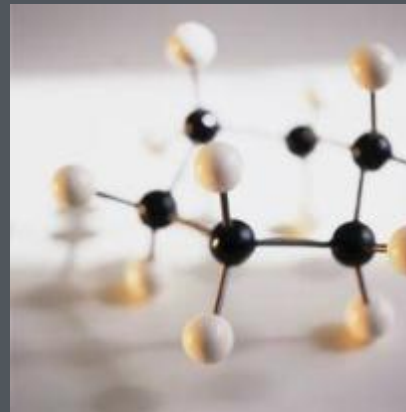


The Future of Biomass-Based Energy: The DOE Perspective

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy



Agricultural Outlook Forum
February 25, 2011

Paul F. Bryan,
Program Manager
DOE Biomass Program

- Jobs and boost to rural economies
- Reduces GHG emissions from crude oil and coal
- Reduces direct & indirect costs of imported oil
- Reduces risks and damages from oil production & transportation
- Leadership in industrial & agricultural biotechnology



The Biomass Program is working to advance biomass technologies in support of DOE's mission to strengthen America's energy security, environmental quality, and economic vitality through:



Feedstocks

Developing lower cost feedstock logistics systems

Conversion technologies

Improving conversion efficiencies and costs

Integrated biorefineries

Systematically validating and deploying technology at first-of-a-kind facilities

Infrastructure

Evaluating vehicle emissions, performance, and deployment options

Biopower

Providing a clean, domestic, dispatchable renewable source of power

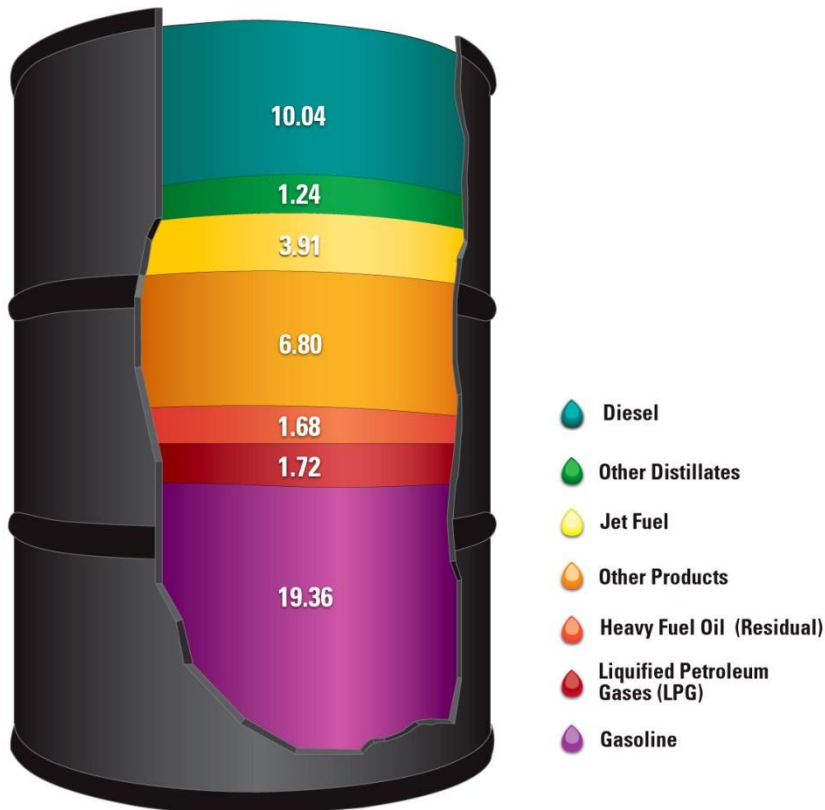
Advanced biofuels

Expanding portfolio beyond cellulosic ethanol to hydrocarbon fuels

- Ethanol, Drop-In Fuels, and the Portfolio Balance
- Second-Generation Biofuels and Bio-feeds – Getting the Pioneer Plants Up and Running
- Feedstock Supply and Sustainability
- Stable Regulatory Environment



