

# ENERGY SITUATION FOR AGRICULTURE

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## ACEEE Forum on Energy Efficiency in Agriculture

Des Moines, IA

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### Economic/Production Factors Contributing to High Energy Prices

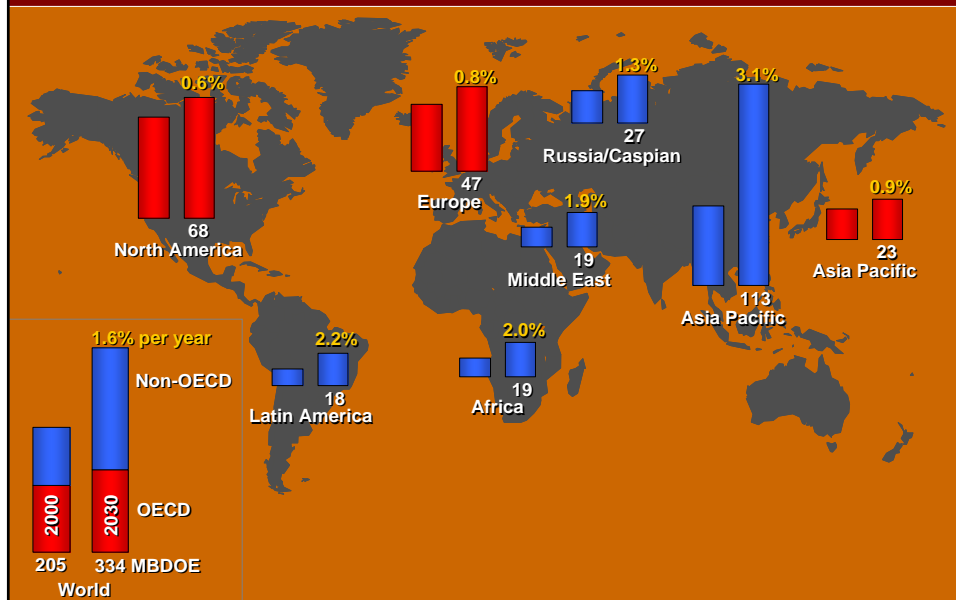
- New demand from newly industrialized countries
  - China
  - India
- Refinery constraints
- Distillates – inventory low
- Gasoline – imports are key
- Constrained domestic natural gas production
  - Relatively modest LNG imports
  - High use by utilities for meeting peak demand

