B. Process Equipment Development
• Task C. Go/No-Go Review Meeting
• Task D. Harvest Equipment Demonstration
• Task E. Process Equipment Demonstration
• Task F. Feedstock Quality Monitoring & Improvement
• Task G. Performance Evaluation & Baseline Development
• Task H. Sustainability Assessment and Data Collection
• Task I. Project Management & Reporting
Kelderman Bale Merger and 6-packer Accumulator

- Reduces passes in field
- Accumulates up to 9 bales
- Creates “6-packs” for more efficient bale handling and roadsiding
Kelderman Bale Picking Truck

The Bale Picking Truck creates a truckload of (36-42) bales by picking them up in the field 1 to 6 bales at a time.
Kelderman Bale Pre-Loader

- Designed to handle “6-pack” bale modules
- Capable of operating in wet soils where currently available equipment cannot
- Also for use in commercial bale yard operations
Kelderman Bale Pre-Loader

Pre-loader will also be capable of loading from or unloading to stacked bales.
Kelderman Bale Pre-Loader and 3rd Generation Self Loading Trailer

Pre-loader can load directly onto 3rd generation Self Loading Trailer
Directly Unload at Processing Facility

The Self Loading Trailers, Bale Picking Trucks, and Pre-Loader are capable of unloading directly onto the end-user’s processing in-feed conveyor.
Infeed Conveyor, Automatic De-stacker, and Shuttle Conveyor System

Bales are automatically de-stacked and shuttled to processing lines
Round Bale System Development Activities

• Improved Round Baler Development
  – Increased bale density
  – Improved durability/lifetime
  – Reduced maintenance/downtime
  – Improved dirt reduction

• Improved Biomass Processing Equipment
  – Automated De-baler/Net Wrap Removal
  – Improved Biomass Grinding

• Advanced Round Bale Transportation
  – Advanced Round Bale Trailer
NIR in the INL Biomass Feedstock National User Facility (BFNUF)

- Mobile Spectrometer
- Dual Illuminators
- Turntable
- Modular Configurations
- Multiple Sample Holders
- Hand-Held Probe for contact measurements
- NIR Bale probe will be tested in Fall 2014
INL model Full Cross Validation Results
Early Commercial Success from DOE Logistics I Project

Dozens of unit orders pending
Closing Remarks

• Broad spectrum of new agricultural biomass logistics tools and equipment is under development
  — Round and square bale systems
  — Processing equipment
  — Quality analysis tools (NIR based)
  — Sustainability verification and tracking

• Largest demonstration operations to date (from this team) planned for Fall 2014
  — Round and square bale harvest equipment
  — NIR-based bale probe and methods

• Extensive performance and cost data collection being performed

• Not possible without DOE investments and significant cost-share from team members
JCB Tractors with Vermeer 605 SM Round Balers

Sample Field Tracks

• Data Summary from ~2,080 acres
  – 21.4 bales/hr
  – 19.9 acres/hr
  – 12.3 BDT/hr
  • Based on measured data from 2013 CS Harvest:
    • 1,135 lb/bale
    • 11.8% moisture content
Baling & Roadsiding Performance
(Round Baler & Truck-mounted 12-bale Side Loading Bale Mover)
Estimated Harvest Costs vs. Iowa Custom Rates

2013 Iowa Corn Stover Harvest Summary
- Average Direct Harvest Cost ($/BDT) = $23.19
- Average Overall Harvest Cost ($/BDT) = $35.41
- Custom Rates ($/BDT) = $15.99 - $43.46
- Fields of Complete Data = 16
- Average Baling Production (BDT/hr) = 12.3
- Average Biomass Yield (BDT/ac) = 0.65 (0.30 - 1.07)