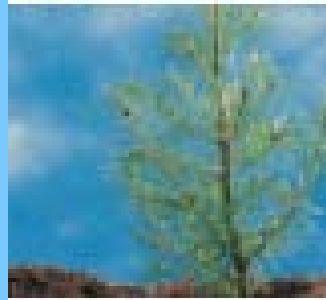
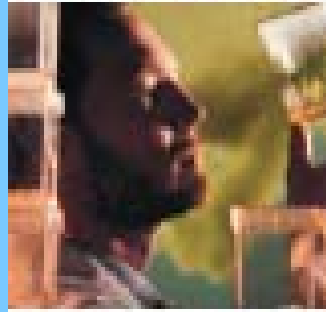


# Wisconsin Bioproduct Industry Development

## Presentation to UW Bioenergy Gathering

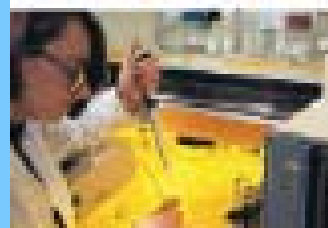
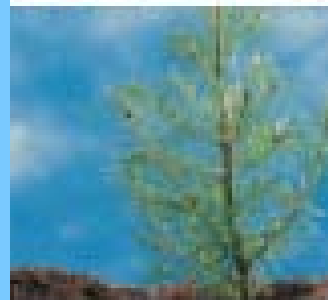
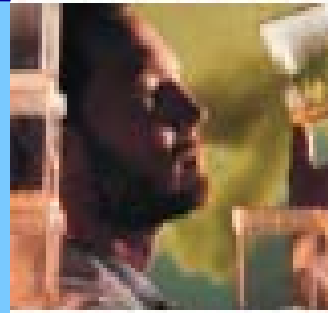
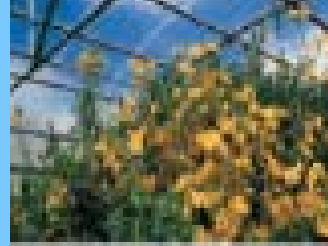
Will Hughes

Department of Agriculture, Trade &  
Consumer Protection



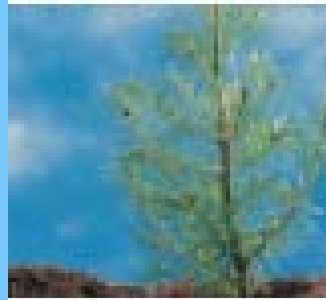
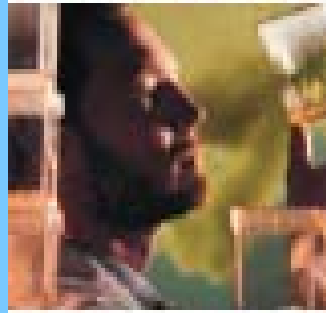
# Today's Objectives

- Overview of bioindustry trends
- Wisconsin's strategies to capture the bioindustry future
- Challenges to UW
  - Research and Development
  - Economic Impact

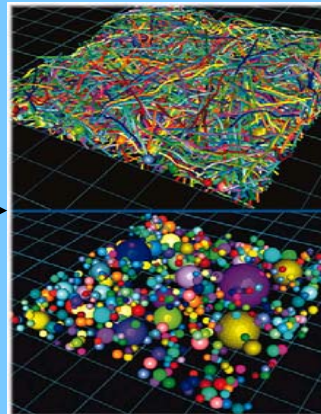
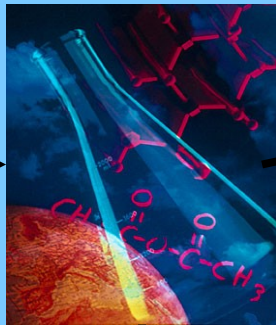


# Scope of BioIndustry

- Biofuels
- Bioenergy
- Bioproducts
  - **Biochemicals**
  - **Biomaterials**

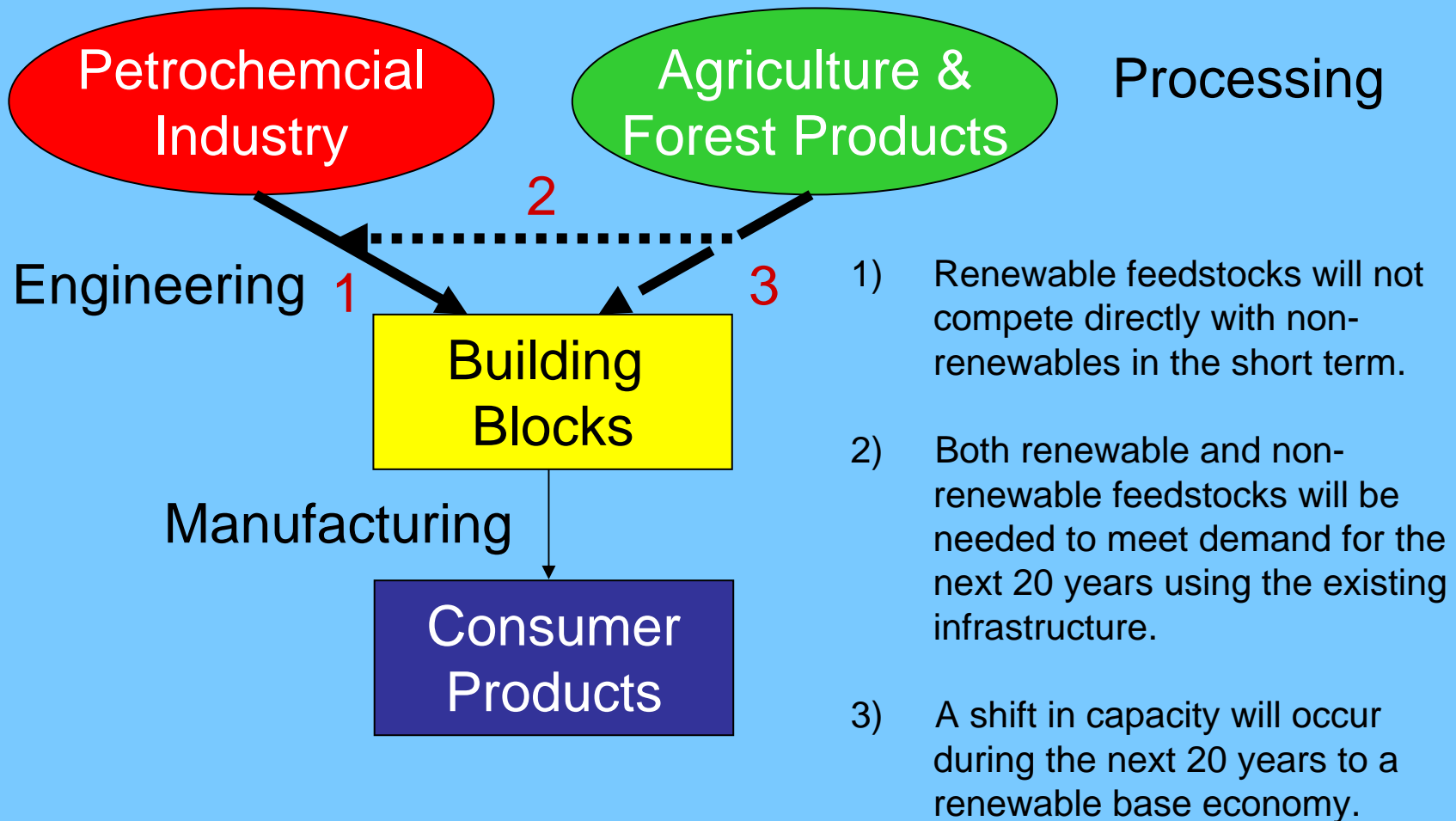


# Overview and Trends

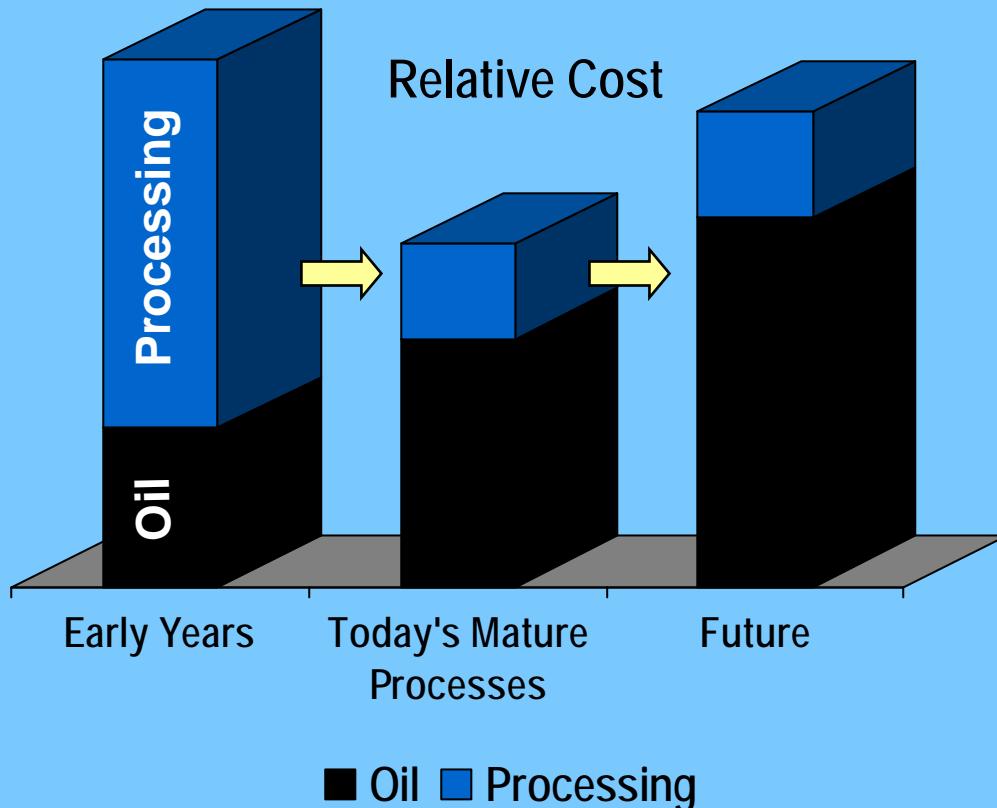


One of 13 industry concepts. (Northrop Grumman/Orbital Sciences)

