



East Regional Biomass Roadmap Update Workshop

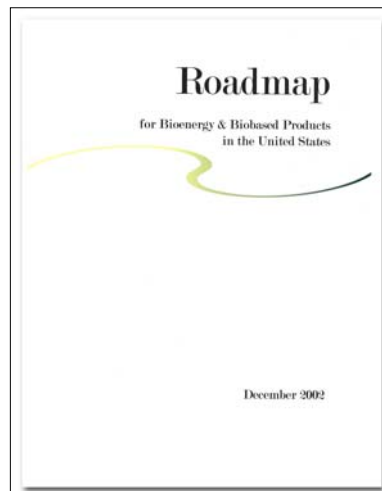
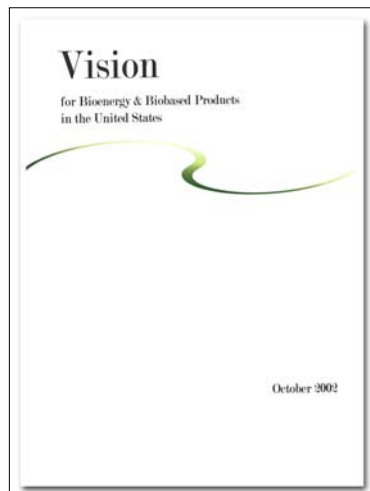
Federal Biomass R&D
Technical Advisory Committee,
U.S. DOE and USDA,
SUNY ESF

Marx Hotel Conference Center
Syracuse New York,
September 19-20



Biomass Vision and Roadmap Update

Current status of Update Process

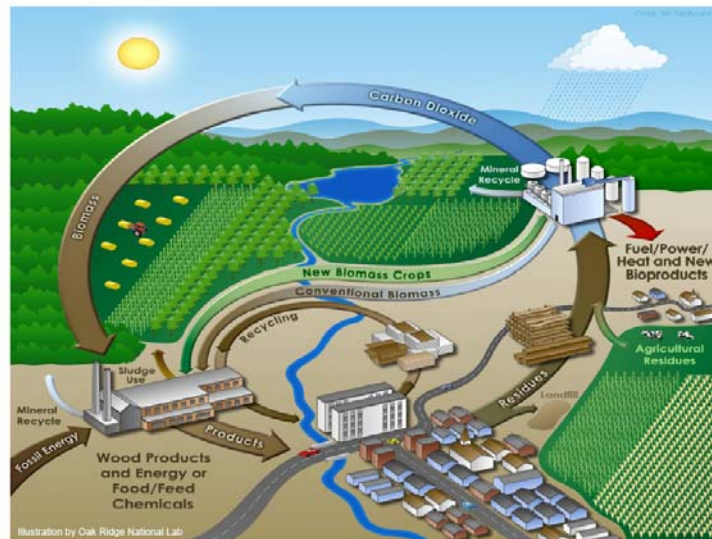


- *The Vision for Bioenergy and Biobased Products in the United States was created in 2002*
- *It established far-reaching goals to increase the role of biobased energy and products in our nation's economy.*
- *It represented the collective vision of the Biomass Research and Development Technical Advisory Committee established by the Biomass R&D Act of 2000.*

- The Energy Policy Act of 2005 mandated an update of the Vision and Roadmap.
- The updated *Vision* does not change the original 2010 goals but recognizes that in some cases the U.S. is not on track to meet them.
- The *Vision* makes minor changes to its 2020 and 2030 goals and establishes 2015 goals which describe the types of activities that must occur to reach that goal and move down the path to the aggressive targets for 2020 and 2030.
- Updated Vision was reviewed by 74 experts in the field including an independent peer review.
- The Vision update will be available in October 2006.

	Units	2000	2004	2010	2015	2020	2030
Biofuels	Market share (%)	0.7	1.2	4.0	6.0	10.0	20.0
	Consumption (billion gasoline-equivalent gallons)	1.1	2.1	8.0	12.9	22.7	51.0
Biopower	Market share (%)	3.0	3.0	4.0	5.5	7.0	7.0
	Consumption (Quadrillion Btu)	2.0	2.1	3.1	3.2	3.4	3.8
Bioproducts	Production (billion lbs)	12.8	17.6	23.7	26.4	35.6	55.3

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Vision Goals relative to Other High Profile Recommendations

	2010	2020	2025	2030
BIOFUELS GOALS				
<i>Vision (billion gallons)</i>	11	17	34	68
President's Biofuels Initiative (billion gallons)	--	--	--	60
Aspen "A High Growth Strategy for Ethanol" (billion gallons)	--	--	100	--
TOTAL ENERGY GOALS				
<i>Vision – Quads</i>	4	5	7	10
25x'25 quads	--	--	32*	--
BIOBASED PRODUCTS GOALS				
Biobased Products (billion lbs.)	24	36	45	55

* 25x'25 includes solar, wind, and biofuels across all sectors; Committee Vision includes only biomass in transportation, industrial, and utility sectors. It does not include residential and commercial sectors.

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Comparison of Approaches of Various National Efforts

	Goal Areas	Approach	Outcomes
National Biomass Initiative	Biofuels Biopower Bioproducts	Vision workshop to update goals; followed by peer review. (final: Sept. '06) Three Region-specific Roadmap workshops	<ul style="list-style-type: none"> •Roadmap of R&D and policy strategies and timelines (regional and national perspective) •Guidance to R&D Board •Guidance for annual joint USDA/DOE solicitation •Used to monitor progress by agencies
President's Biofuels Initiative	Cellulosic ethanol	Convened 30x'30 workshop Compiling outputs from multiple strategic planning sessions*	<ul style="list-style-type: none"> •R&D & policy strategies to provide basis for DOE R&D planning •Federal Posture Plan to map agency roles
Aspen Institute	Ethanol	Convened experts for 3-4 day dialogue	Generated 16 unanimous recommendations on R&D, policy, and incentives
25 x '25	Wind, Solar, Biofuels	Holding planning meetings and established workgroups**	Roadmap of R&D and policy recommendations, (draft: Oct. '06)

*Includes National Biomass Initiative Roadmap workshops, regional feedstock partnership workshops, etc.

**Work groups include: Biofuels, Electric Generation from RE, Outreach & Education, RE in other Sectors, & Natural Resources & Wildlife.

What is the Roadmap?

- Developed to map R&D needed to achieve original Vision goals.
- Used to guide annual joint DOE/USDA solicitation under the Biomass Initiative.
- Provides guidance to federal agencies on direction for biomass related R&D.