# Long Term Energy Outlook Private Sector

## One Major Energy Company's View

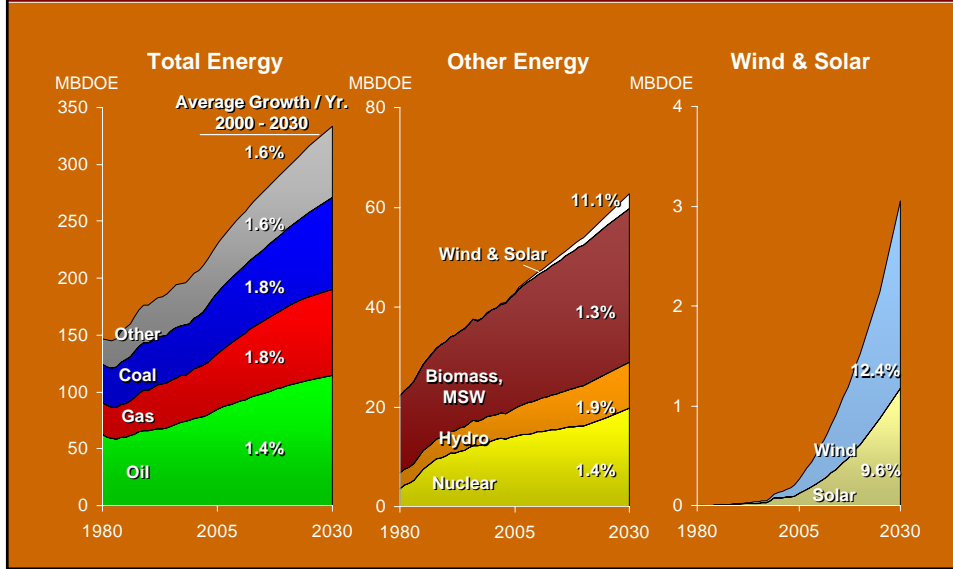
### Energy Use - 2030

Exxon/Mobil Long Term Outlook



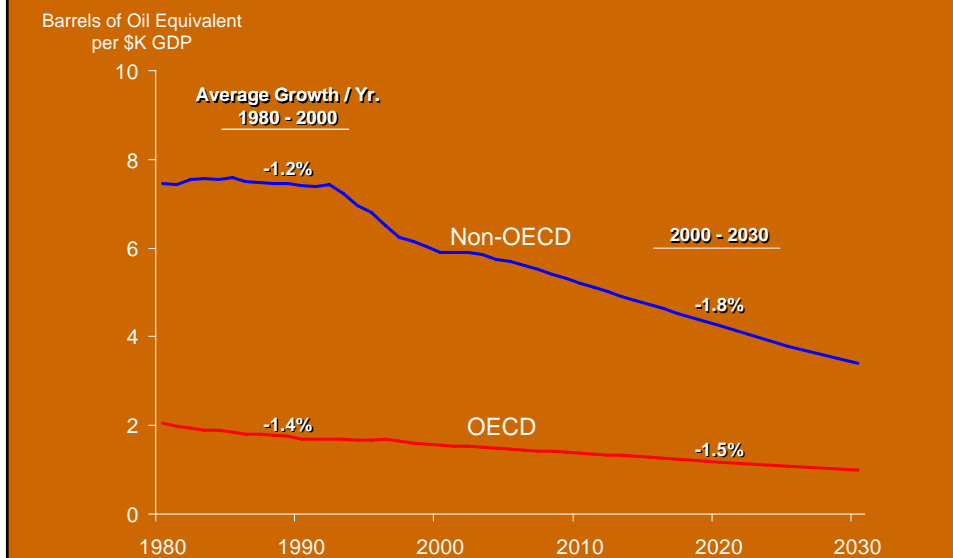
# Oil and Gas Remain Predominant

Exxon/Mobil Long Term Outlook



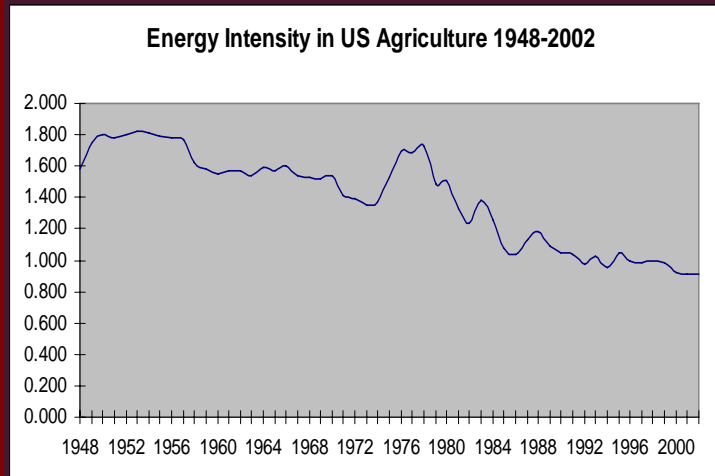
# Energy Intensity - Declining Trend Accelerates

Exxon/Mobil Long Term Outlook



# U.S. Agriculture has Produced Long Run Energy Efficiency Gains

USDA Economic Research Service



## The Quest for Energy Efficiency in U.S. Agriculture

- Farm expenditures for energy-related production inputs (electricity, fuels and oils, fertilizers)
  - Rose from 5 percent of total farm cash expenses in 1910 to over 17 percent by the early 80s
  - From the early 80s to '99, efficiency gains and generally stable prices caused the percentage to fall to 11 percent.
  - The share of energy-related expenses started rising again after the energy price spikes of 2000-2001.
  - USDA's Nov. 3, 2005 farm income forecast, placed 2005 energy-related expenses at 14 percent of total farm cash expenses.

## Current Situation

### Agriculture is Experiencing Energy Cost Increases Across the Board

- High energy prices are driving up barge and rail rates.
- Higher energy prices are also raising rail, truck, storage and processing costs.
- Farm production costs are rising. Off-road diesel prices used for combines could average \$1.65 per gallon higher than last year.
- Farmers are experiencing increased costs for propane to dry grain
- Farmers are experiencing significantly higher fertilizer costs for fall applications.