# Assumes a Fundamental Shift from Petro to Bio Economy

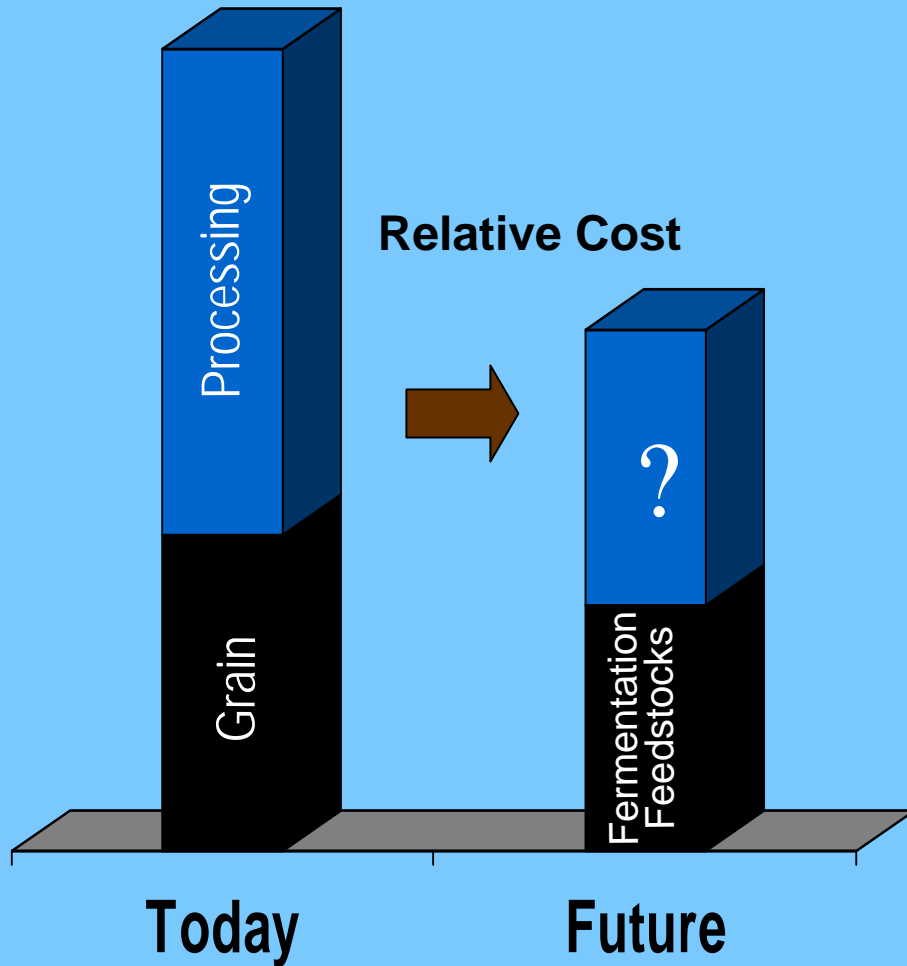


# Impact of Raw Material Costs and Processing Improvements on Petroleum Prices



- Historically, petrochemical processing costs exceeded feedstock costs
- Processing efficiencies have increased and costs have decreased dramatically
- Reaching point of limited returns on “oil investment”
- Raw materials have long-term issues:
  - Costs will continue to increase as supplies tighten
  - High price variability
  - Impacts national security
  - Not renewable

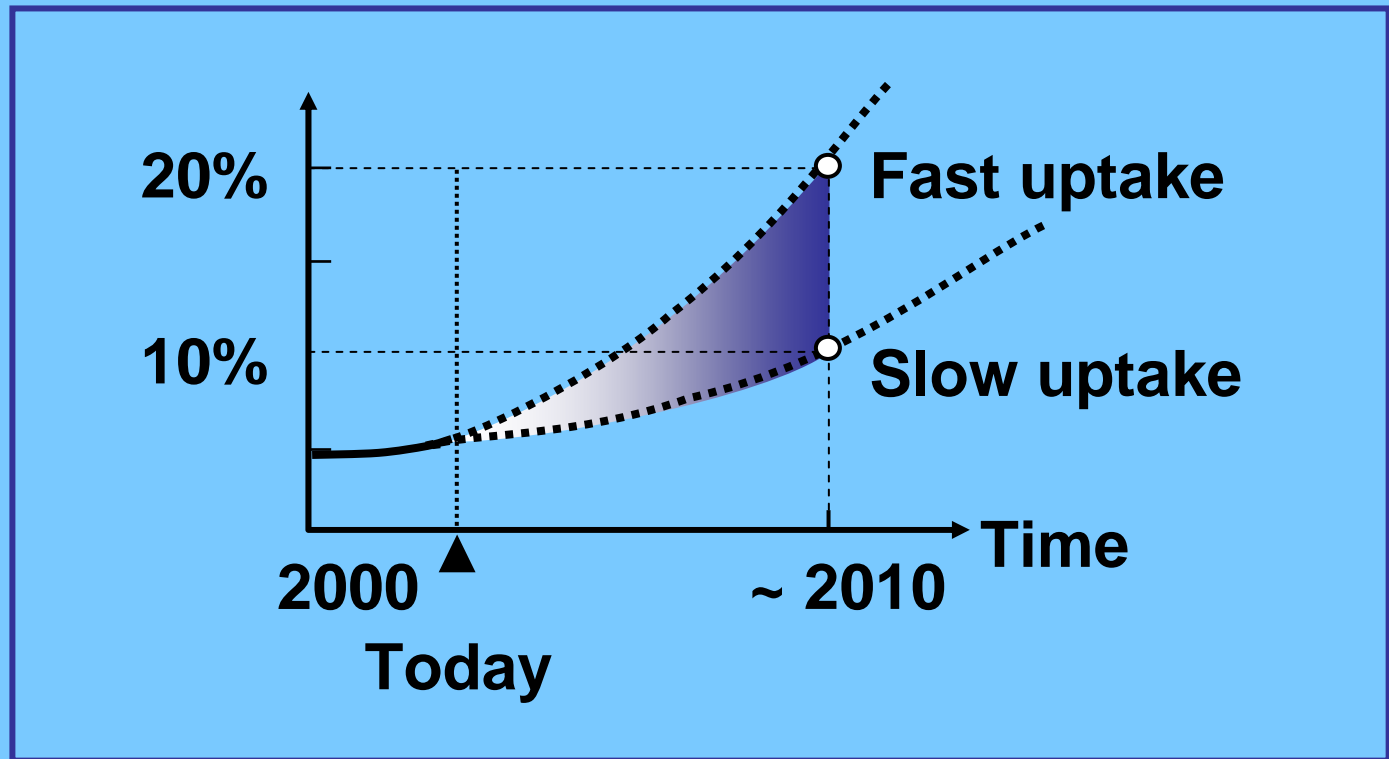
# Future Impact of Raw Material Costs and Processing Improvements on Biobased Products



- Processing is dominant cost of bio-materials today
- Raw material costs should be stable or even decrease long-term
  - Renewable resource
  - Biomass opportunity
- Key question is how far and how fast processing costs can be reduced
- What new can be done to accelerate developments?

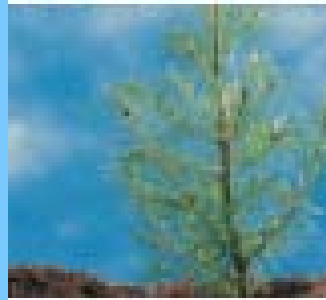
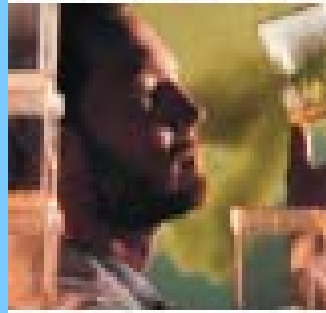
# Enabling the Bio-Industrial Revolution

Achieving the vision will require an entirely new toolbox – a set of technologies that is unique from that of the petroleum-based chemical industry



# Biofuels

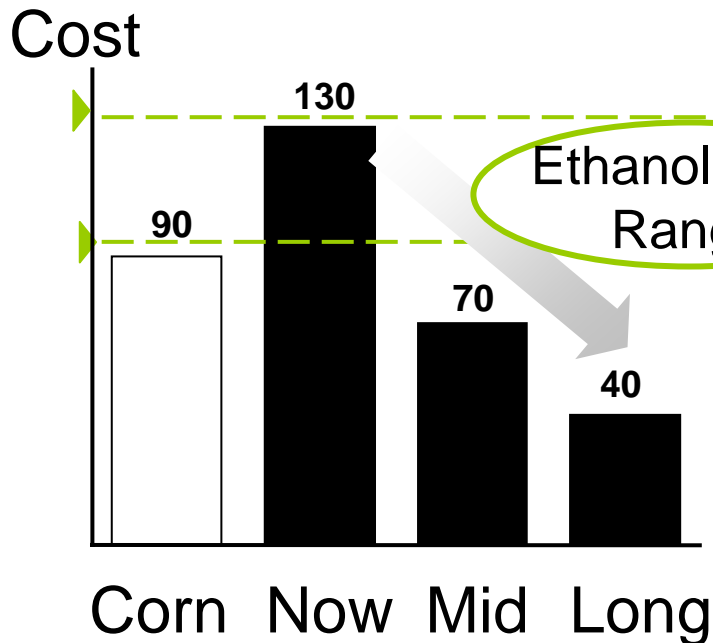
- Ethanol
- Biodiesel
- Future Technology