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Roadmap Update Process

- Roadmap Update Workshops are planned by Regional Chairs with BCS/DOE support
- Workshops incorporate regional experts pertaining to the Roadmap categories: Feedstocks, Processing and Conversion, Product Uses and Distribution, Public Policy

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- Update Roadmap language
- Incorporate New federal/state activities
 - Renewable Fuels Standards
 - Produce 8 million gallons of ethanol by 2012
 - Biofuels Initiative
 - Decrease cost to \$1.07 per gallon of ethanol by 2010
 - Displace 40 billion gasoline equivalent gallons by 2030
- Revisit path towards achieving Vision Goals
- Invitation only with regional experts

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- Midwest Regional Roadmap
 - Chair: Tom Binder, ADM
 - Chicago, IL, April 11-12, 2006
- West Regional Roadmap
 - Ralph Cavalieri, Washington State
 - Sacramento, CA, August 8-9, 2006
- East Regional Roadmap
 - Douglas Hawkins, Rohm & Haas
 - New York, September 19-20, 2006

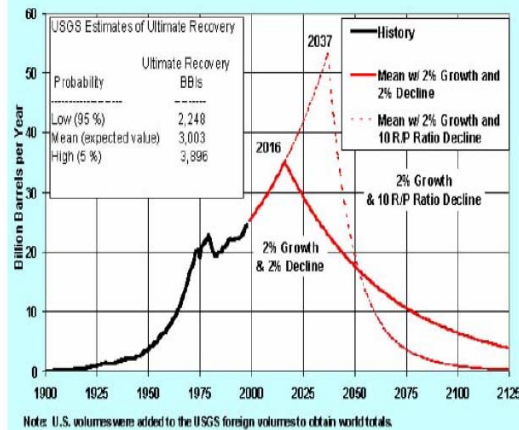
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Why have a Roadmap?

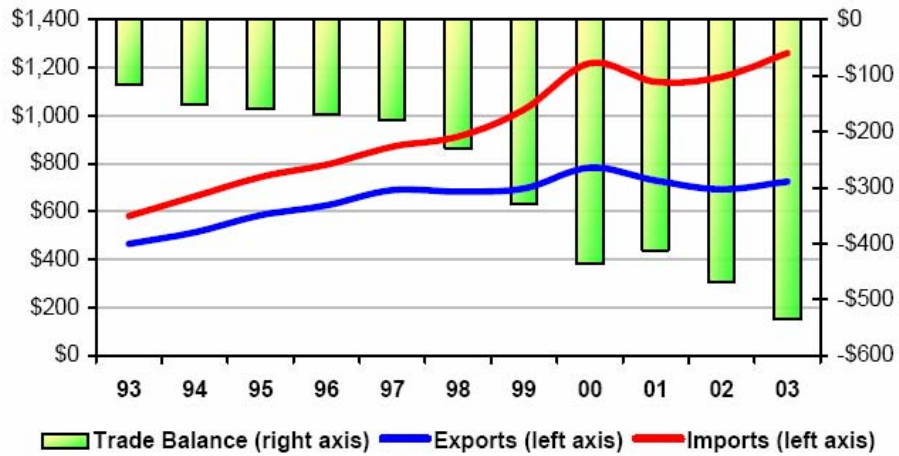
What is beyond Peak Oil?



Annual Production Scenarios with 2 Percent Growth Rates and Different Decline Methods



**US Trade in Goods with the World
(\$ Billions)**



What role can biomass play?



U.S. Agricultural Economy and Biomass

- Ethanol and biodiesel industry creates domestic jobs
- Ethanol industry has grown to 81 plants in 20 states which support 147,000 jobs in the United States, mostly in rural communities.
- On average, a 40 million gallon per year ethanol plant supports 41 full-time jobs and nearly 700 jobs throughout the entire economy.
- Cuts the trade deficit by \$34.1 billion through 2012.

(Data 8/2005 From http://www.eere.energy.gov/biomass/economic_growth.html#trade and "Homegrown for the Homeland - Ethanol Industry Outlook for 2005")

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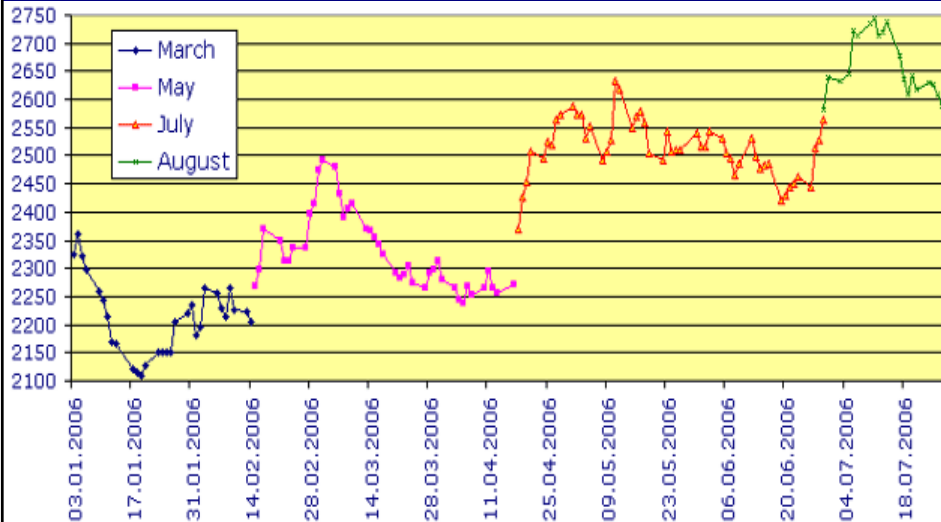
Biodiesel USA

Year	Production Gallons
2000	1,989,400
2001	6,437,200
2002	8,814,600
2003	18,400,000
2004	18,900,000
2005	100,000,000*

Source CCC Data

*Estimate

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Source: <http://www.palmoil.com/index.php?q=D1VTW1NASgIEAhEbVg9RAAsI>
Data from Chicago Board of Trade

