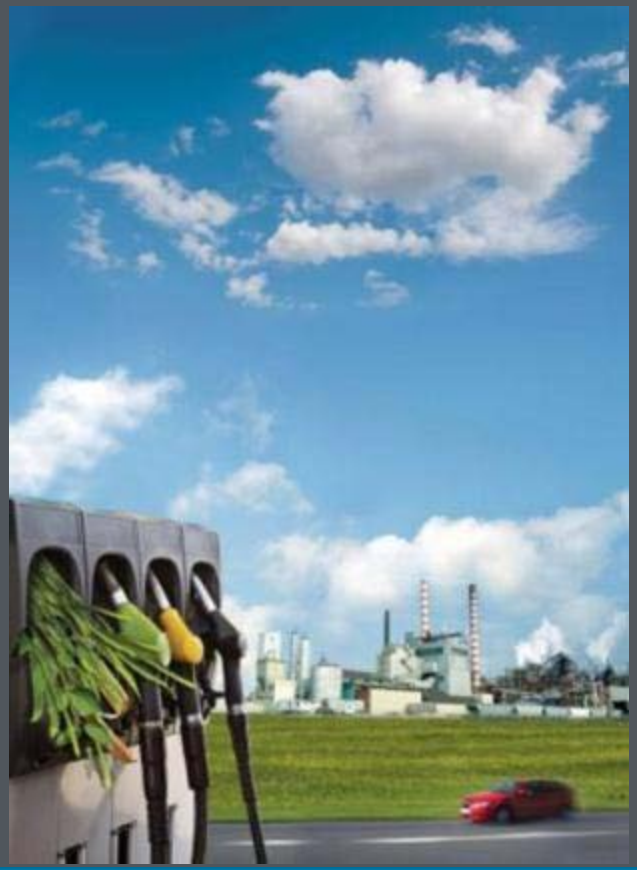
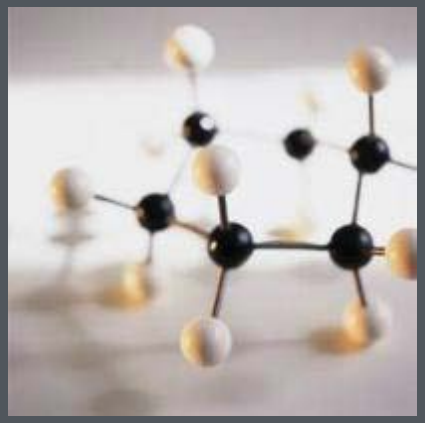
The Future of Biomass-Based Energy: The DOE Perspective

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





Agricultural Outlook Forum

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Program Manager
DOE Biomass Program

Biomass: Value to the Nation

- 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

Sustainable Biofuels, Biopower, and Bioproducts

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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

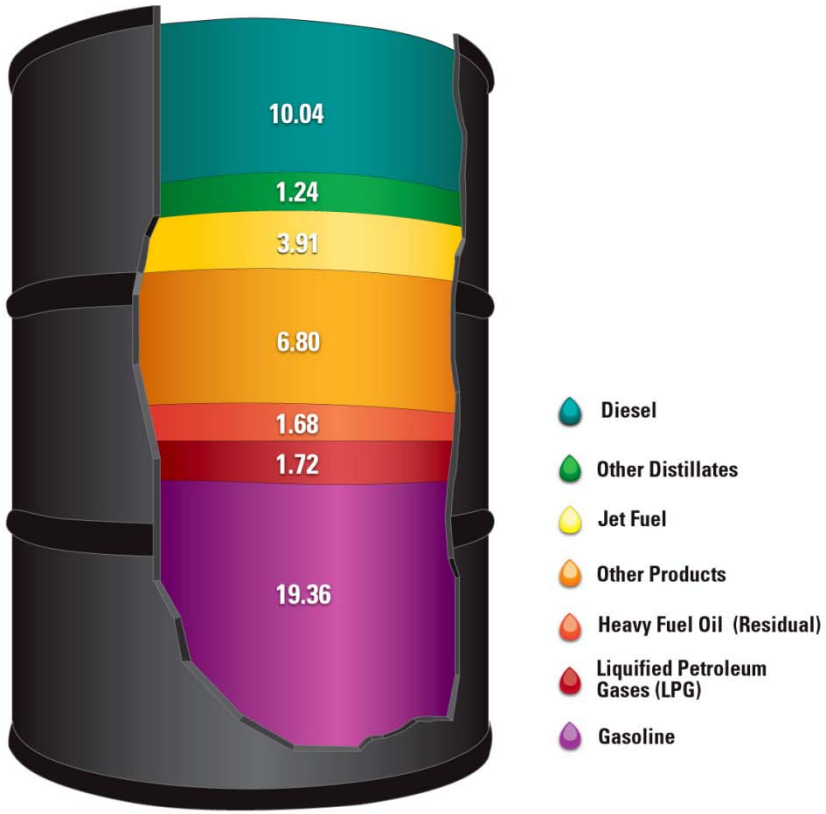
Expanding portfolio beyond cellulosic ethanol to hydrocarbon fuels