# Ethanol among the first and biggest markets to profit from low-cost biomass feedstock

## Cost reduction

US cent/gallon

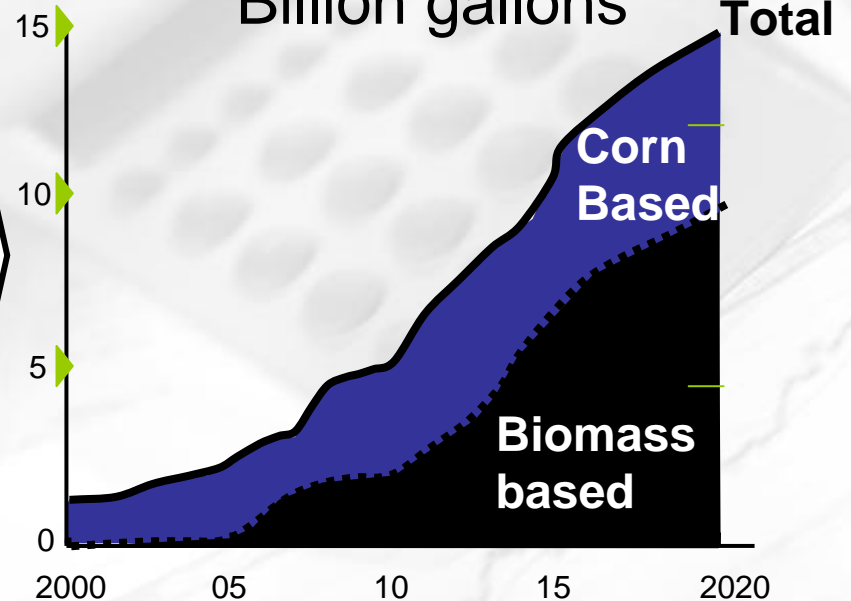


**Biomass-based ethanol**

## US market growth

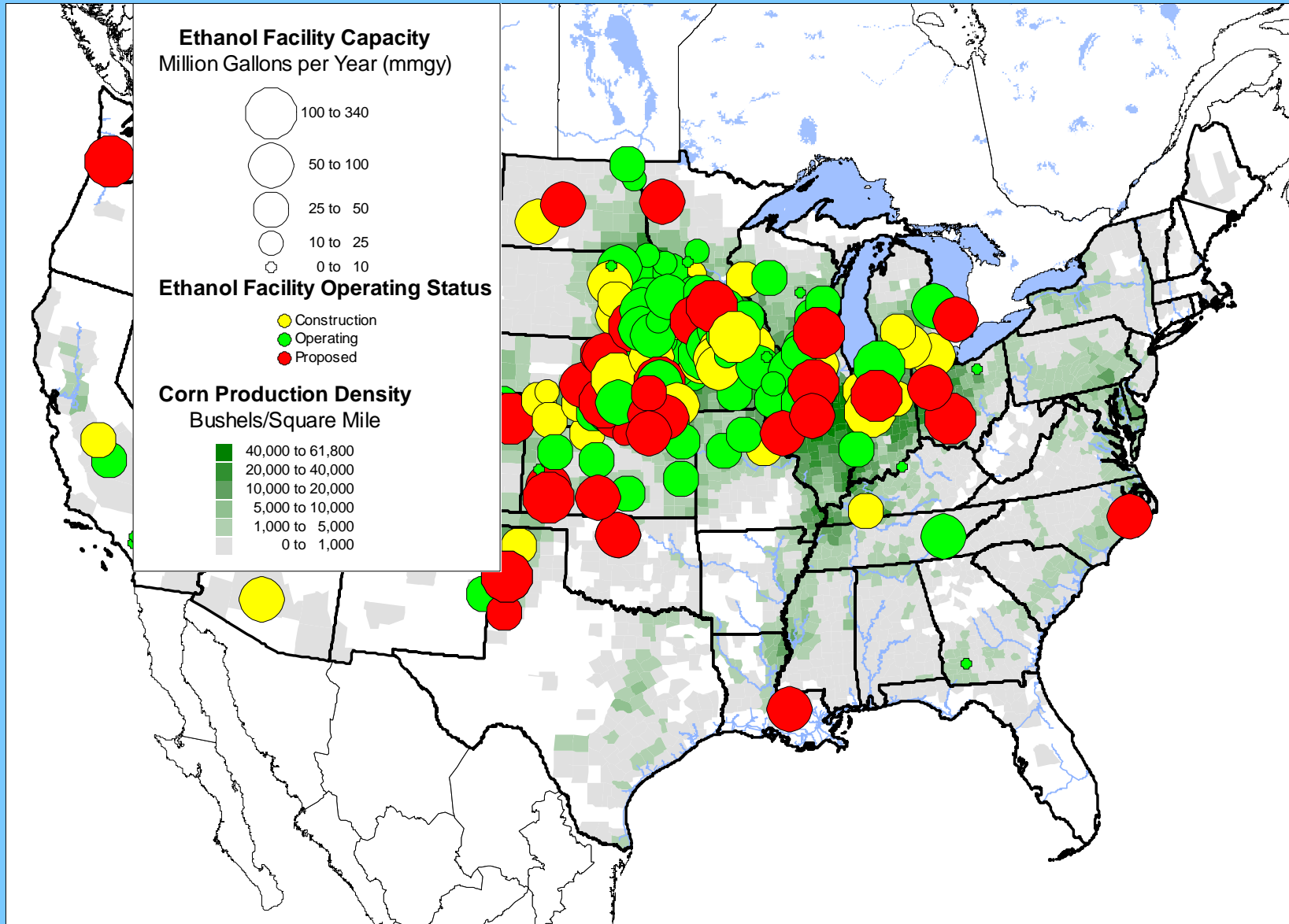
(DOE estimate)