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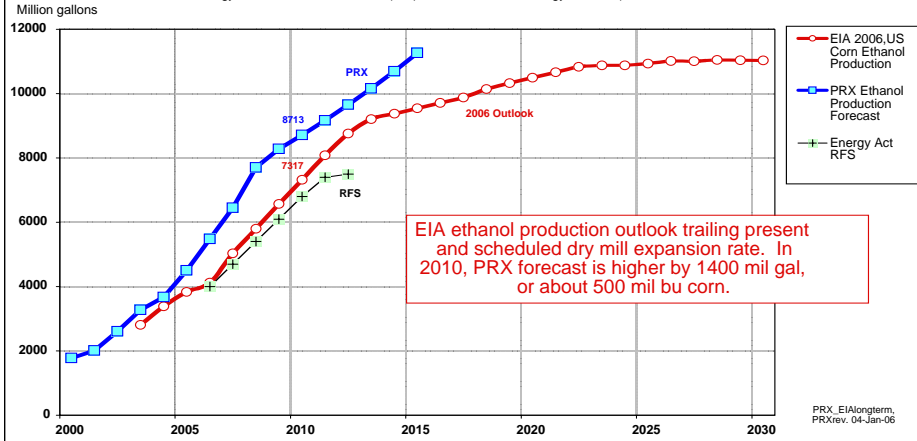
- Crop Year 2004 Approx. Production 18.7 B lbs
- 7.5 billion pounds of biodiesel derived from soy oil would represent approximately 40% of current total soy oil demand. This would be 1 billion gallons or 2% of diesel demand.

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U.S. Corn Ethanol Production

US CORN ETHANOL PRODUCTION, with PRX ESTIMATE

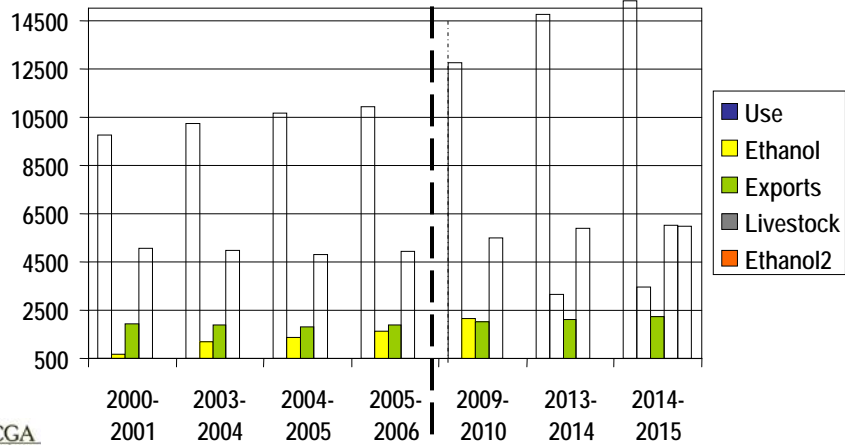
Energy Information Administration (EIA), US DOE, Annual Energy Outlook (AEO)



According to the EIA:

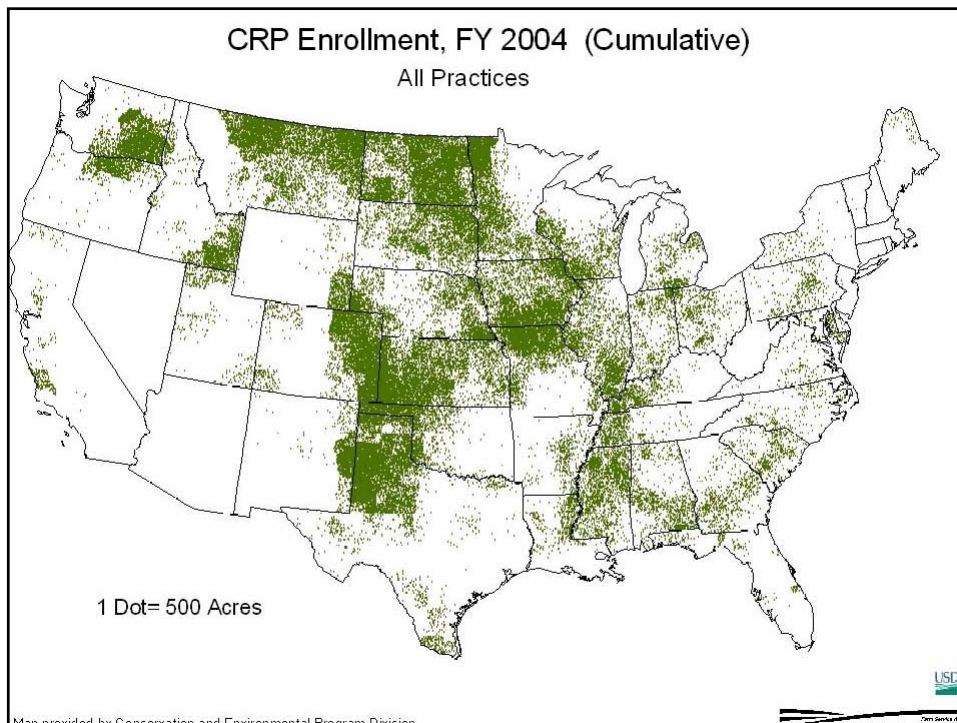
"The AEO2006 reference case includes only those sections of EPACT2005 (the recent Energy Bill) that establish specific tax credits, incentives, or standards—about 30 of the roughly 500 sections in the legislation."

Corn Use – 1999-2015



- Dedicated perennial energy crop production potential
- On Conservation Reserve Program (CRP) Acreage
- Using switchgrass, hybrid poplar, willow, etc.

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Switchgrass Production Areas with data available

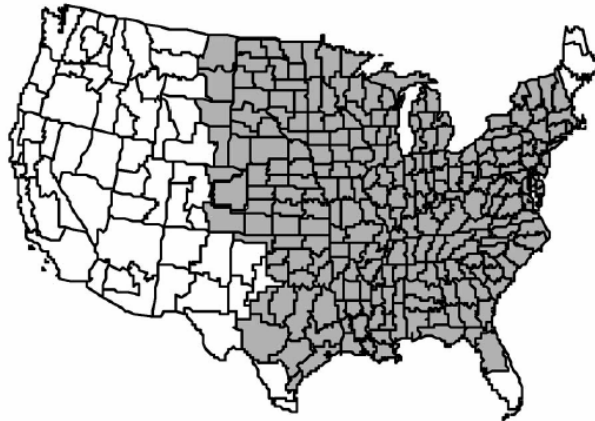


Figure 1. Switchgrass production regions (switchgrass can be grown in regions other than those included in the analysis, but yield and production practices data are lacking for these regions).

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Walsh, M. et al. *Environmental and Resource Economics* 24: 313–333, 2003.

Hybrid Poplar Production Areas with data available



Figure 2. Hybrid poplar production regions (hybrid poplar can be grown in regions other than those included in the analysis, but yield and production practices data are lacking for these regions).