## Rising Fertilizer Costs...

- Natural gas is the primary input in the production of nitrogen fertilizer.
- Prices Paid Index for fertilizer rose
  - by 34 percent from 1999 to 2004.
  - by 11 percent from September 2004 to September 2005.
- Long-term increases in natural gas prices will lead to an increase in the cost of U.S. nitrogen fertilizer production and higher expenses for fertilizers.
- Increasing imports of fertilizer can limit the impact to the extent natural gas prices in other countries do not increase as rapidly as U.S. prices.

## Energy Intensity is Commodity Specific

Energy Cost Per Acre  
by Major Agricultural Commodity - 2003

Tobacco	\$400
Rice	128
Sugar Beets	98
Peanuts	97
Corn	66
Sorghum	51
Wheat	34
Soybeans	16

Energy Related Costs  
as a Percent of Per Acre Total Farm  
Expenditures for 2003

Sorghum	23%
Rice	21
Corn	19
Wheat	18

## Energy Intensity is also Regionally Specific

In 2003, energy-related expenses as a share of total farm production expenses were highest in the Midwest (11%), and lowest in the Atlantic and West regions (7%).

## Energy Related Costs for 2005

- If the 2003 cost of production data for energy-based inputs is indexed to reflect the higher energy costs of 2005, energy-based production expenses for the 2005 crops are about:
  - 20 cents per bushel higher for corn and soybeans
  - 31 cents higher for wheat, and
  - 45 cents higher for sorghum.

## What Can U.S. Agriculture Do to Mitigate High Energy Costs?

- In the short run, options are limited...
  - Some may allow crops to dry naturally
  - With most fall crops harvested there is little flexibility this year
- Over the longer term, energy savings are possible in a number of areas.

## Some Intermediate-term Energy Saving Strategies

- Adopt precision agriculture
  - Irrigation water management
  - Pesticide management
  - Nutrient management
- Shift to grazing systems instead of baled feed
- Add windbreaks
- Purchase energy efficient equipment
- Generate energy on the farm (anaerobic digesters)
- Switch to less energy-intensive crops.

## **How is USDA Helping?**

### **Some Examples...**

**USDA, through its mission areas, provides basic research, education, technical assistance and funding for private sector and University research and development of many initiatives that contribute to Americas energy efficiency and independence**

**Natural Resources  
Conservation Service  
Energy Efficiency Efforts**

NRCS provides technical and financial assistance to help farmers and ranchers install or adopt conservation practices, many of which result in more efficient use of energy

## NRCS

Many conservation practices conserve soil and water resources and help farmers and ranchers conserve energy

- Residue Management
- Irrigation Water Management
- Nutrient Management
- Drainage Water Management
- Rotational Grazing

## NRCS

**NRCS Programs that Support Energy Conservation Include:**

- Conservation Technical Assistance
- Environmental Quality Incentives Program
- Agricultural Management Assistance Program
- Conservation Security Program

## **NRCS Conservation Security Program**

- Created by the 2002 Farm Bill
- Designed to reward the best stewards
- Among other authorities, CSP authorizes NRCS to directly reward producers for energy saving activities and renewable energy production

## **NRCS CSP**

### **CSP provides Energy Enhancement Incentives for the following activities**

- Energy Audits
- Recycling On-Farm Lubricants
- Use of Legumes and Manures
- Bio-fuel Purchases
- Reduced Soil Tillage
- Renewable Energy Generation
- Reduced Energy Use

## **NRCS Biomass Research and Development Initiative**

- Jointly administered by USDA and DOE
- Provides grants for research, development, and demonstration of biomass technologies
- NRCS administered the program for USDA from 2002 Through 2005 and awarded \$44.7 million
- Beginning in 2006, the Biomass Program will be administered by Rural Development