Products Made from a Barrel of Crude Oil (Gallons) (2009)

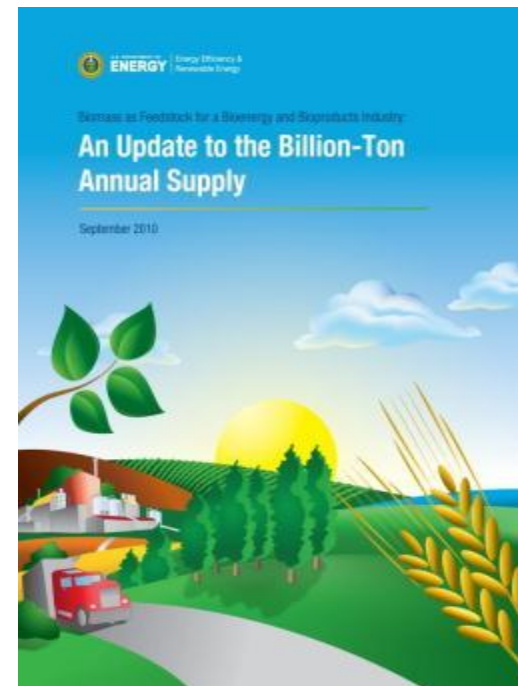


Source: Energy Information Administration, "Oil: Crude Oil and Petroleum Products Explained" and AEO2009, Updated February 2010, Reference Case.

- At low % blends, refiners can adjust operations
- At higher % biofuel, displaced products may be shifted to less-valuable markets
- As crude is displaced as a source of one product, there may be shortfalls in other markets
- Ethanol is / is not a drop-in fuel?
- "HC-X" is / is not a drop-in fuel?
 - Paraffin vs. Aromatic
 - Single component (volatility)
 - Acceptable "contaminant" in other fuels?
 - Combustion behavior?
 - Refinery adaptability?

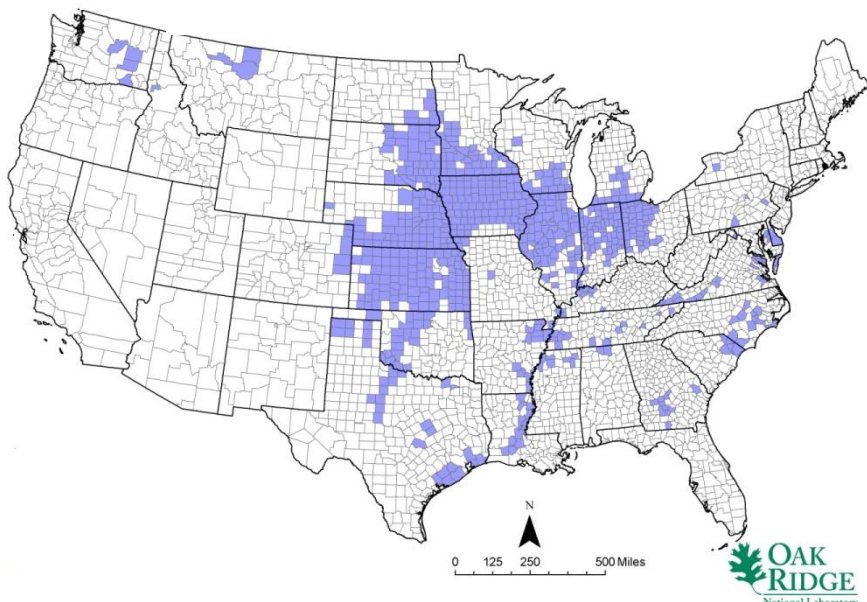
- Cellulosic Fuel Production
 - Stood at <10% of EISA target in 2010,
 - Target doubled, no new production: <5% in 2011,
 - Gap is likely to widen without intervention
- Industry will not grow robustly in a risk-averse credit market
- Near-term capacity is mostly ethanol, exacerbating blend-wall issue
- Industry kick-start, including drop-ins, would cost ~\$5 billion *tota*