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Walsh, M. et al. *Environmental and Resource Economics* 24: 313–333, 2003.

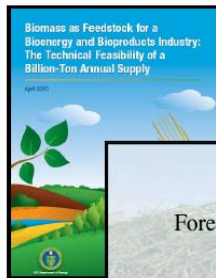


Figure 3. Willow production regions (willow can be grown in regions other than those included in the analysis, but yield and production practices data are lacking for these regions).

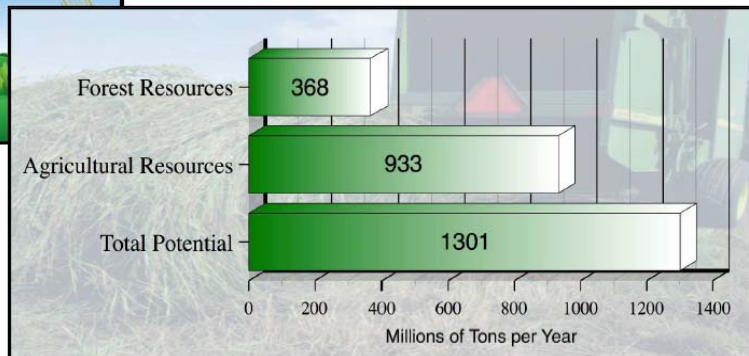
Walsh, M. et al. *Environmental and Resource Economics* 24: 313–333, 2003.

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U.S. Biomass Resource Assessment



- Updated resource assessment - April 2005
- Jointly developed by U.S. DOE and USDA
- Referred to as the “Billion Ton Study”



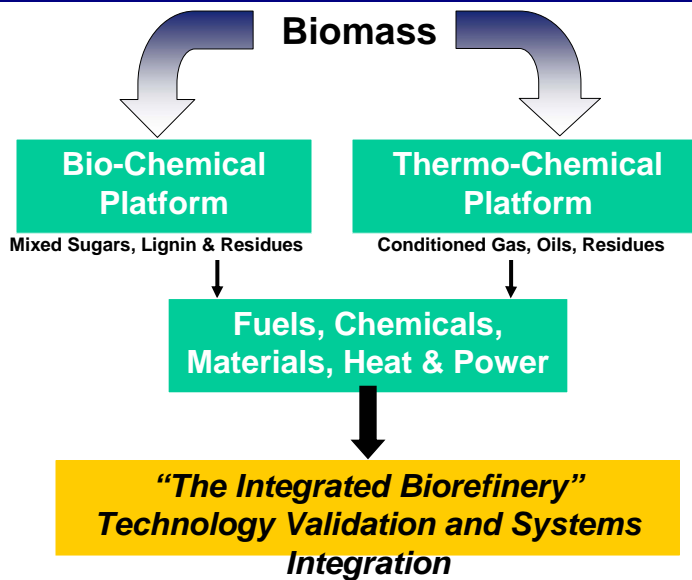
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What conversion technologies are available?

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The Integrated Biorefinery



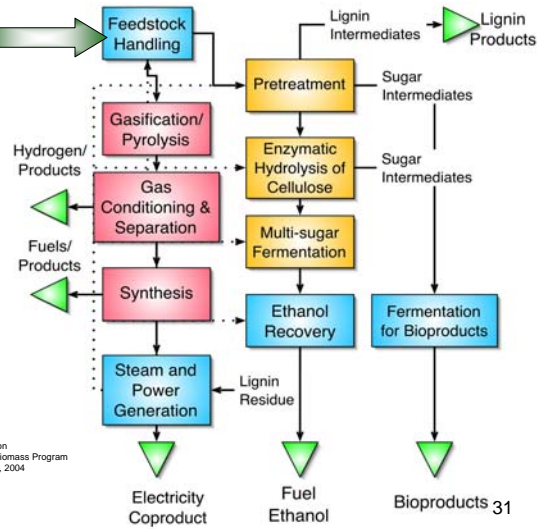
Don Richardson
Office of the Biomass Program
September 29, 2004

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Lignocellulosic Biomass

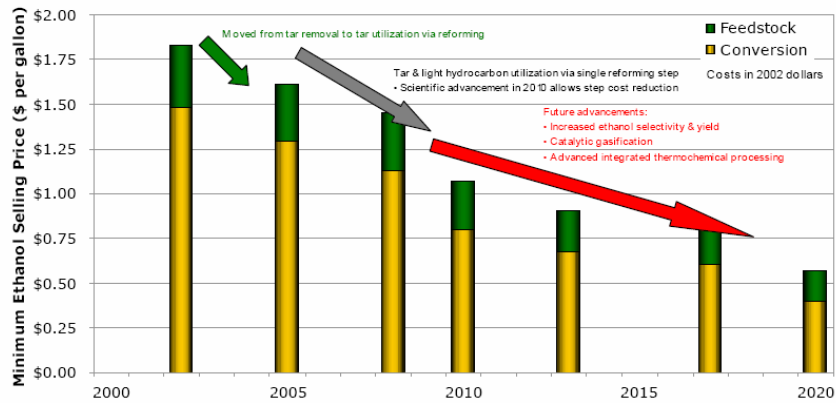
An integrated biorefinery makes use of:

- Thermochemical conversion technology
- Biochemical conversion technology
- Existing technology



Don Richardson
Office of the Biomass Program
September 29, 2004

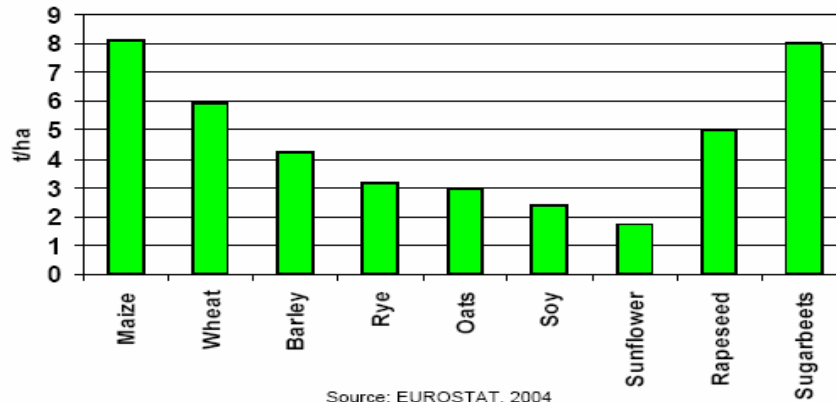
Ethanol From Thermochemical Mixed Alcohols



- Vision for Biomass – long way to go
- We need a good roadmap to get us there
- Time to get to work.

