# *Renewable Fuels Technical Modeling USDA-ARS-ERRC*

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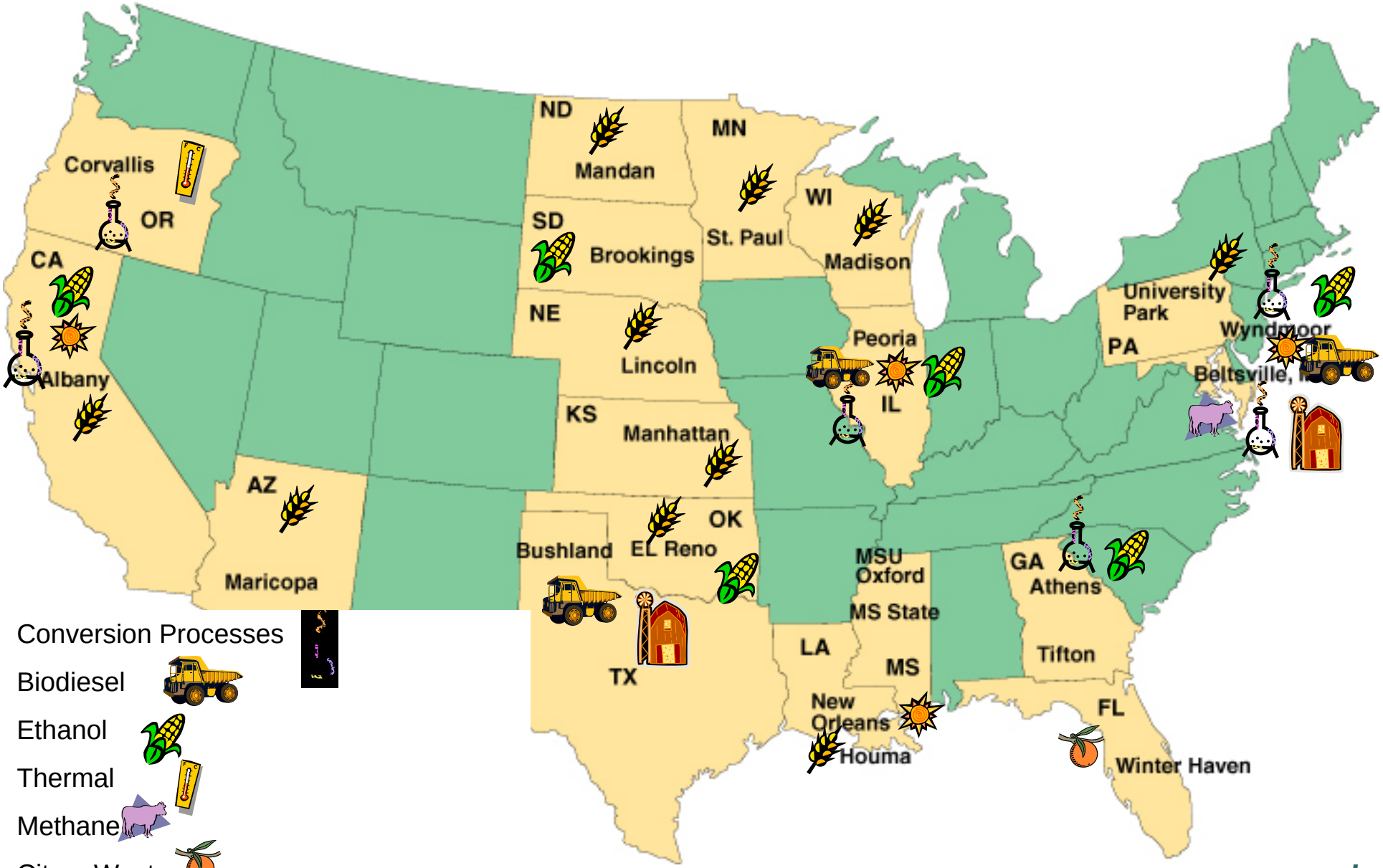
# ARS Profile

- Scientific research arm of USDA
- Farm-to-table research scope
- Information and technology transfer
- National Programs
- 1,100+ projects
- 2,500+ scientists
- 9,000 employees
- 100+ lab locations
- $1.1 billion annual budget (FY06)
- International collaboration
- Partnerships with universities and industry
- Stakeholder driven priority process

# ARS' Bioenergy Program

- Energy crop research
  - Developing new plant varieties for biofuels feedstocks
- Ethanol
  - Processing
  - Developing new microbes and enzymes for conversion
  - Developing valuable co-products from ethanol production
- Biodiesel
  - Processing
  - Quality and performance
- Other
  - Methane from manure
  - Thermo-chemical and biological conversion of biomass to hydrogen
  - On-farm and remote renewable energy systems




# USDA Bioenergy Research Locations

# Process and Cost Modeling

Tools for ARS Researchers and others

Provides an understanding of the technical and economic issues involved in processing agricultural products

Demonstrate the potential economic impact of specific research goals

# Modeling Results

- Material and Energy Inputs and Outputs
- Processing Details
- Analysis of capital and operating costs

# Current Renewable Fuel Models

- **Biodiesel Process**
- **Corn Wet Milling Process**
- **Dry Grind Ethanol Process**

# Corn Ethanol Modeling

- Changing Economic Conditions
- Process Variations
- Alternative Feedstock's

# Corn Ethanol Process Variations

- Front and Back End Separation Process
- Oil Recovery
- Energy Reduction Alternatives
- New Co-products

# Alternate Feedstocks

- Pearl Millet
- Sugar beets
- Barley

# Typical Corn Based Ethanol Costs

- Plant Capacity — 40 MGY Ethanol
- Capital Cost — $ 1.50 - $2.00 / Gallon
- Corn Costs — $ 3.50 / Bu.
- Production Costs — $ 1.68 / Gallon

# Typical Ethanol Costs By Area

| | $ / Gal. |
|---|---|
| Corn Cost | $ 1.27 |
| Grain Handling & Starch Conversion | $ 0.17 |
| Fermentation | $ 0.07 |
| Ethanol Processing | $ 0.23 |
| Co product Processing | $ 0.25 |
| Co product Credits | $ 0.31 |

# Biodiesel Processes

- Biodiesel from virgin oil
- Biodiesel from recycled oils & rendered products
- Biodiesel from soapstock
- Biodiesel from soy flakes

# 1st Use Feedstocks Biodiesel Costs

- Plant Capacity 10 MGY Biodiesel
- Capital Cost $1.25 / Gallon
- Soy Oil Cost $ 0.32 / Pound
- Production Costs $ 2.75/ Gallon

# 1’st Use Feedstocks Biodiesel Processing Cost Breakdown

| | $ / Gal. |
|---|---|
| Soy oil  Cost | $ 2.31 |
| Energy Charges | $ 0.05 |
| Methanol & Catalyst Charges | $ 0.16 |
| Other Processing  Charges | $ 0.25 |
| Crude Glycerin Credits | $ 0.025 |

# 2nd Use Feedstocks Biodiesel Costs

- Plant Capacity 10 MGY Biodiesel
- Capital Cost $1.50 / Gallon
- Feedstock Cost $ 0.22 / Pound
- Production Costs $ 2.48/ Gallon

# 2’nd Use Feedstocks Biodiesel Processing Cost Breakdown

| | $ / Gal. |
|---|---|
| Feedstock Cost | $ 1.71 |
| Energy Charges | $ 0.19 |
| Methanol & Catalyst Charges | $ 0.23 |
| Other Processing Charges | $ 0.37 |
| Crude Glycerin Credits | $ 0.024 |