## **Cooperative State Research, Education and Extension Service**

### **Energy Efficiency Efforts**

## National Energy Star®/Extension Education Program

- Promotes energy efficiency in existing residential settings by providing energy workshops, presentations and programs along with other educational materials.
  - 1,122,154 consumers reached.
  - 467,333 consumers adopted energy conservation practices
  - 205,804 households purchased Energy Star® products
  - 427 energy workshops, presentations, and programs held
  - \$672,510 reported saved in household energy costs
- <http://www.energyextension.com>

## Building America Program

- A private/public partnership sponsored by DOE that researches energy-efficient solutions for new and existing housing to be implemented on a production basis.
- CSREES cooperates with the National Association of State University and Land-Grant Colleges (NASULGC) and the DOE to reach homebuilders with energy research.
- Seven state housing Extension specialists from New York, Delaware, Florida, Louisiana, Minnesota, Alaska and Kentucky were part of the project in 2004.
- [http://www.eere.energy.gov/buildings/building\\_america/](http://www.eere.energy.gov/buildings/building_america/)

## Utah House and Louisiana House

- Demonstrate minimizing energy, water, pollution and waste.
- **Utah House:** demonstrate, educate, empower the public about new ways of building homes and creating landscapes that promote the sustainable use of resources, energy efficiency, water conservation, universal design, and healthy indoor environments.  
<http://extension.usu.edu/cooperative/utahhouse/>
- **Louisiana House:** to show Louisiana consumers and professionals how it is possible and practical right now to have MORE (comfort, durability, value, health) with LESS (energy, water, pollution, waste, damage).  
<http://www.louisianahouse.org>

## CSREES Research Projects

- **Cornell University:** Examine affordability of housing issues related to residential energy efficiency and indoor air quality.
- **North Carolina A&T University:** Track incidence/resolution of energy-related and other housing problems in new manufactured homes.
- **University of Alaska-Fairbanks:** Examine the energy efficiency of the Alaska-built house.

## National Research Initiative Iowa State University

- Expand and improve uses of vegetable oils (biodiesel) for non-food and food applications, reducing dependence on foreign oil.
- Develop new agricultural oil-based plastics, increasing the value of crops as raw materials for manufacturing and conserving renewable petroleum resources.
- Develop/use waste streams co-products from biofuel production to produce value added non-food products.
- Research ways to use renewable resources, specifically plant biomass sugars, to produce chemicals and fuels.

## Agricultural Research Service Research Initiatives that Support Energy Efficiency

# ARS

## Research Findings That Result in Energy Efficiency

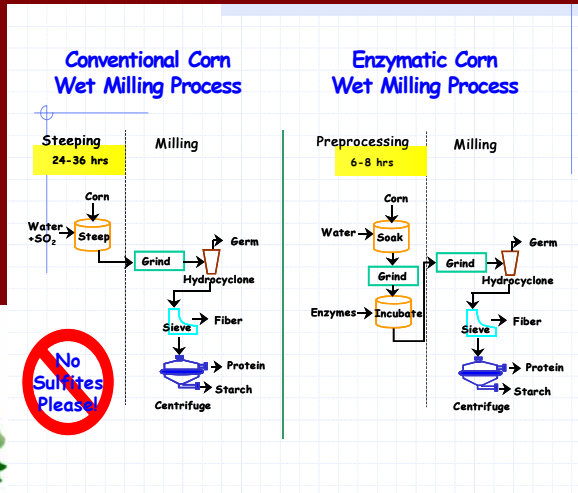
- Many ARS research projects result in improved energy efficiency through reduced inputs, lower costs, and improved output:
  - **Processing/conversion:** low energy fruit blanching methods.
  - **Irrigation:** efficient water application methods.
  - **Molecular biology:** improved plant varieties that require less tillage, use of fewer pesticides, and produce greater yields
  - **Precision agriculture:** Use of navigational and spatial data to reduce equipment, fertilizer, pesticide, seed, and fuel use.
  - **Crop Production practices:** Efficient tillage practices reduce soil erosion, improve soil quality and greatly reduce fuel requirements. Improved fertilizer application practices reduce fertilizer, and energy inputs.
  - **Biofuels development:** More energy efficient ways to produce biofuels reduce the energy intensity and improve the cost and acceptance of alternative fuels