Backup slides with additional information

Crop yields



Yielding potential of energy crops in EU25

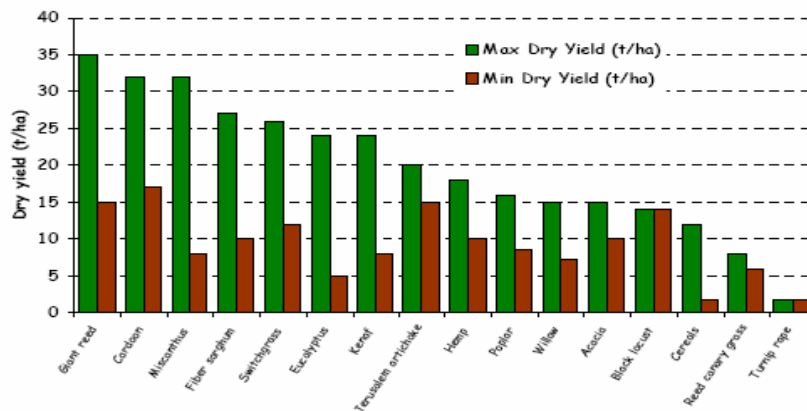
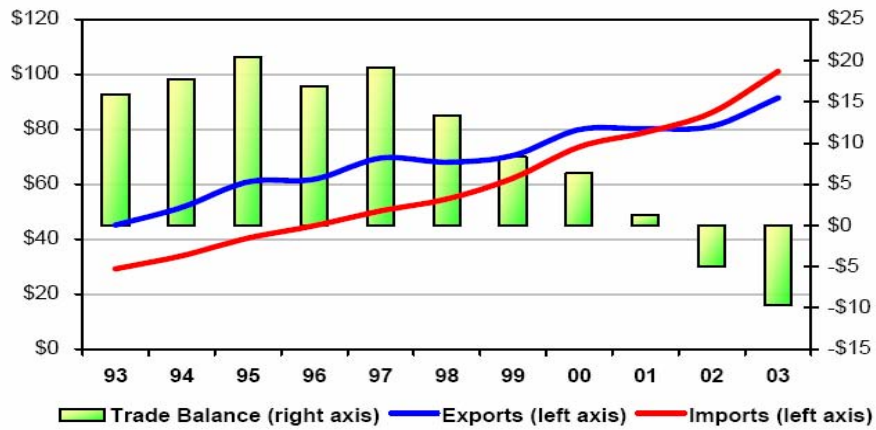
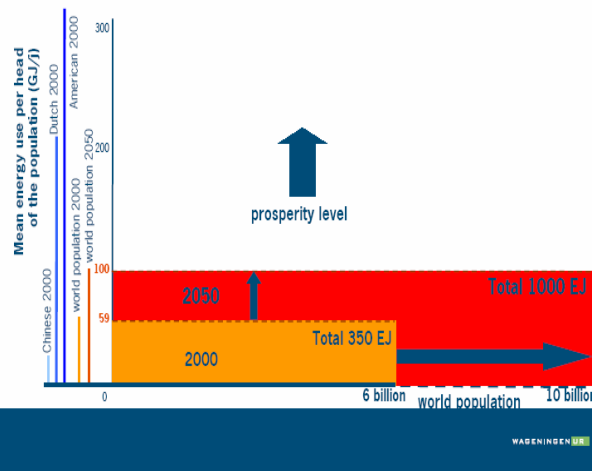
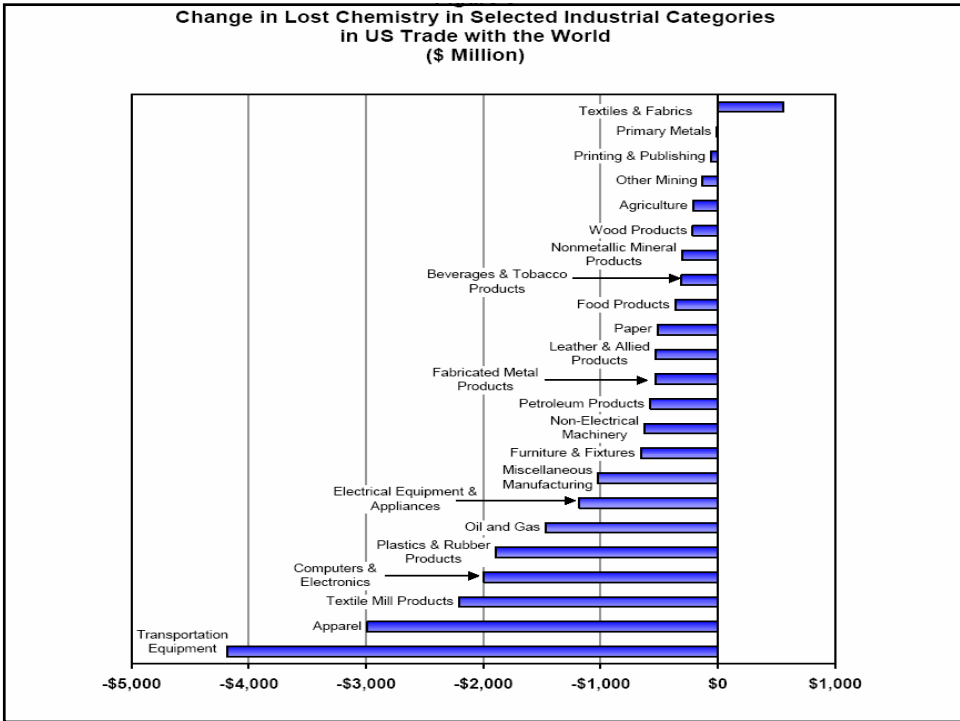
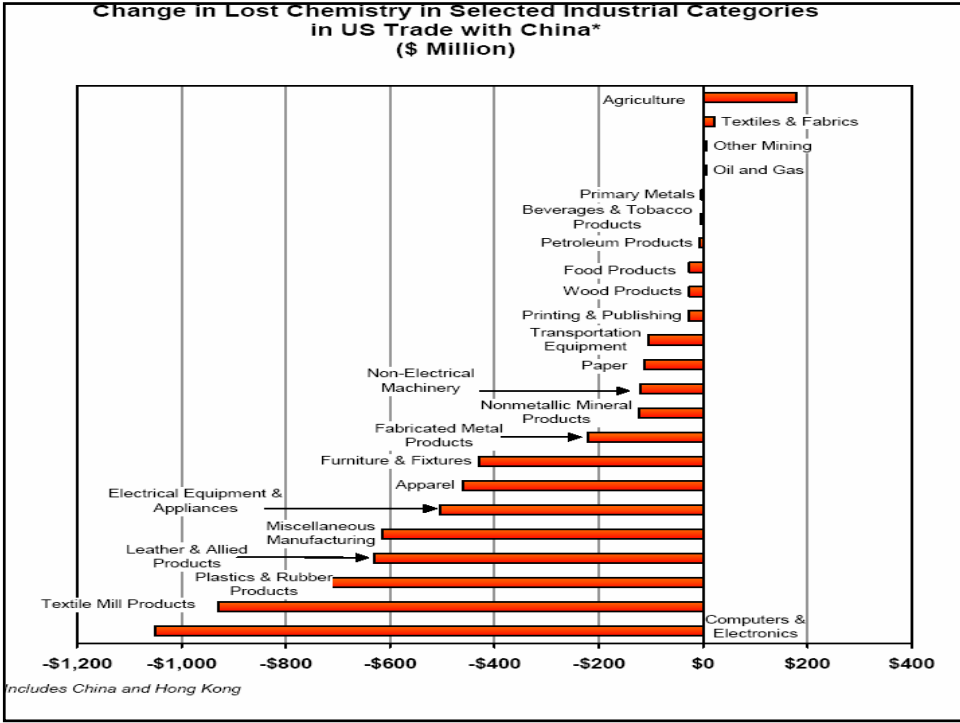


