U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

DOE Bioenergy Technologies Office Feedstock R&D

Advanced Bioeconomy Feedstocks Conference

Miami, FL

June 8 2016

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Bioenergy Technologies Office

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MISSION: Transform America's abundant biomass resources into commercially viable, high-performance biofuels and bio-based products, through targeted research, development, and demonstration supported by public and private partnerships.

Terrestrial Feedstocks

-Resource assessment; supply analysis

- R&D on Feedstock characterization, handling, and logistics

Advanced Algal Systems

- Competitive projects to increase yields/ productivity/reduce costs

- Targeted R&D along the algal supply chain.

Conversion

- Thermochemical
- Biochemical
- Deconstruction
- Upgrading

Demonstration and Market Transformation

-IBR partnerships

-Infrastructure

Analysis and Sustainability

- Develop and improve critical models and tools : (GREET, BSM, WATER)

Impacts: More than 1 billion tons of biomass could be sustainably produced in the U.S. without impacting markets for food and feed. By 2030, 1 billion tons of biomass could:

- Produce up to 60 billion gallons of biofuels, displacing 30% of U.S. petroleum consumption
- Produce 50 billion pounds of biobased chemicals and bioproducts, replacing a significant portion of the chemical market
- Generate 92 billion kWh of electricity to power 8 million households
- Provide reductions of CO_2 emissions by 500 million tons a year.

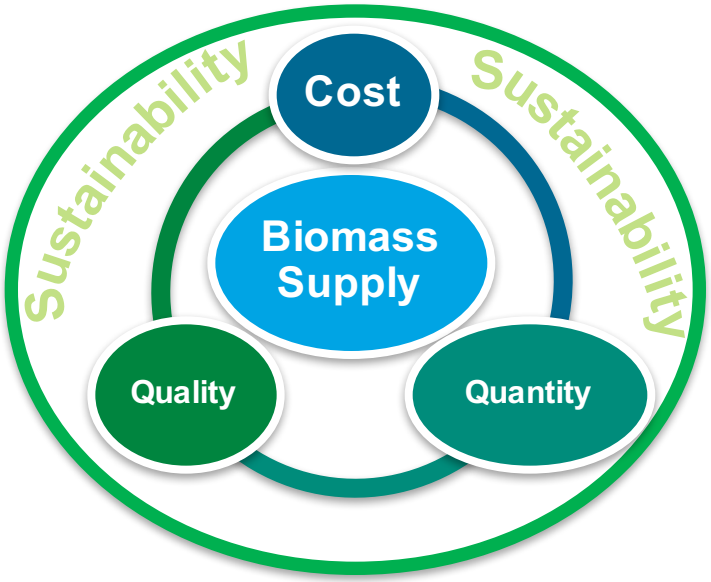
White House Climate Action Plan

- **Reduce Oil Imports 50% by 2020**
- **Reduce GHG emissions at least 26% by 2025**

Feedstock Supply and Logistics

Focus

- Fully integrate feedstocks into supply chain (multiple interfaces).
- Reform raw biomass into high-quality feedstocks.
- Use innovative technologies to ensure sustainable supply and reduce costs.
- Reduce risks to enable industry expansion.



Approaches

- Use basic and applied science to understand, model, and manage.
- Provide nationally, but solve locally.
- Meet environmental performance targets and goals while assuring sustainability.
- Work with stakeholders and partners.

Feedstock Supply and Logistics Focus Areas

- **The strategic goal of Feedstock Supply and Logistics (FSL) is to develop technologies to provide a sustainable, secure, reliable, and affordable biomass feedstock supply for the U.S. bioenergy industry, in partnership with USDA and other key stakeholders. This goal corresponds to the following cost targets:**
  - Validate efficient, **low-cost**, and **sustainable** feedstock supply and logistics systems that can deliver feedstock to the conversion reactor throat at required conversion process infeed specifications, at or below $80/dry ton by **2017**.
  - By **2022**, develop and validate feedstock supply and logistics systems that can economically and sustainably supply 285 million dry tons per year at a delivered cost of $80/dry ton to support a biorefining industry (i.e., multiple biorefineries) utilizing a diversity of biomass resources.