# ARS

## Biofuel Production Research

# Enzymatic Corn Wet Milling

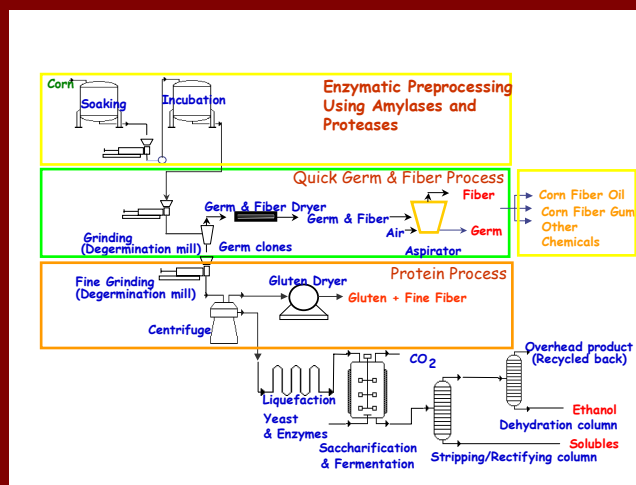
Johnston et al., U.S. Pat. 6,566,125, (2003)  
 (Now being licensed by major enzyme company)



This revolutionary new process dramatically decreases steeping time (an energy intensive step) and decreases time and chemicals needed for corn wet milling. It was just successfully demonstrated at a corn wet milling plant in Asia in 8/2005. The process will save significant energy and prevent pollution for the industry

# Enzymatic Dry Grind Ethanol Process

Johnston, et al., U.S. Pat. 6,899,910, May 31 2005



This new process uses protease enzymes to make fuel ethanol more efficiently. More ethanol will be produced by smaller ethanol plants, and less energy will be needed to dry the DDGS byproduct. The result will be cheaper ethanol and better byproducts.

## ARS Process and Cost Simulation Models

ERRC/ARS makes sophisticated process and cost models of fuel ethanol and biodiesel production processes.

The models estimate the thermal and electrical energy used in each phase of ethanol, biodiesel, and co-product production to improve energy efficiency of commercial production facilities

## ARS Efficient Irrigation Methods

## Low Pressure Spray Irrigation



## LEPA Spray System



## LEPA Sock System



## ARS

### Efficiencies of Irrigation Methods

Irrigation Method	Typical Efficiency (percent)	Water Application Needed to Add 100 mm To Root Zone (millimeters)	Water Savings Over Conventional (percent)
Conventional Furrow	60	167	
Furrow with Surge Valve	80	125	25
Low-Pressure Sprinkler	80	125	25
LEPA Sprinkler	90- 95	105	37
Drip	95	105	37

## Rural Development

### Funding of Biomass, Energy Generation Facilities and Rural Development Projects

## RD Renewable Energy Funding Fiscal Years 2001-2005

<u>Renewable Energy</u>	<u>No.</u>	<u>Amounts \$ Millions</u>
Business/Industry Loan Gtys.	12	94.7
Rural Business Enterprise Grants	19	1.4
Rural Business Opportunity Grants	4	.2
Rural Economic Development Loan & Grant	5	2.3
Value Added Producer Grants	107	18.7
Section 9006 Energy	<u>278</u>	<u>73.1</u>
Total	419	190.3

## RD - Section 9006 Funding Activity Fiscal Years 2003-2005

<u>Renewable Energy</u>	<u>No.</u>	<u>Amounts \$ Millions</u>	<u>Leveraged Funds</u>
Biomass	119	29.8	197.1
Wind	121	27.8	446.4
Solar	17	1.4	3.6
Geothermal	4	.4	1.1
Hybrid	<u>9</u>	<u>2.4</u>	<u>185.5</u>
Totals	270	61.8	833.7
Energy Efficiency Improvements: 165 - \$4.9MM			
Guaranteed Loans (Biomass): 2 - \$10MM; Leveraged Funds \$13.1MM			

In addition Rural Development funds many rural electrical generation projects through its Rural Utilities Service, which provide for the energy needs of rural areas throughout the U.S.

## Energy Policy Act Implementation

The Energy Policy Act charges DOE, USDA, DOI, EPA, FERC and other federal agencies, to improve America's ability to work toward energy independence

USDA is collaborating with other federal agencies to implement to the various provisions of the Act and to provide funding for authorized activities when appropriated by Congress