Figure 1
US Trade in the Business of Chemistry
(\$ Billions)



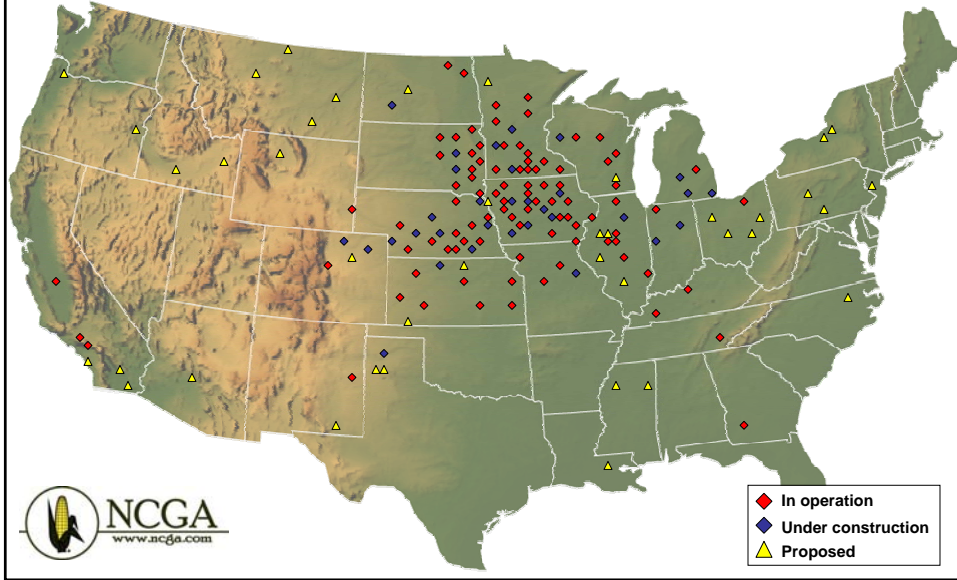
Energy consumption in 2050 three times larger than today