SGI Regional Feedstock Partnership Field Trial Network

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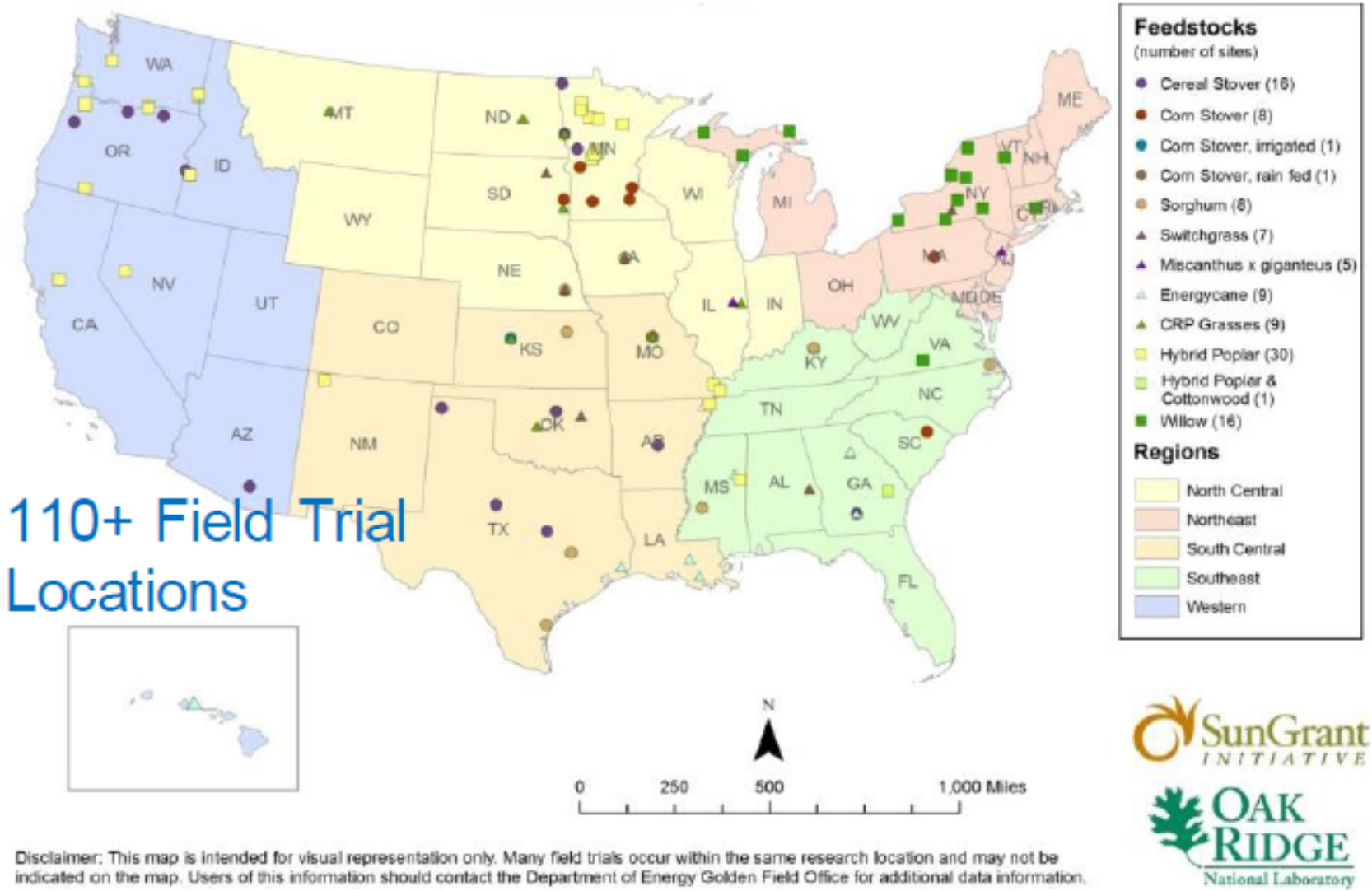