Billion gallons

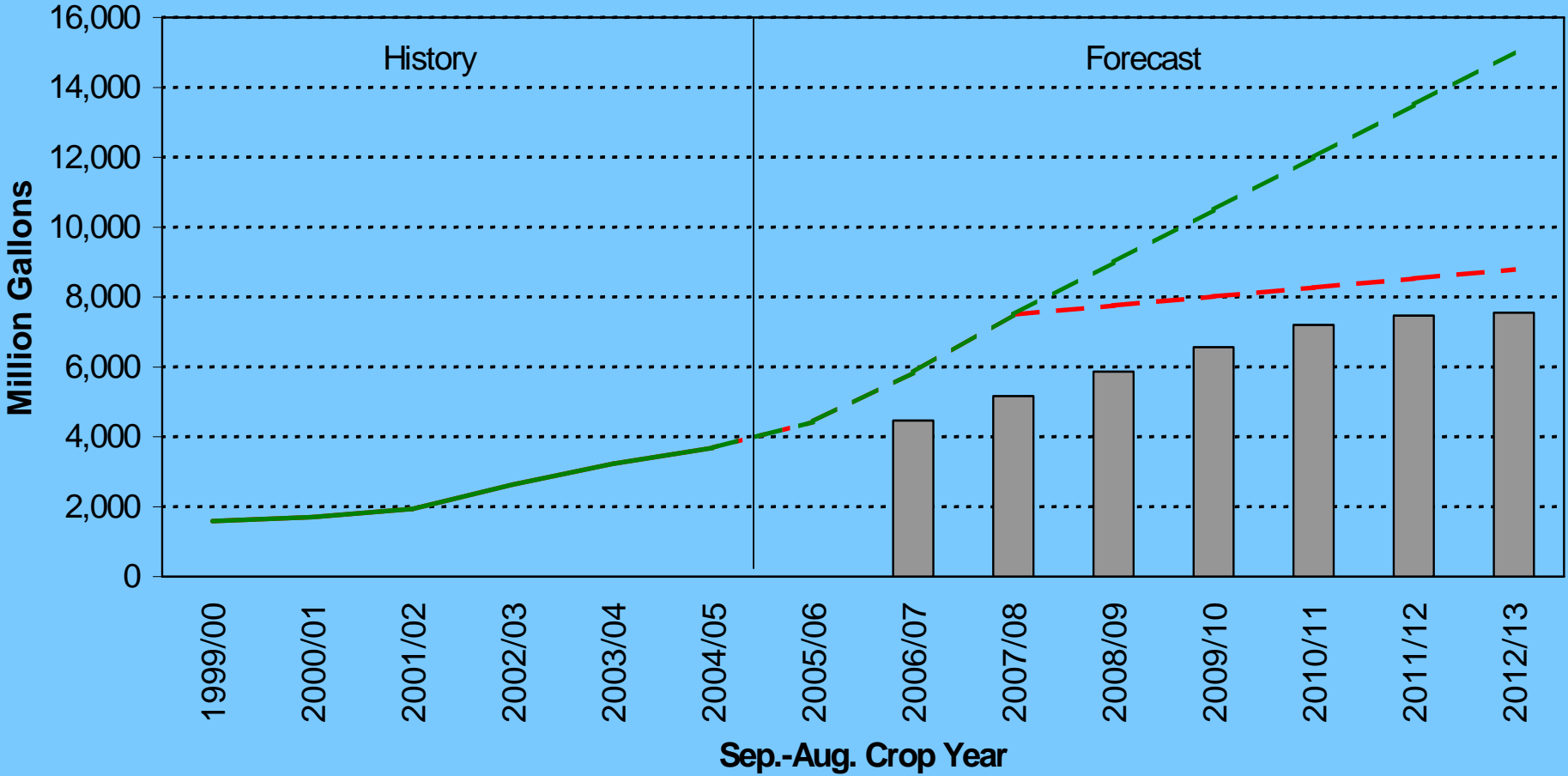


**(Legislation to support fuel ethanol also in Canada, Europe, Brazil, others)**

# Geography of Ethanol Production



# U.S. Ethanol Volume Trajectory



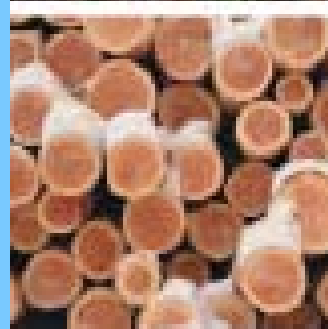
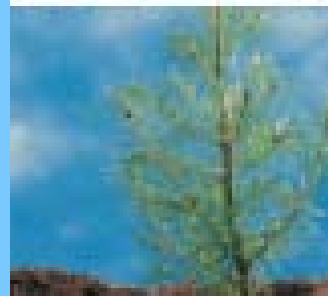
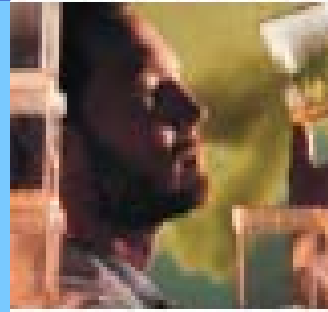
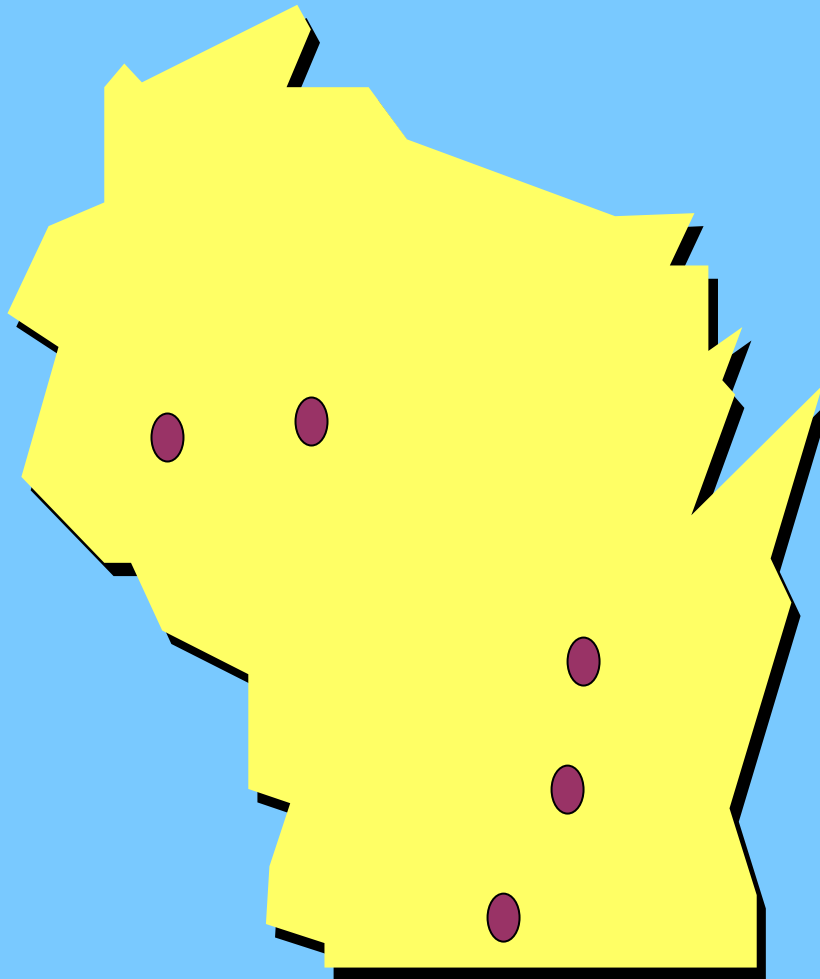
- Renewable Fuels Standard (Crop Yr. Equivalent)
- Ethanol Prodn., Slow Growth After 2007/08 (No Cellulosic)
- Ethanol Prodn., High Growth After 2007/08 (No Cellulosic)

# Wisconsin Ethanol Plants

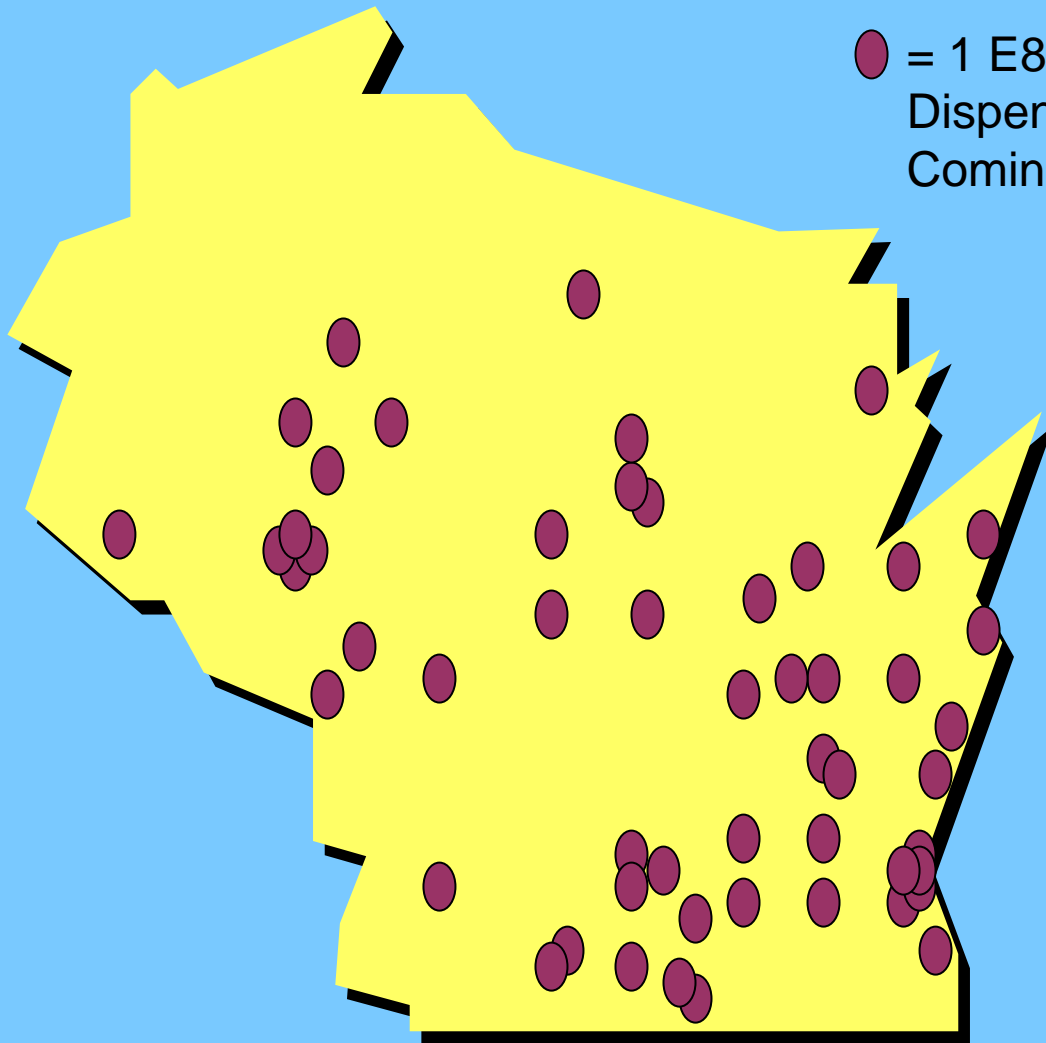
## 5 Operating Ethanol Plants in Wisconsin

*Current Annual Production:  
172 million gallons*

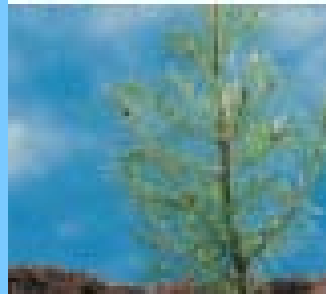
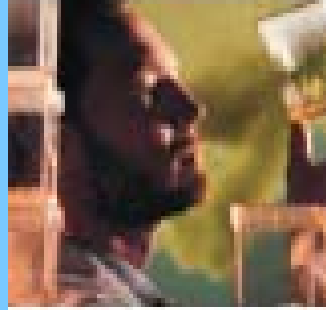
- **Badger Ethanol: Monroe**
- **Ace Ethanol: Stanley**
- **Utica Energy: Utica**
- **United Wisconsin Grain Producers: Freisland**
- **Western Wisconsin: Boyceville**



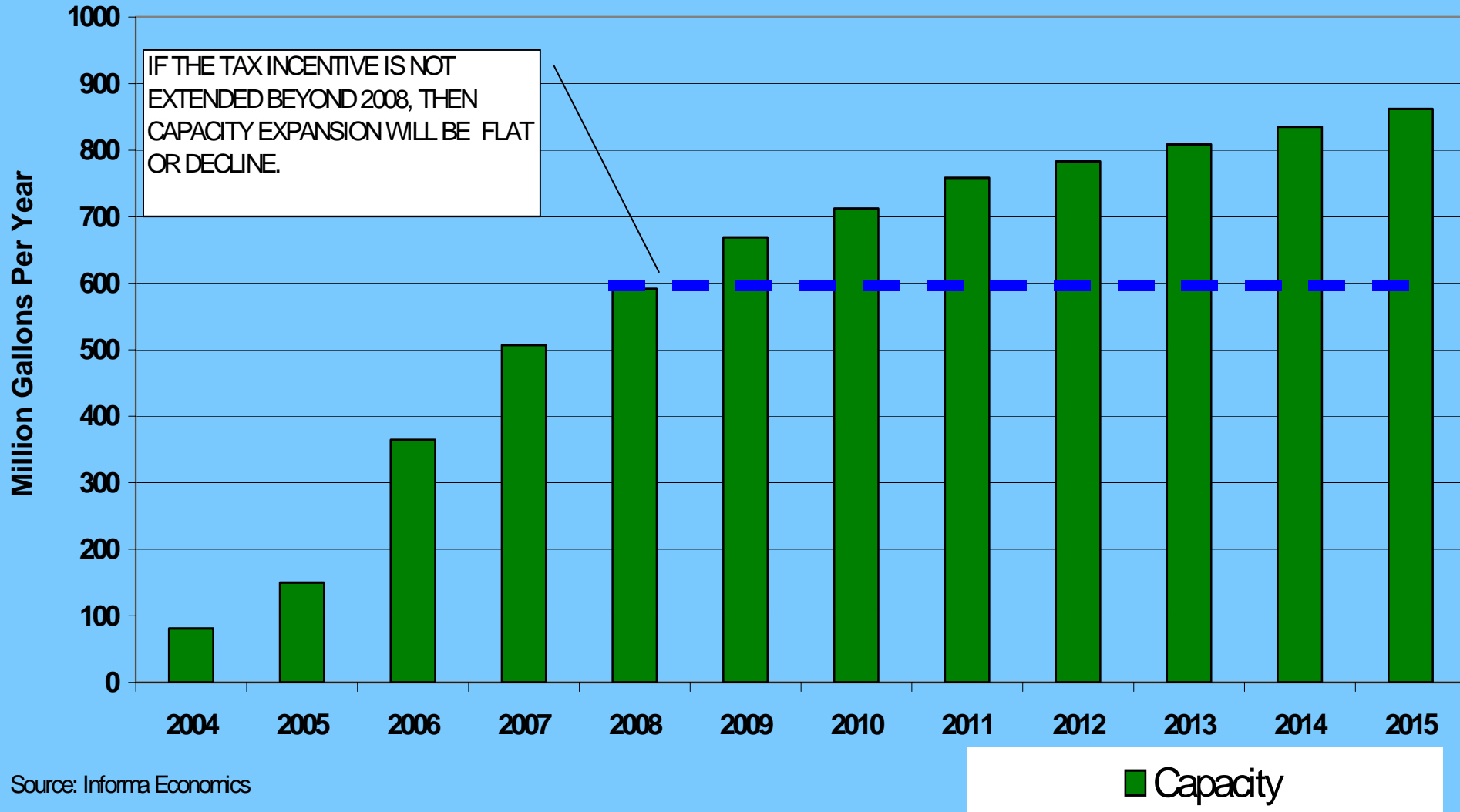
# 54 Wisconsin E85 Stations!