Top Policy Issues

- 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

Replacing the Whole Barrel

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?**

Commercializing Advanced Biofuels: Industry Growth is Anemic

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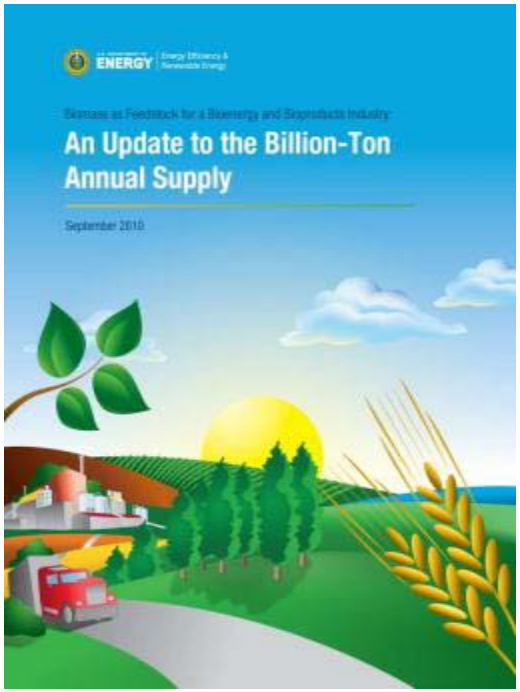
- Cellulosic Fuel Production
  - Stood at <10% of EISA target in 2010,
  - Target doubled, no new production: <5% in 2011,
  - Gap is likely to widen without intervention
- Industry will not grow robustly in a risk-averse credit market
- Near-term capacity is mostly ethanol, exacerbating blend-wall issue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

Feedstock Resource Assessment

- **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

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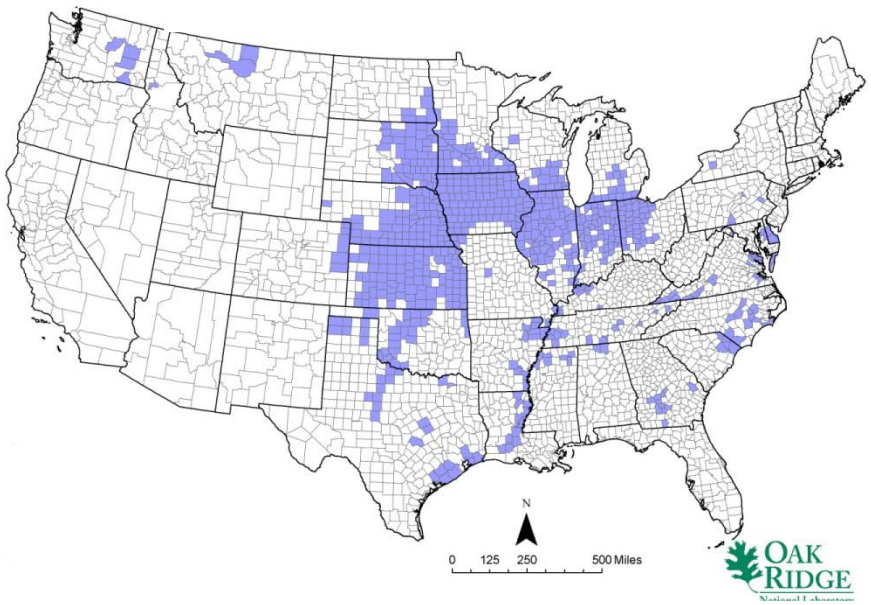
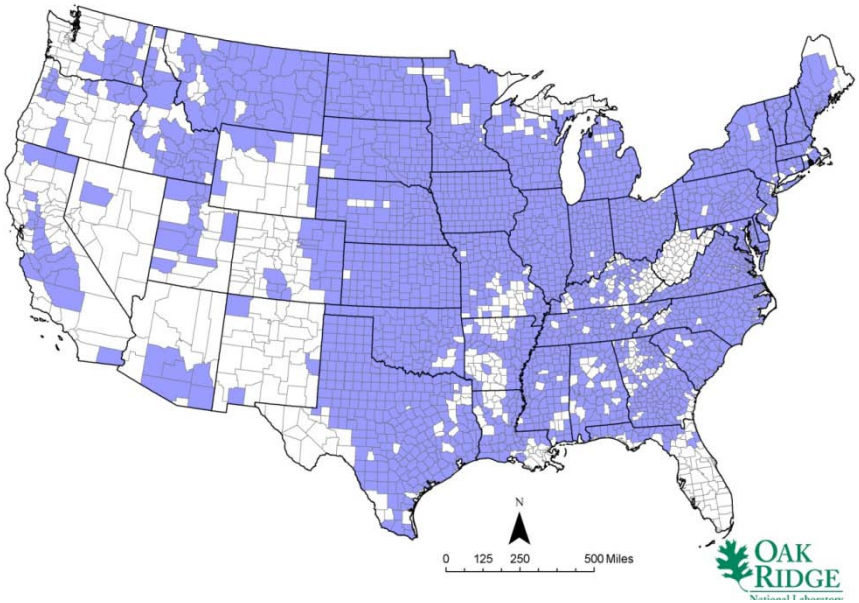
Number of counties that could potentially produce high-density biomass feedstock resources under existing production and logistics systems