SunGrant INITIATIVE

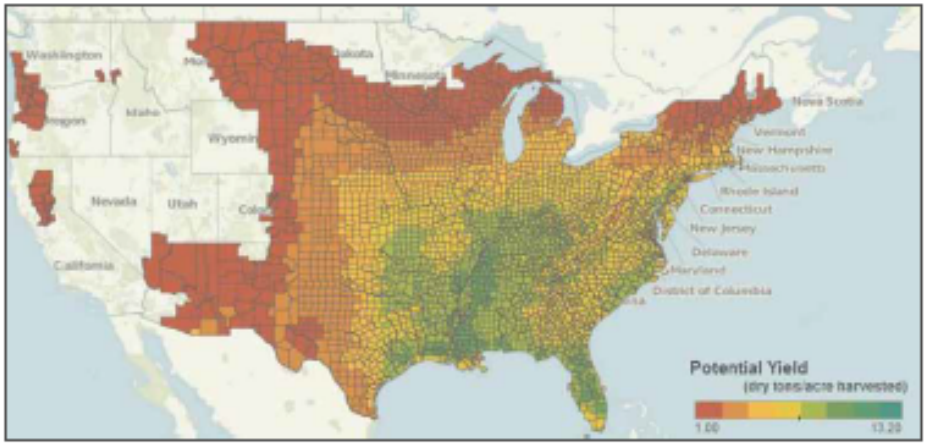
OAK RIDGE National Laboratory

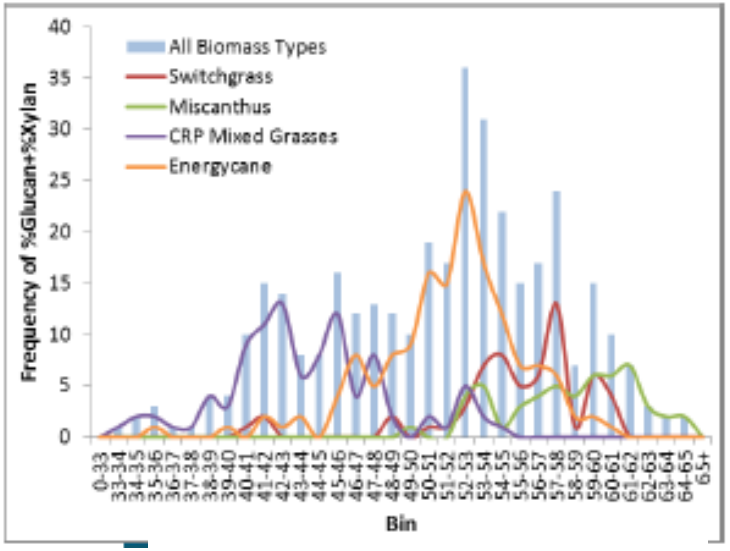
SGI Regional Feedstock Partnership Field Trial Network

- Ground-truth potential yield and supply
- 100+ coordinated network of trials of residues and dedicated energy crops
- Seven years of replicated trials
- 100's of publications
- Focus on yield potential, yield durability, and feedstock quality