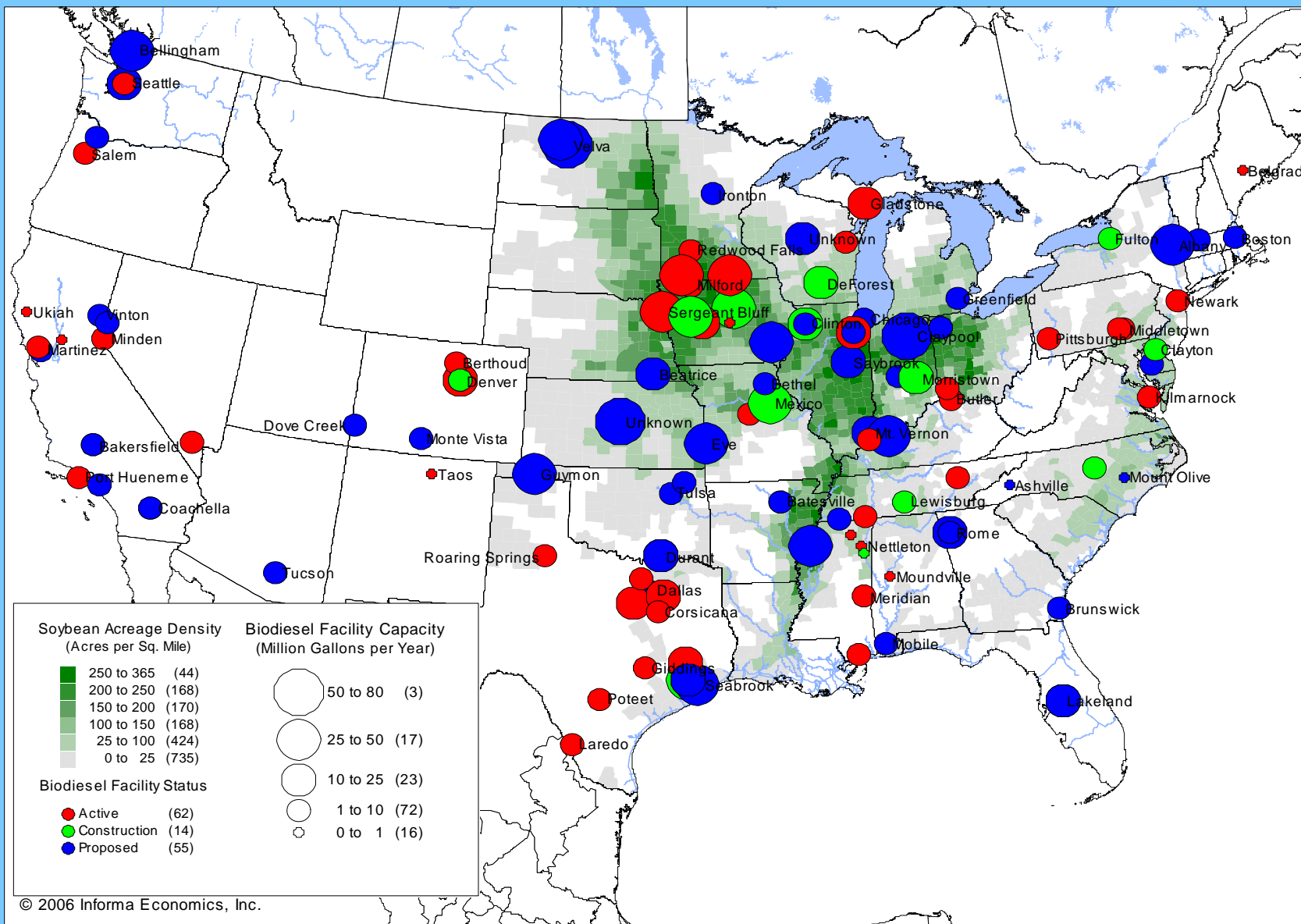
● = 1 E85 Station  
Dispensing or  
Coming Soon



# US Biodiesel Capacity Outlook



# Biodiesel Facilities Distributed In U.S.

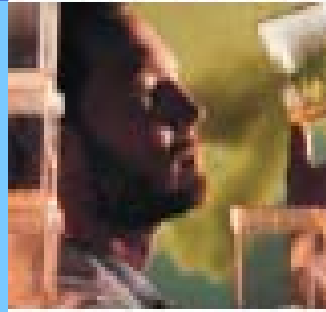
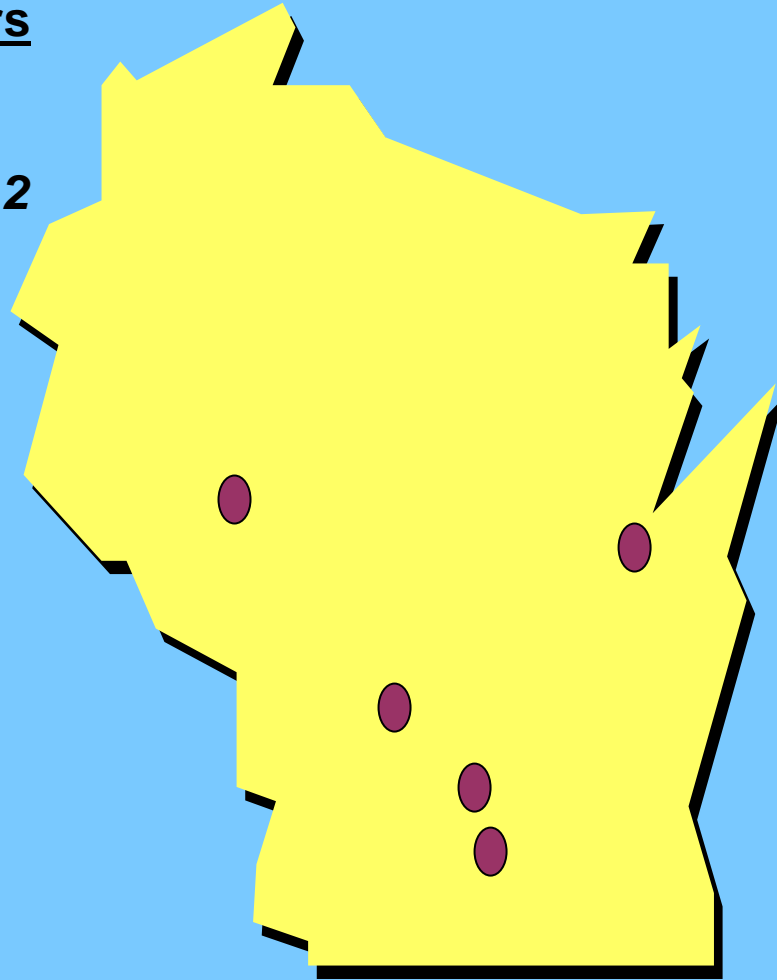


# Wisconsin Biodiesel Plants

## 4 Operating Biodiesel Producers in Wisconsin

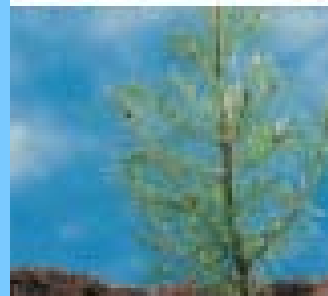
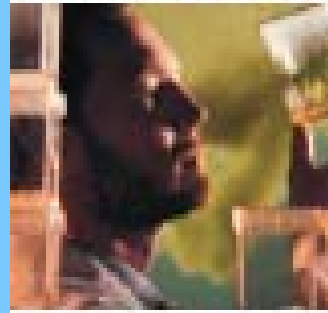
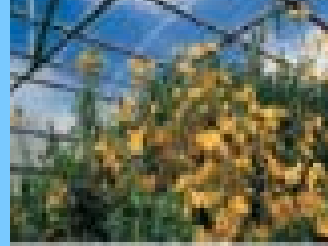
*Current annual production est. 2 million gallons*

- Renewable Alternatives: Green Bay
- Great Lakes Biofuels: Madison
- WE BE Bio, Ltd: Mauston
- WRR Environmental Services: Eau Claire
- Anamax Energy Services: De Forest (Industrial Facility, under construction)



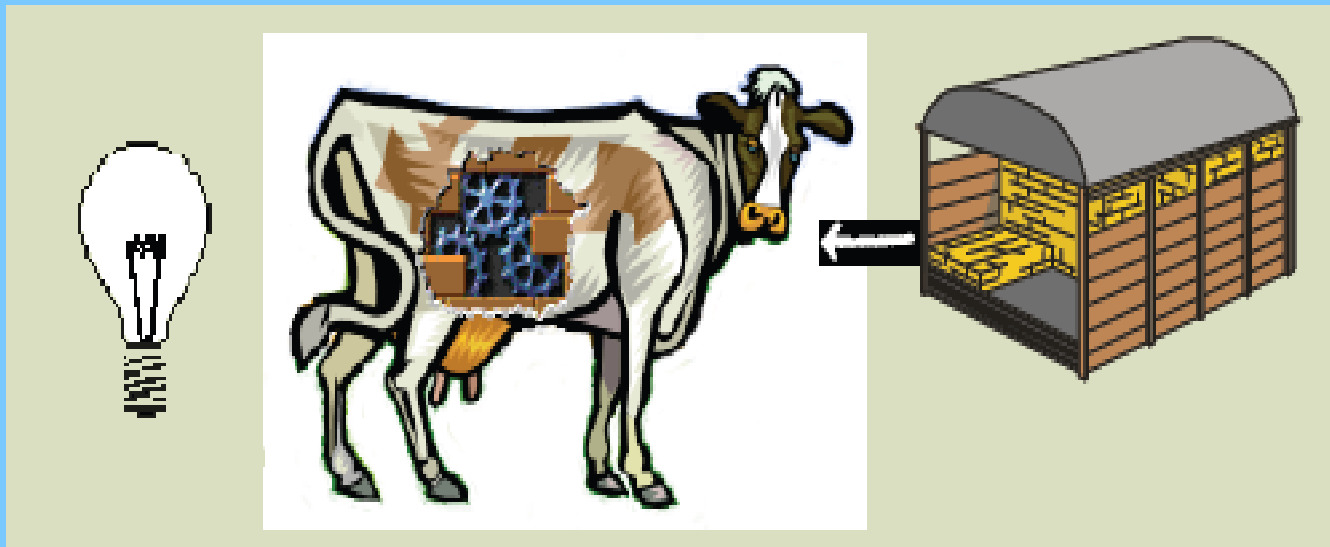
# New Feedstocks

	<u>Today</u>	<u>\$/gallon</u> <u>Theoretical</u>
Cellulosic Ethanol	\$2.00-2.50	\$0.60-0.80
Thermochemical Ethanol	\$1.90-2.30	\$0.80-1.00
Butanol	\$1.70-2.50	\$1.30