- **Update to the 2005 Billion Ton Study**
 - Workshops to gain industry perspective were held in December 2009 (“high-yield scenarios”)
 - County-level inventory and costs for all major feedstocks
 - Used POLYSYS agriculture and new forestry economic models
 - Added sustainability criteria
 - Data and maps to be available in KDF
 - Expected publication in 2011 (currently undergoing peer and DOE review)
- **Future Work**
 - Focus on identifying sustainability and feedstock quality criteria, eventually incorporating into resource assessments
 - Intend for primary dissemination of information to be via KDF



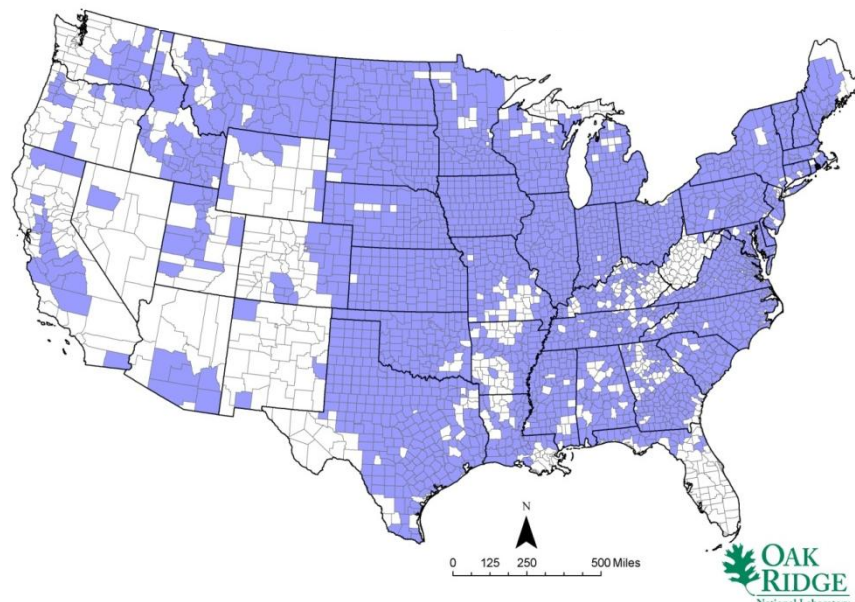
Unlocking the Resource – An Illustrative Example

Number of counties that could potentially produce high-density biomass feedstock resources under existing production and logistics systems