Sun Grant Regional Feedstock Synthesis Report

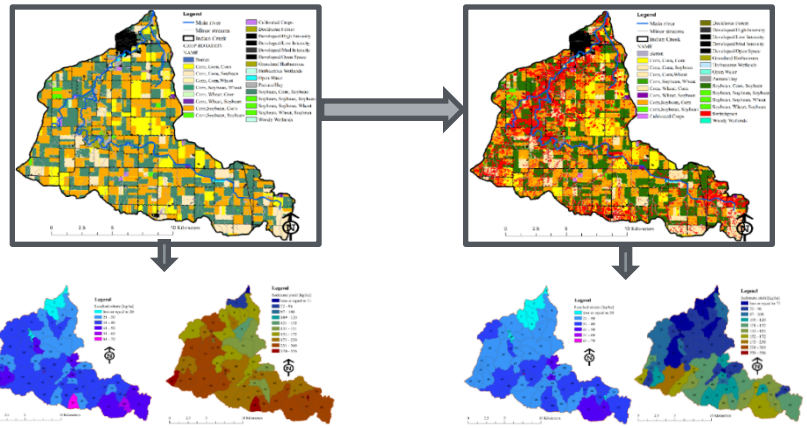
- A value-add report that summarizes the impact of results of the partnership, including yield and quality results
  - Note the original source for data
- PIs will be authors of the report, along with national laboratory researchers
- Report to be released along with BT16





Project in Focus: Sustainable Landscape Design

- Testing at the field scale the biomass production and nitrogen removal & reuse potential of a deep-rooted willow buffer intercepting subsurface flow from a corn field.
- Developing a framework for the design of landscapes that achieve production of food, feed, and fiber while providing ecosystem services.
- Interacting with farmers to get real-world perspective on how bioenergy crops can be integrated in the landscape and enhance their business models.



Models predict a decrease compared to business-as-usual in leached nitrate and sediment losses from an integrated landscape incorporating bioenergy in vulnerable and underproductive land (SWAT). Modeling also suggests that the integrated landscape has the potential to increase the pollinator nesting index in the watershed (InVEST).

Assembling Key Pieces of the Puzzle

Advanced Harvest & Logistics, 2nd Pass

Regional Impact Modeling & Monitoring

Perennial Grass for Conservation & Biomass Supply

Implementation of Conservation Practices (Cover Crops, Buffer Strips, etc.)

Subfield Precision Business Planning

Advanced Harvest & Logistics, First Pass

Sustainable Residue Harvest

Multi-stakeholder Outreach

ANTARES Group Incorporated

Conversion Interface

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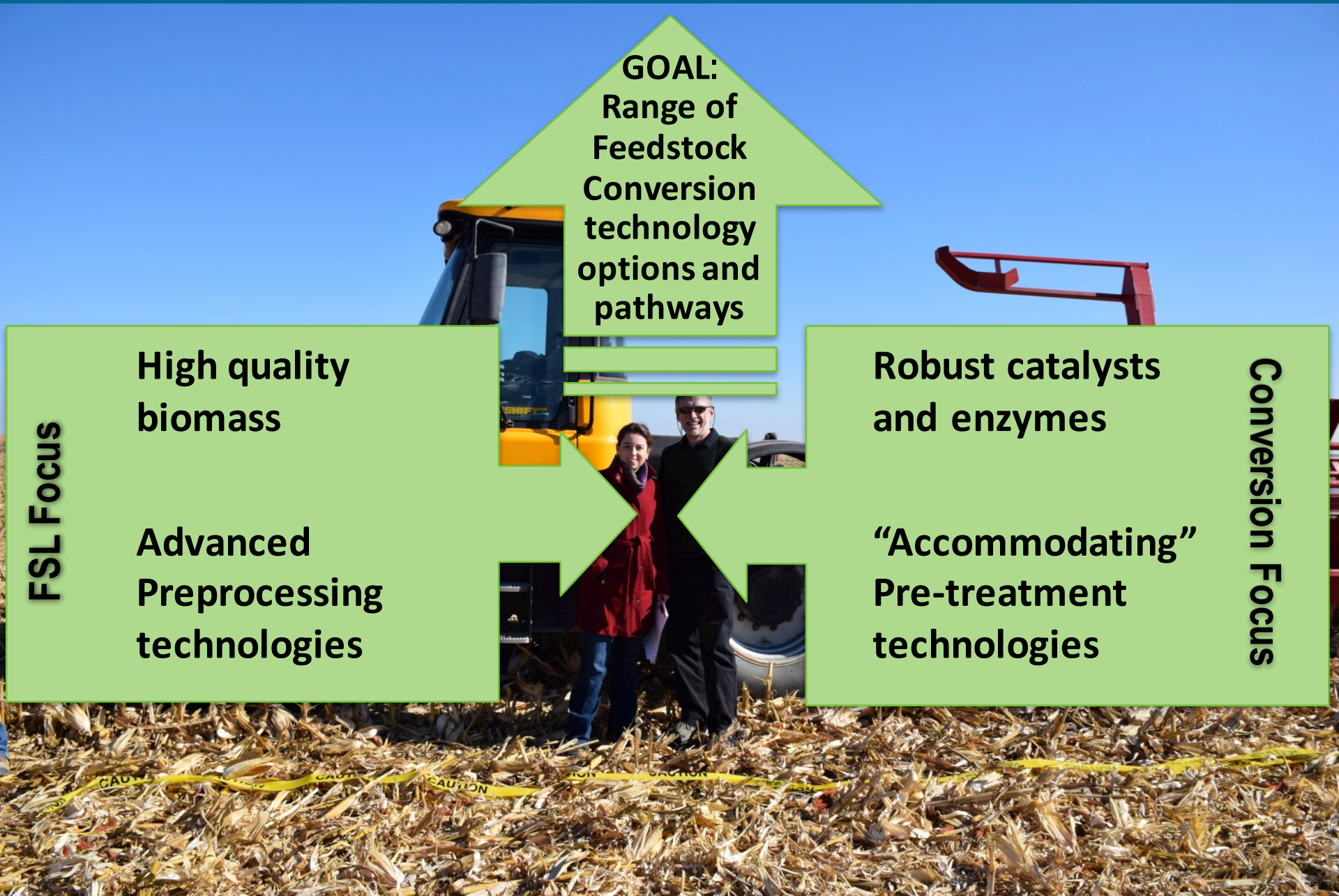