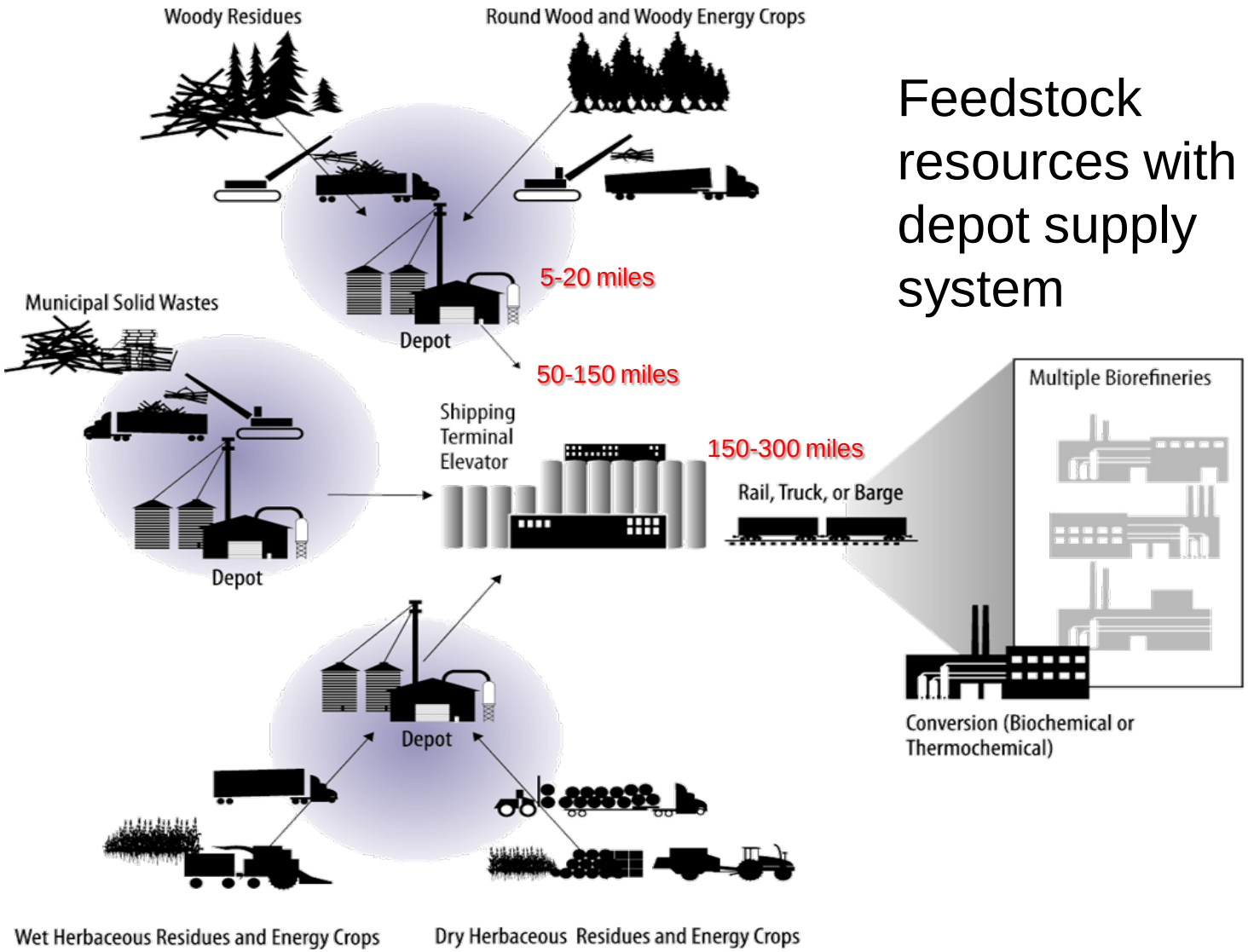
- Little to no improvement in feedstock yield
- Existing harvesting, collection, storage, and transportation techniques
- Sustainability considerations limited
- Conversion specifications for feedstock not addressed
- Supply risk due to price fluctuations, weather events, lack of year-round supply, etc.

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

Unlocking the Resource



Feedstock resources with a depot supply system