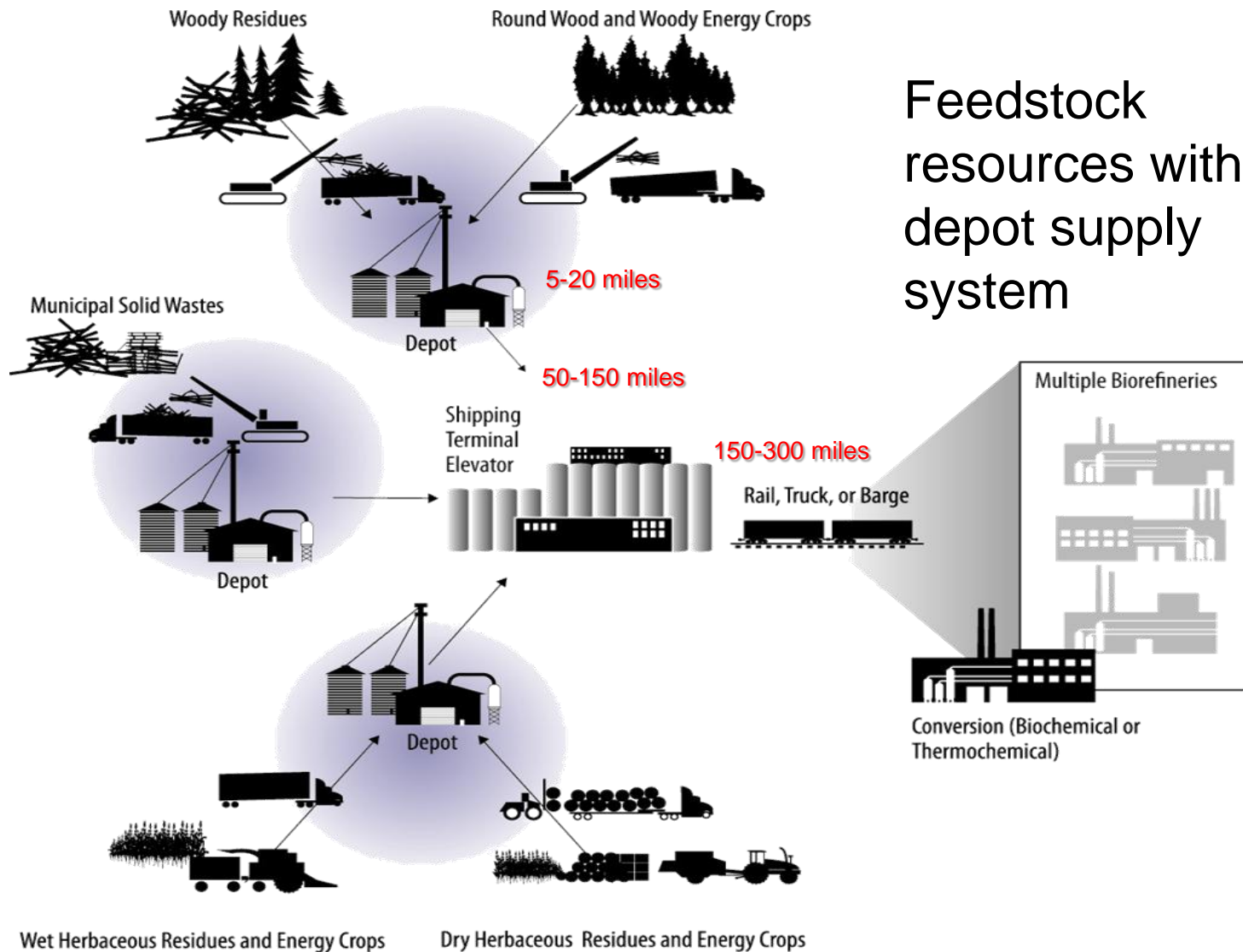


- Little to no improvement in feedstock yield
- Existing harvesting, collection, storage, and transportation techniques
- Sustainability considerations limited
- Conversion specifications for feedstock not addressed
- Supply risk due to price fluctuations, weather events, lack of year-round supply, etc.

Number of counties that could potentially produce high-density biomass feedstock resources under advanced production and logistics systems



- Feedstock yield improved via genetics, genomics, breeding, improved production practices, etc.
- Shift to a uniform-format feedstock preprocessing depot logistics supply system
- Sustainability considerations expanded
- Conversion specifications for feedstock addressed
- Supply risk due to price fluctuations, weather events, lack of year-round supply, etc. decreased



Feedstock resources with a depot supply system

- Reduce greenhouse gas emissions
- Reduce negative environmental impacts (fertilizer runoff, land use change, water consumption) and promote benefits



- Lower costs
- Improve fuel properties
- Enhance economic opportunities for all stakeholders along the supply chain

- Promote rural development and workforce training
- Reduce oil imports

Sustainability Platform Activities

- Monitor and support sustainability of emerging industry
- Apply sustainability criteria in funding biorefineries
- Develop technologies and best practices to further mitigate GHG emissions and with improved environmental impacts