Vision: A Feedstock System Capable of Supplying 1 Billion Tons/year

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The Uniform Commodity Feedstock Vision enables commodity-scale, custom-formulated feedstocks to play a critical role in producing biofuels, biopower, and other bioproducts.

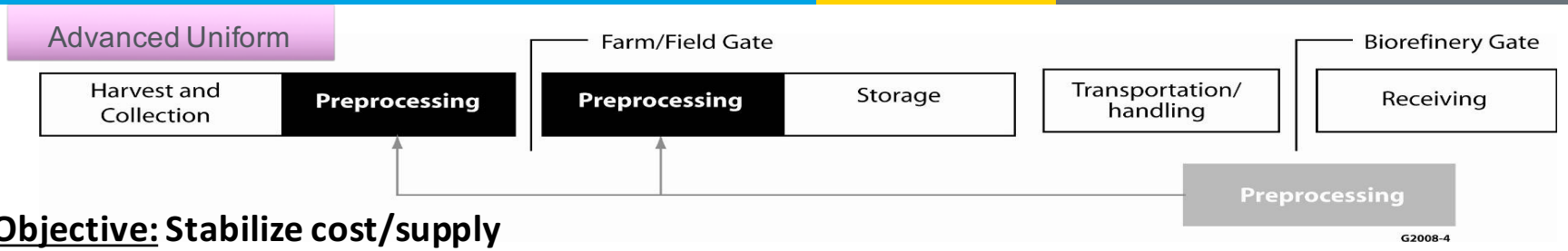
Biomass Preprocessing

Biomass preprocessing, which transforms biomass into feedstock, is key to a commodity bioenergy vision. A preprocessing depot can provide a link between biomass producers and refineries. It also alows flexibility for local communities to produce bioproducts including feedstocks customized for biochemical, thermochemical, and combustion conversion facilities. It also enables production of renewable products, such as livestock feeds, and recycled byproducts, such as soil amendments.