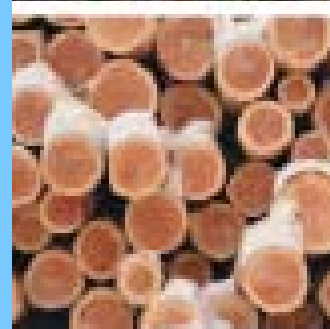
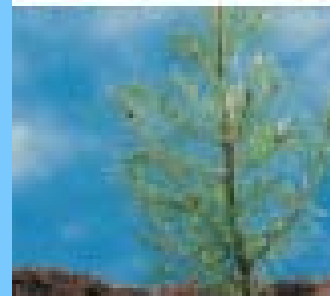
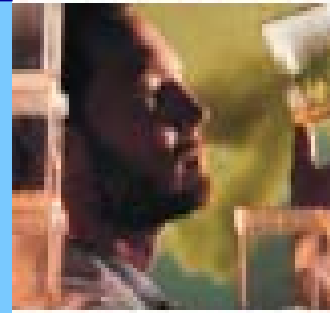


# BioPower

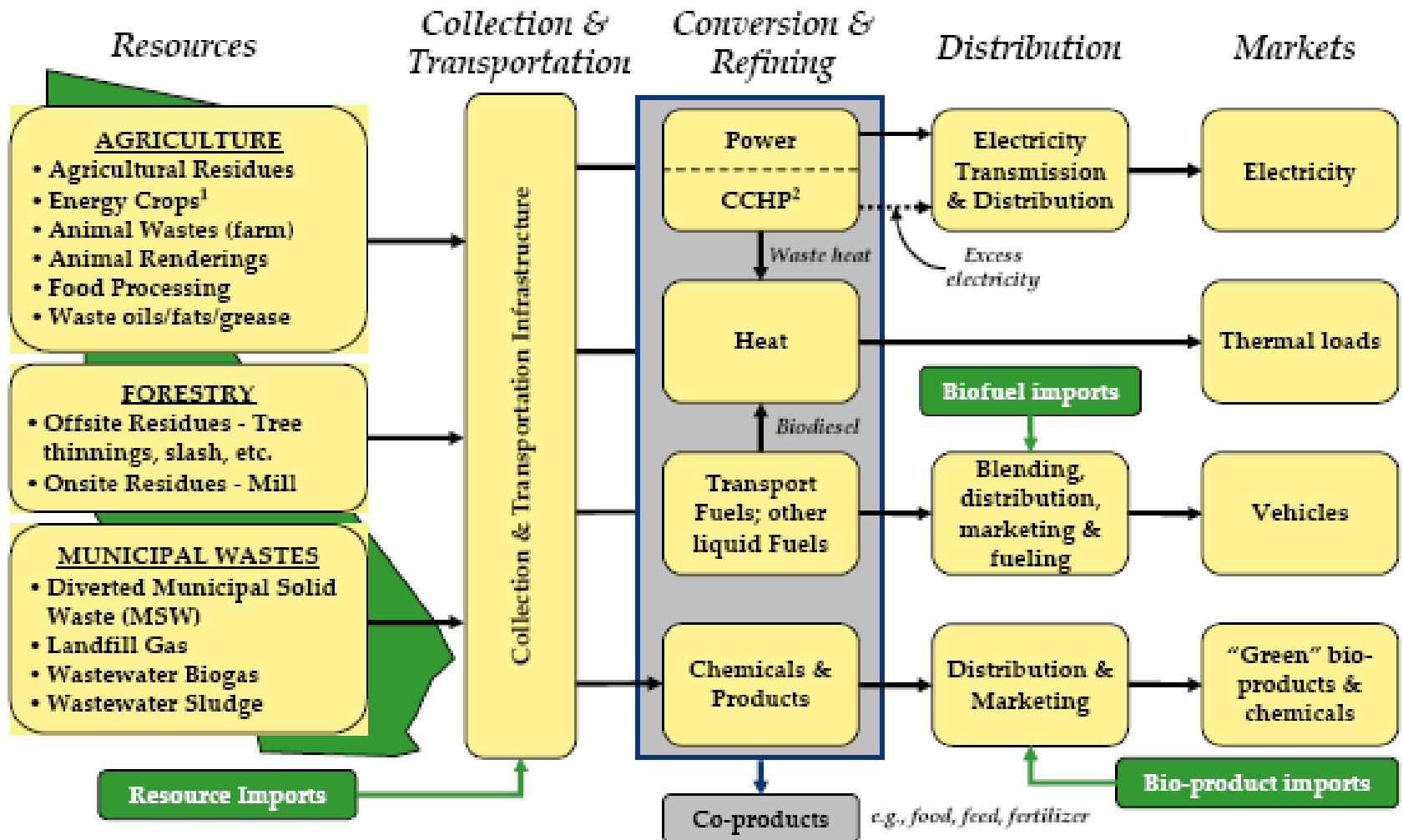
- Energy Production
- Energy Use
- Farm Power



Source: Larry Krom, Focus on Energy



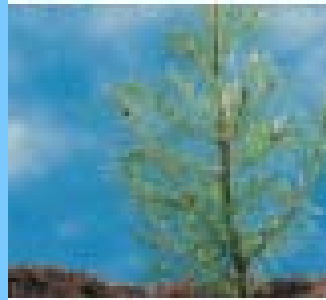
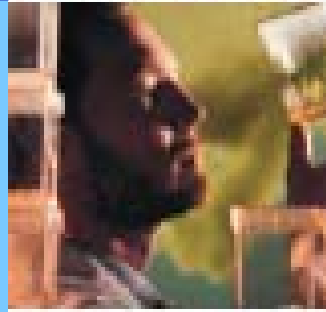
# Simplified Bioenergy Industry Structure