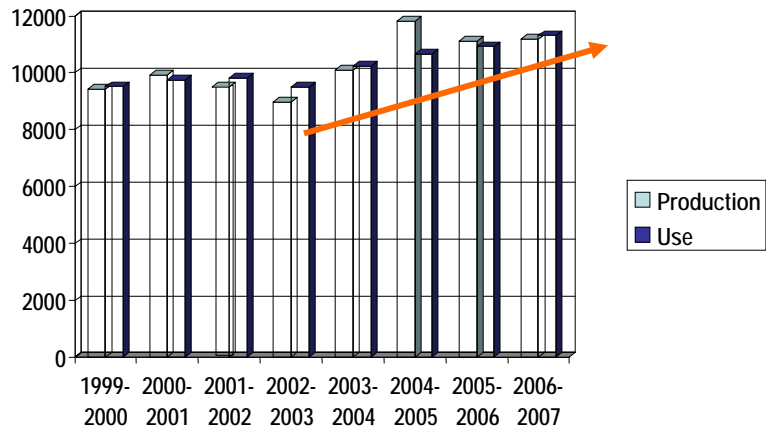


U.S. Ethanol Plants

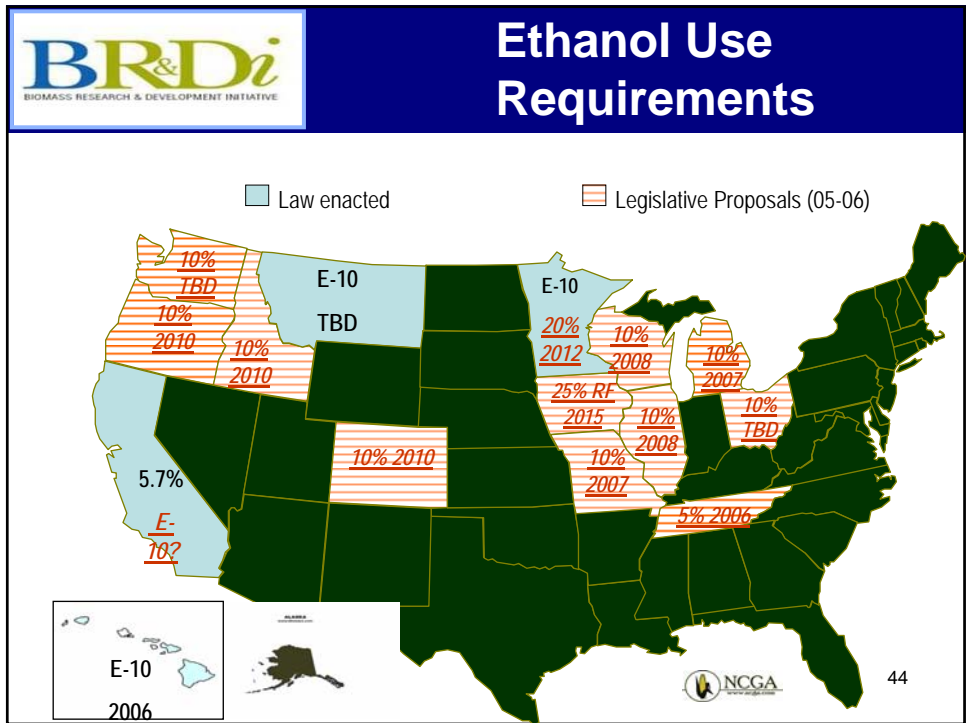
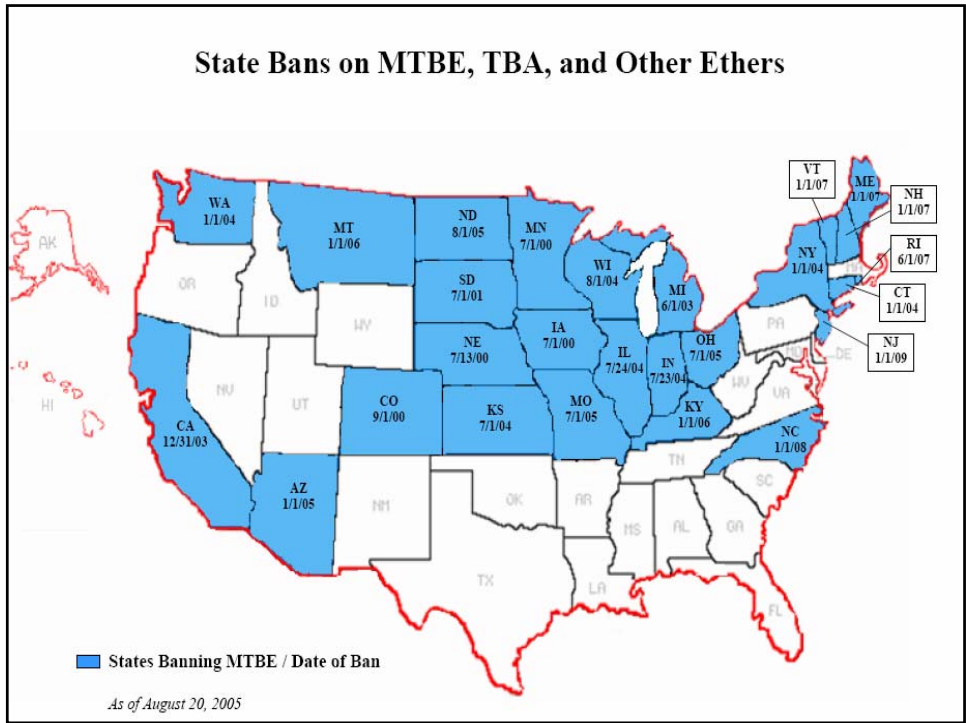
AS OF: December 2005

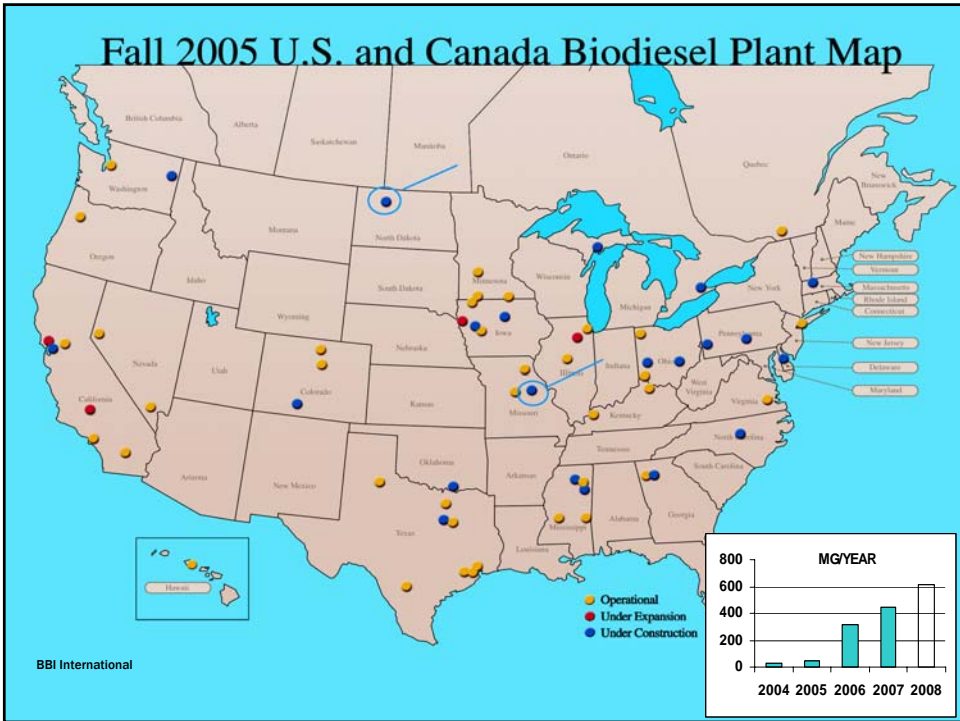
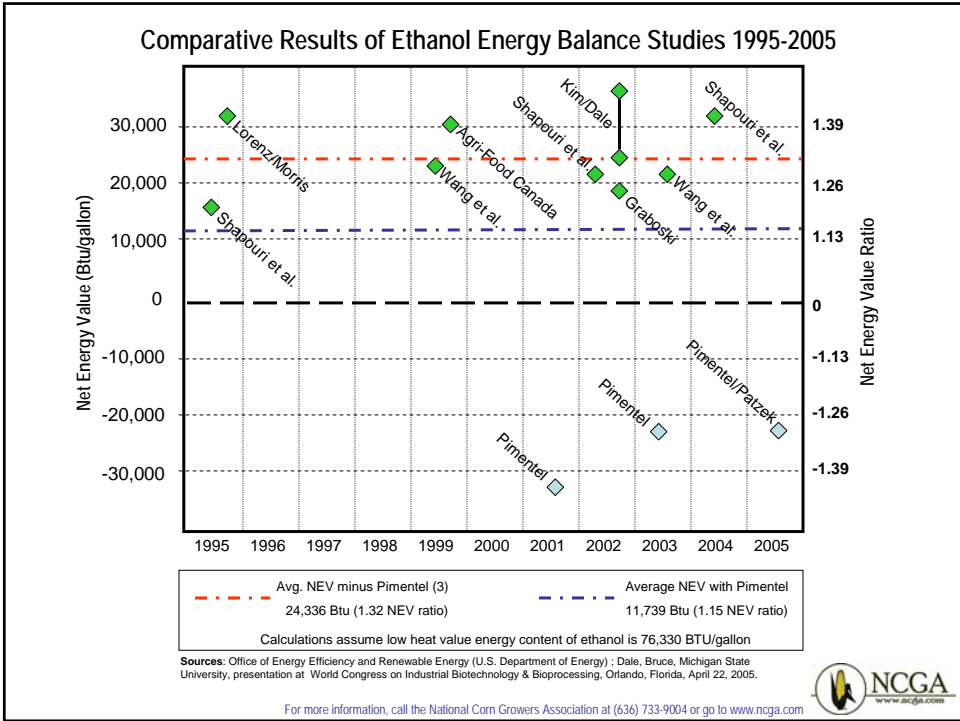