The Preprocessing Depot enables development of commodity biomass feedstock markets by managing diverse biomass, promoting increased resource access, and ensuring quality, on-spec feedstock delivery to conversion facilities.

But a preprocessing depot can do much more. It offers limitless opportunities for innovations to supply entirely new products and markets.

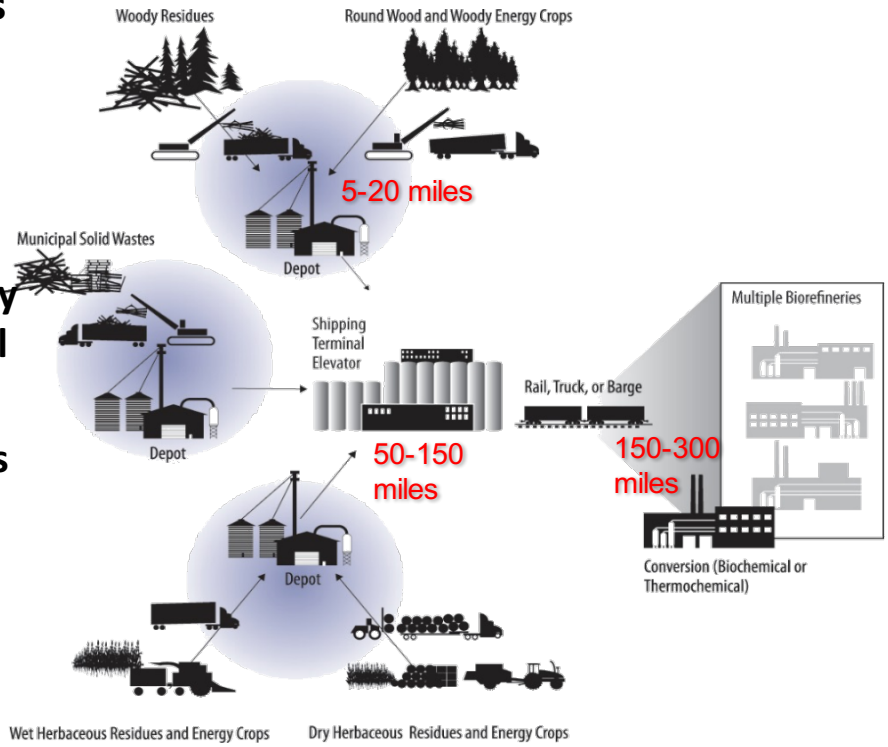
Depot Design Objectives and Approach

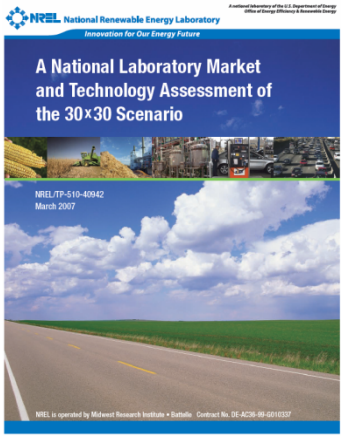


Objective: Stabilize cost/supply through **active** feedstock logistics systems:

- Feedstock characteristic more important than species
- Density and stability
- Beginning to grapple with quality (physical, chemical & rheological properties)
- Increase logistics unit operations within cost constraints

Approach: Depot-based preprocessing of feedstocks into infrastructure compatible commodity formats; **decouple** feedstock from conversion