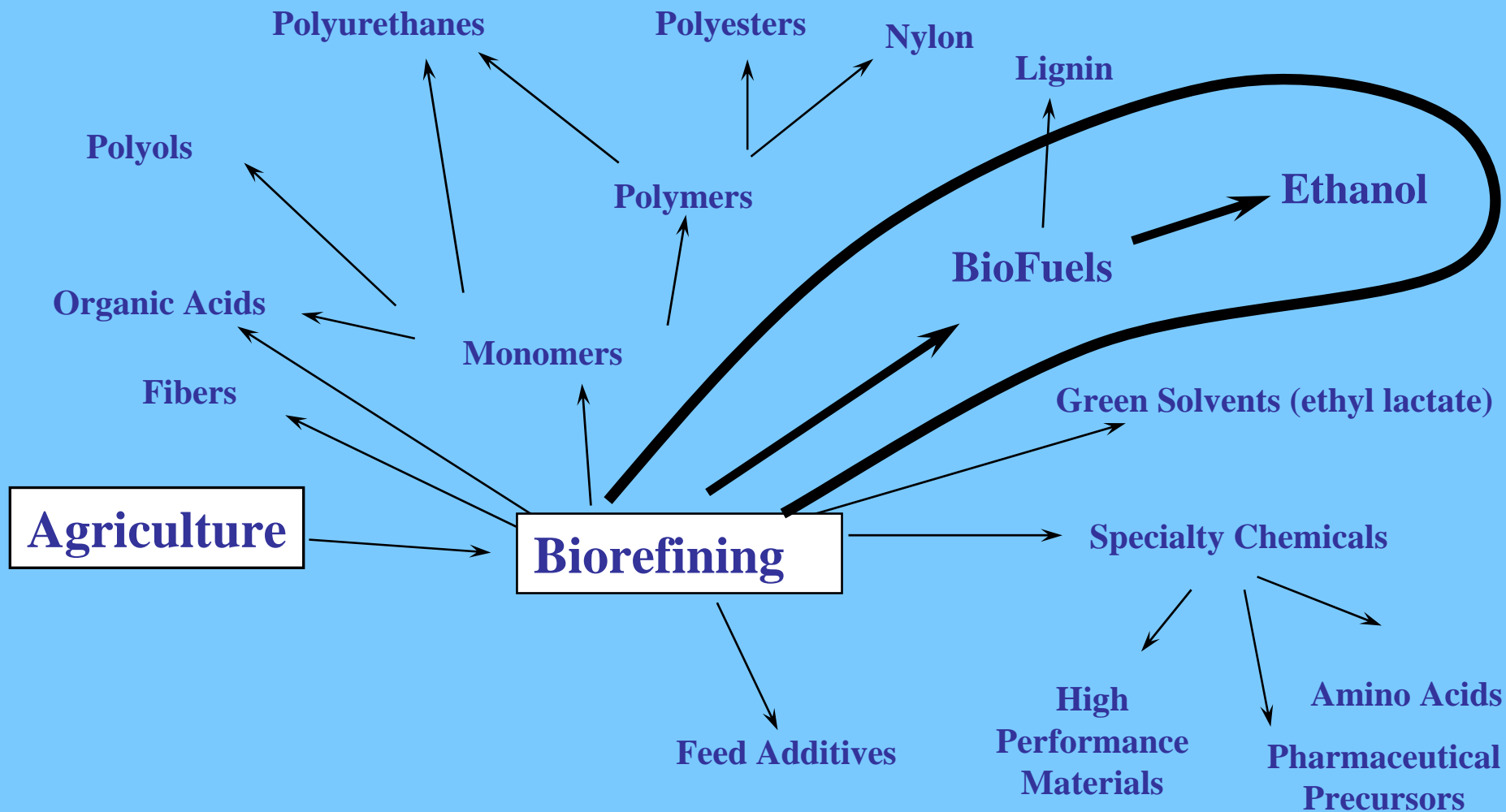


# BioProducts

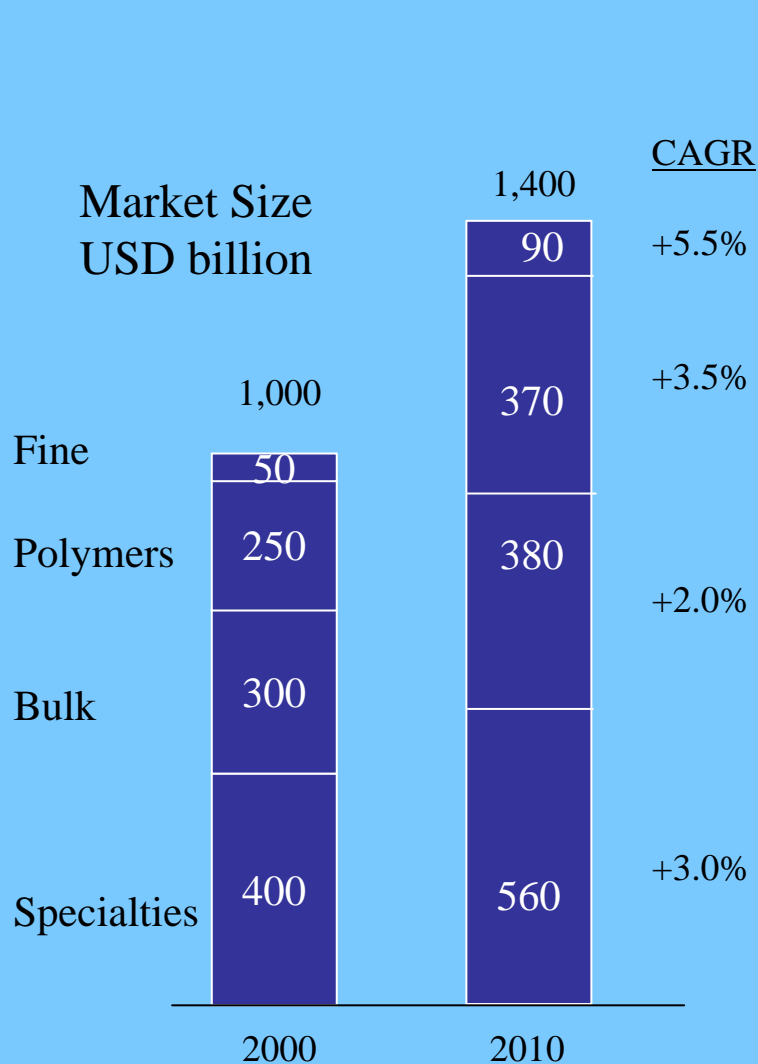
- Biochemicals
- Biomaterials



# Beyond BioEnergy and BioFuels



# Substantial Influence of Industrial Biotechnology in Selected Markets



Biotech Inroads today  
*Examples*

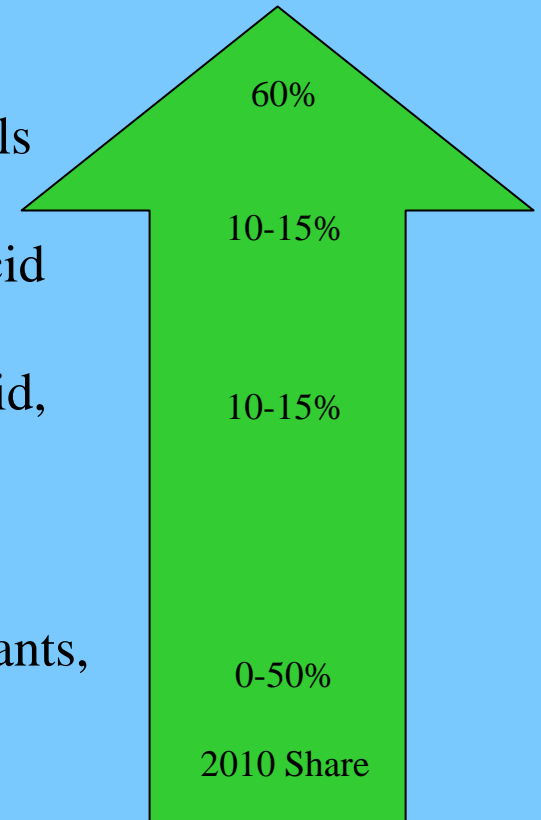
Biopharmaceuticals

3GT, polylactic acid

Ethanol, adipic acid,  
 acrylamide

Detergents, lubricants,  
 Fragrances, food  
 chemicals

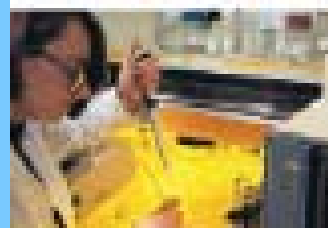
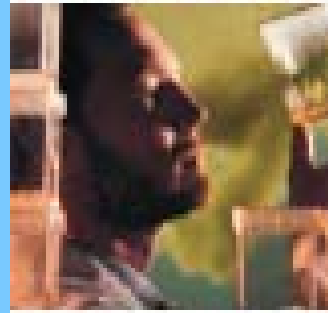
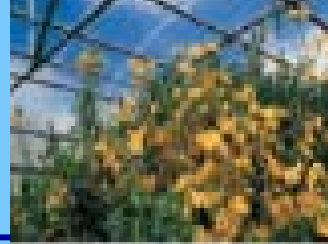
\$160 - 280 billion

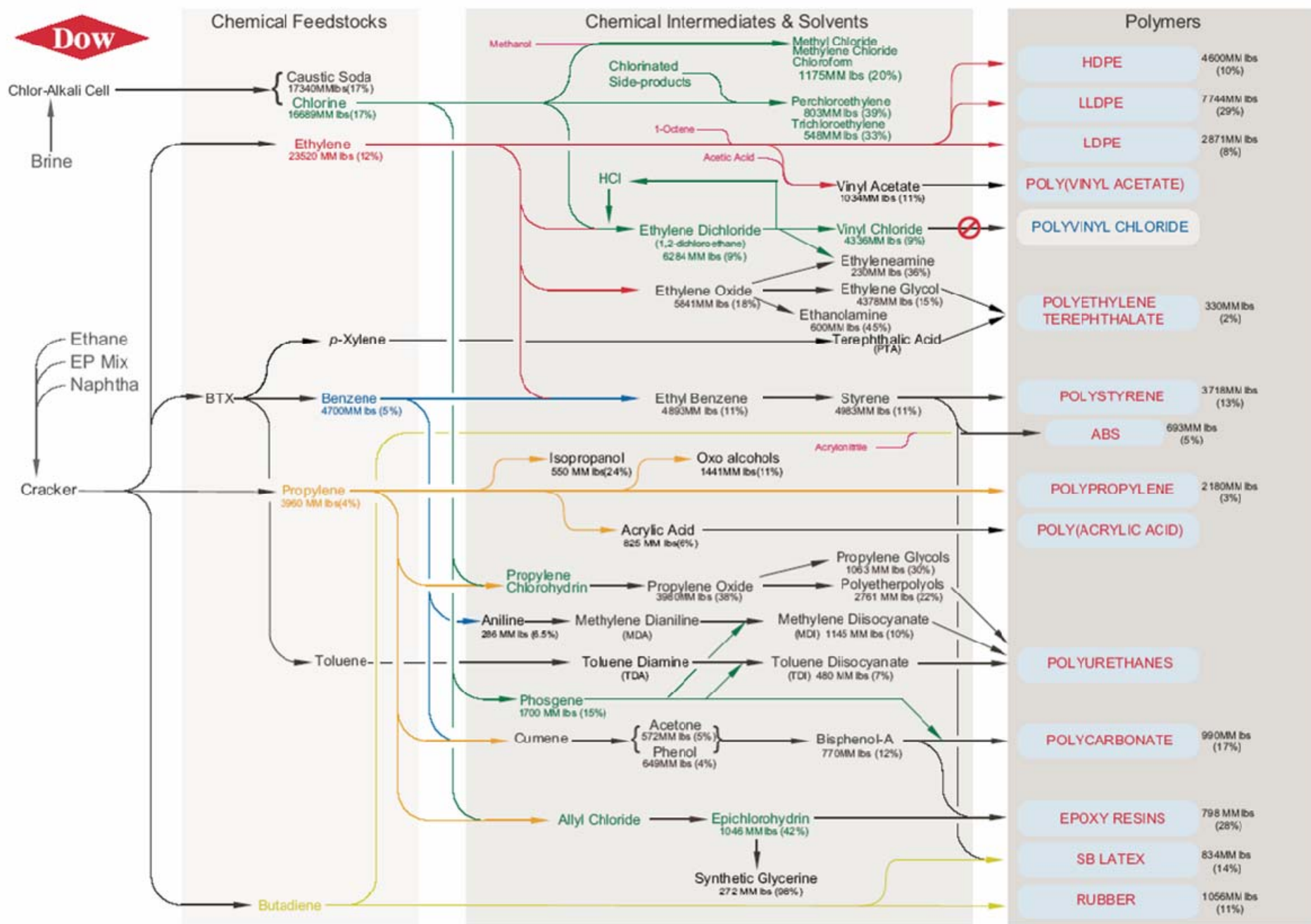


# Chemical Industry Market

- Chemical Industry
  - Petrochemical based
  - \$1000 billion industry (2000)
  - \$1400 billion industry (2010)
- Major Market Segments (2000)

– Fine Chemicals	\$50 billion
– Polymers	\$250 billion
– Bulk Chemicals	\$300 billion
– Specialty Chemicals	\$400 billion
- By 2010 biotechnology-based chemical products are expected to impact 10-20% of the chemical industry
  - \$160 - 280 billion





Volumes are total Dow production (percentage of total world production).