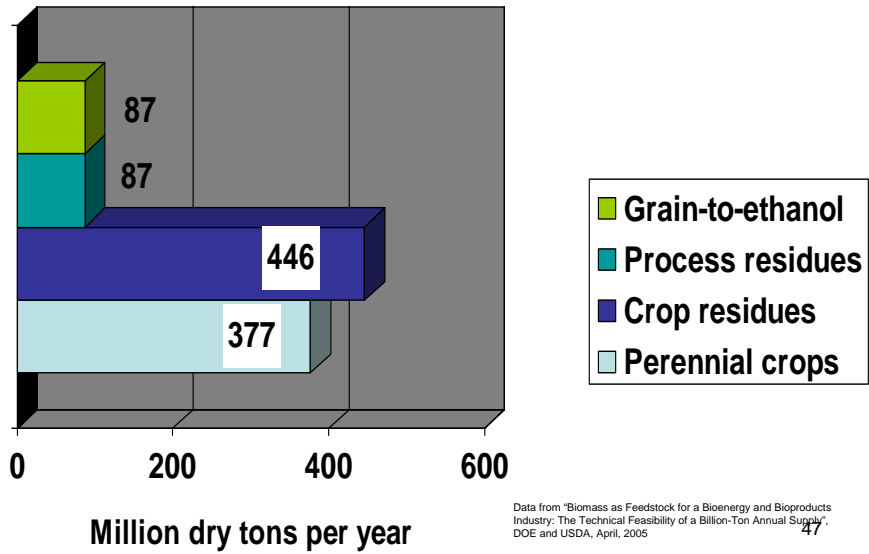
Corn Production and Use: 1999-2006



State Bans on MTBE, TBA, and Other Ethers







Non-Edible Constituents of Biomass

Lignin: 15%–25%

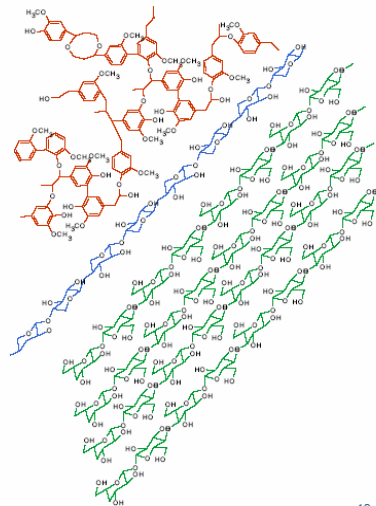
- Complex aromatic structure
- Very high energy content
- Resists biochemical conversion

Hemicellulose: 23%–32%

- Xylose is the second most abundant sugar in the biosphere
- Polymer of 5- and 6-carbon sugars, marginal biochemical feed

Cellulose: 38%–50%

- Most abundant form of carbon in biosphere
- Polymer of glucose, good biochemical feedstock



Edible Constituents of Biomass

Starch: 70%–75% (corn)

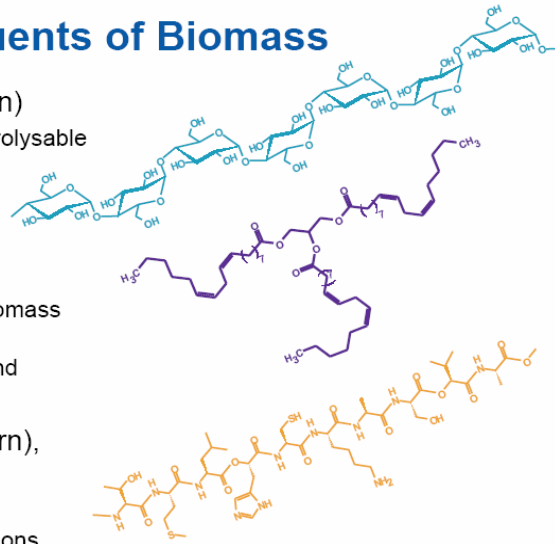
- Readily available and hydrolysable
- Basis for existing U.S. “biorefineries”

Oil: 4%–7% (corn), 18%–20% (soybeans)

- Readily separable from biomass feedstock
- Basis for oleochemicals and biodiesel

Protein: 20%–25% (corn), 80% (soybean meal)

- Key component of food
- Chemical product applications

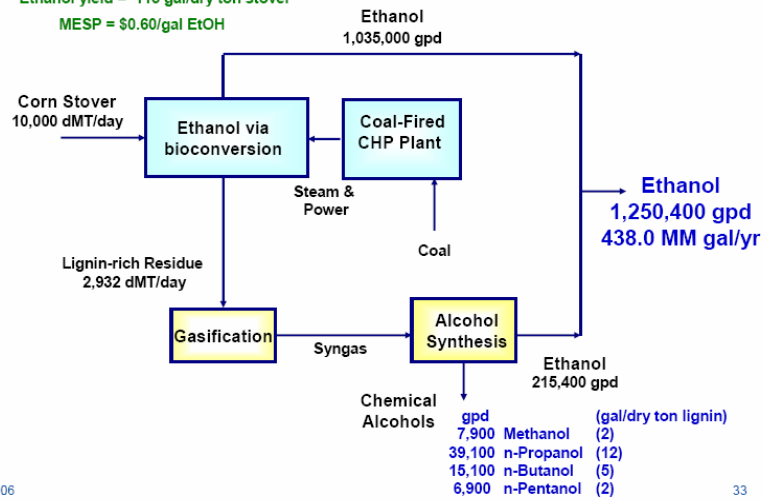


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Integrated Biorefinery

Ethanol yield = 113 gal/dry ton stover
 MESP = \$0.60/gal EtOH



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