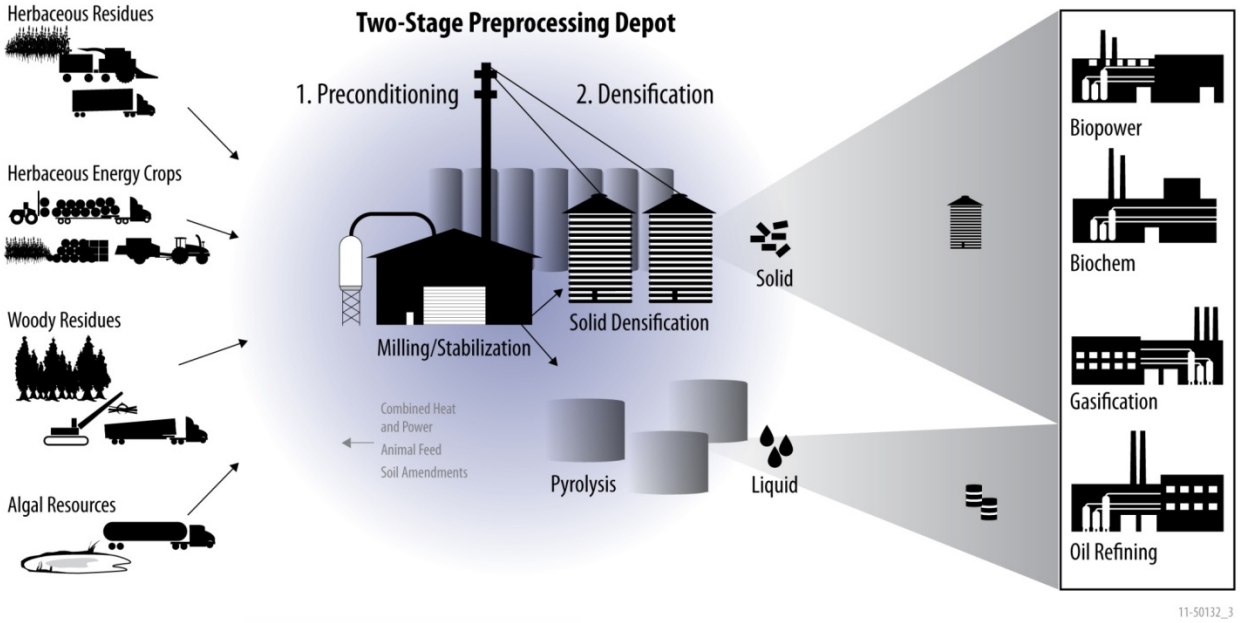


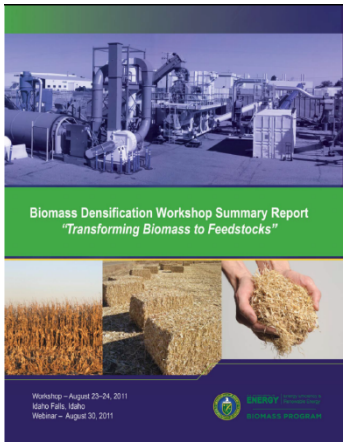
Advanced Depot Design Objectives and Approach

Objective: Transform raw biomass into high-density, stable, commodity feedstocks:

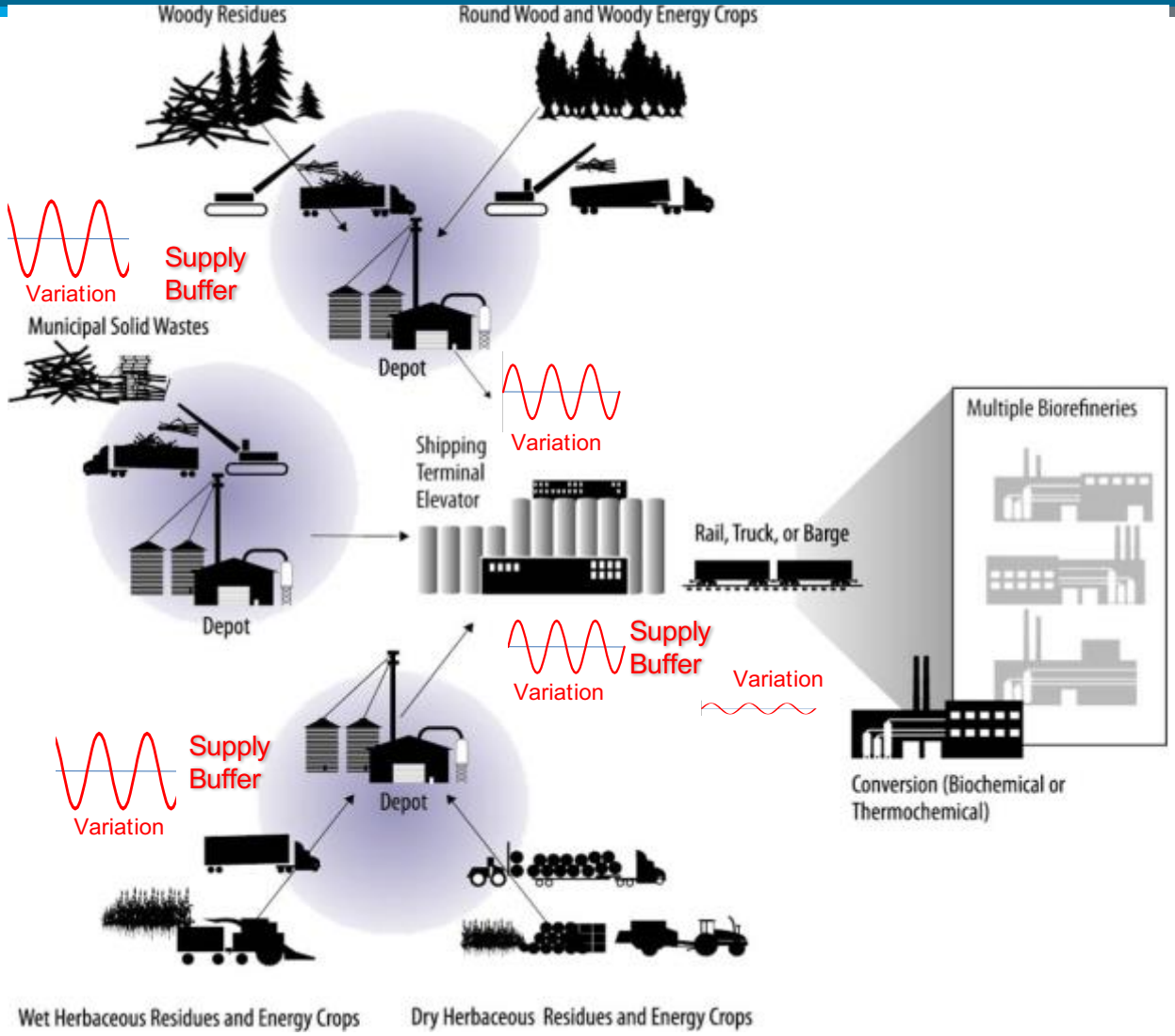
- Actively manage feedstock variability and supply uncertainty
- Feedstock specifications and conversion performance drive logistics and preprocessing
- Advanced preprocessing accesses low-grade and diffuse resources (i.e., use any and all available resources)

Approach: Advanced preprocessing and formulation of multiple raw biomass resources into least cost/performance-based feedstocks





Decoupling Feed Processing from Conversion



- Wide-spread, interconnected supply network
- Stable, flowable, consistent, and ***conversion-ready*** feedstocks
- Reduced feedstock variability in quantity, quality, cost

Decoupling does not solve the feed handling problem, but it does reduce conversion plant downtime.

Revolutionary Biomass Supply Systems Supporting a Billion Ton Bioeconomy Vision

Duration: Respond by June 30, 2016

Audience: Industry, academia, research laboratories, government agencies, and other stakeholders

Purpose: Identify information about current high-technology operations, improved equipment and processes, as well as barriers and solutions associated with the collection/harvest, storage, preprocessing, and transportation of increasing volumes of biomass

Categories:

1. Preprocessing Technologies
2. Quality Management
3. Strategies for Mobilizing a Billion Tons of Biomass

Sustainable Transportation Summit 2016

Sustainable TRANSPORTATION

Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy

When: July 11 -12, 2016

Walter E. Washington Convention Center, Washington, DC

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2016

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