Purchased chemicals are in pink.

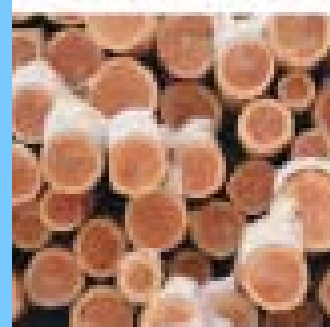
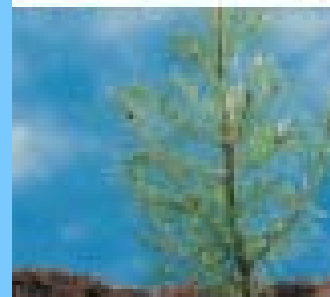
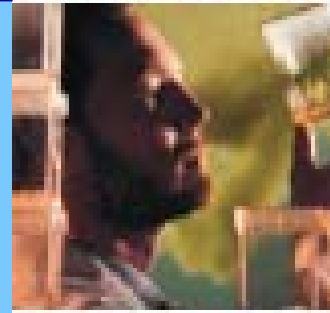
NON-Confidential - from published sources

MEJ-2/2003

# BioMaterials

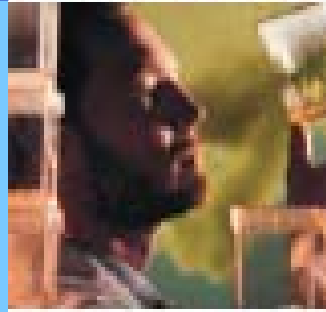
BioMaterials include novel applications and traditional items.

- PLA: A corn-based polymer can be used in fabric or in heavy duty plastic.
- Milk Paint: A traditional form of paint used in the 1800s that utilizes dairy milk as its base.

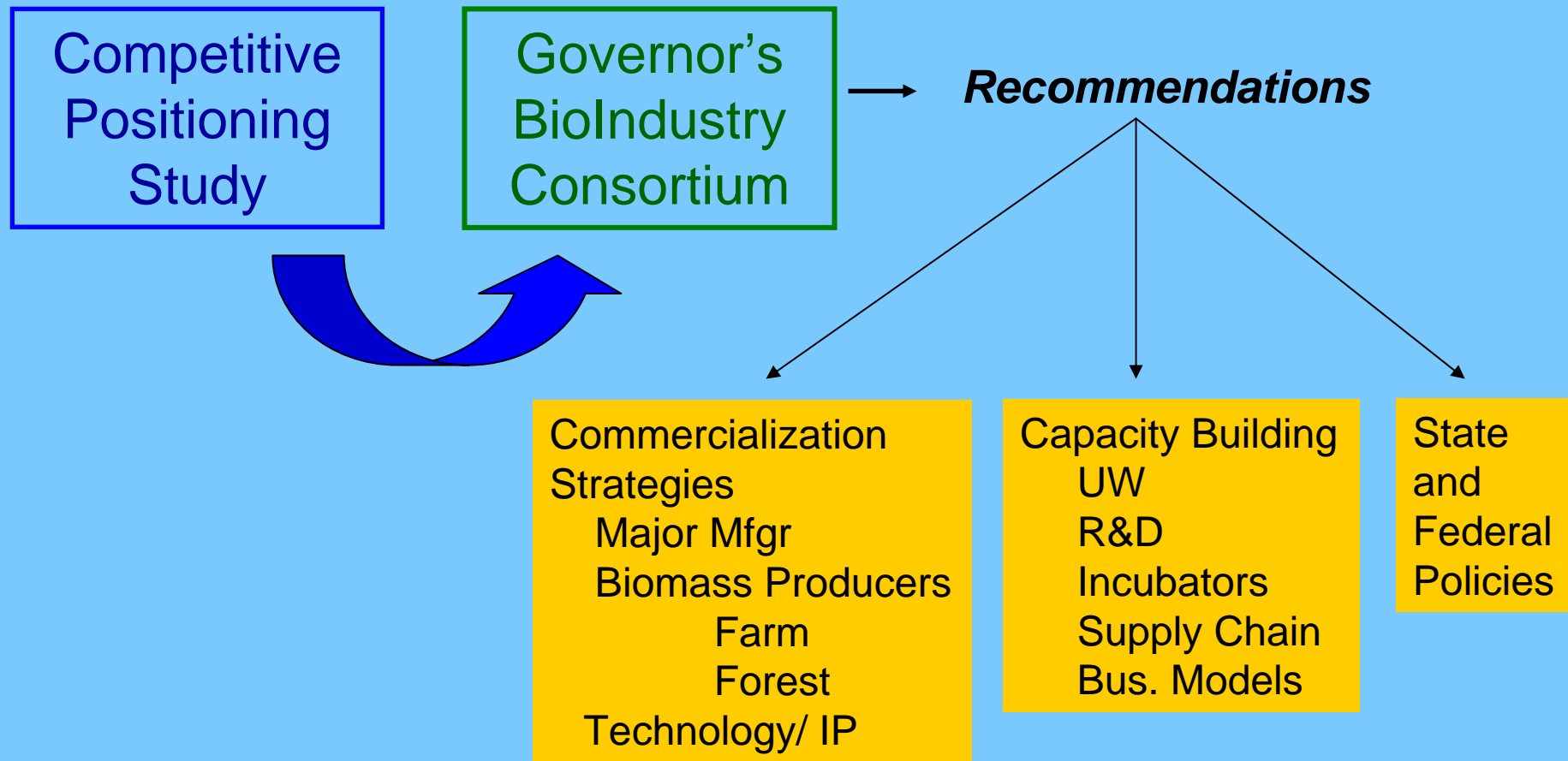


# Wisconsin's Approach

- Wisconsin's Biobased Industry: Opportunities & Advantages Study
  - Energy Center of Wisconsin
    - [www.ecw.org](http://www.ecw.org)
- Governor's Consortium on Biobased Industry
  - Strategies
- Building Capacity
  - Implementation

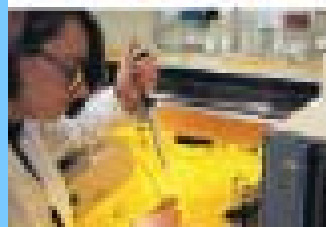
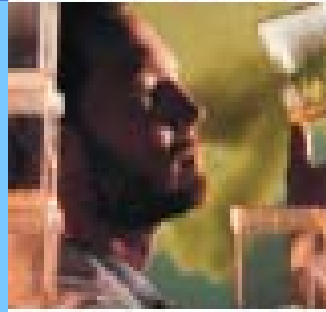


# Conceptual Framework



# Opportunities & Advantage Study

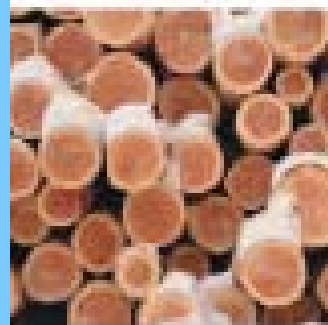
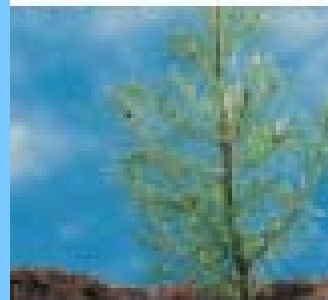
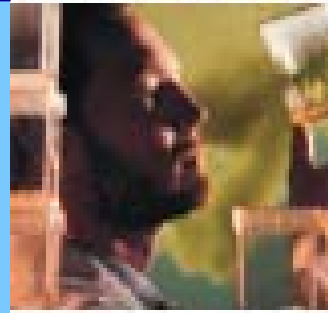
- Comprehensive view of Wisconsin's bio-opportunities.
- 3 Documents
  - Briefing Paper
  - Technical Paper
  - Policy Paper
- [www.bioeconomy.wi.gov](http://www.bioeconomy.wi.gov)



# Key Findings

## *Wisconsin Growth Channels*

- Organic Waste Stream
  - Farm manure management
  - Forest & Crop Residues
- Crops
  - New crops
  - Dedicated crops
- Forest biorefinery
- Biobased chemicals
- Research capacity

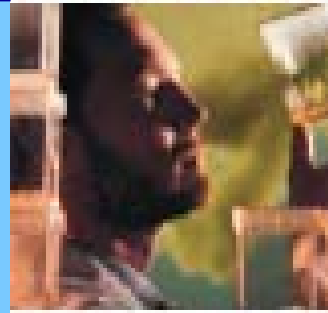


# Governor's Consortium Report

## Recommendations

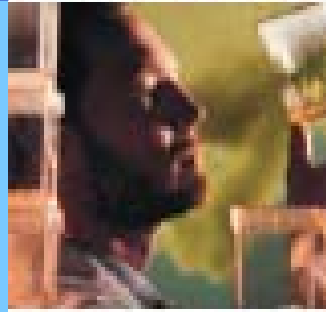
- Create a Sustained and Integrated Effort to Guide the State
- Build the Intellectual Capacity to Lead the BioIndustry
- Create the Infrastructure and Support that enables business to succeed
- Develop the Markets for Biopower, Biofuel, and Bioproducts

[www.bioeconomy.wi.gov](http://www.bioeconomy.wi.gov)



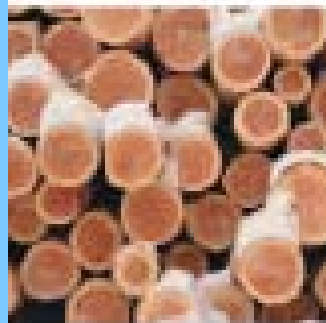
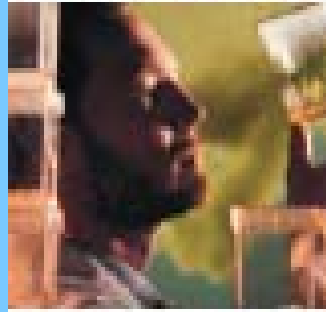
# Governor's Plan

- Declaration of Energy Independence
- 25% of power and transportation fuels from renewables by 2025
- Budget and Policy Proposal (forthcoming)
  - Mix of targeted incentives
  - R&D commercialization grants
  - Research
  - Organizing mechanism to achieve goals



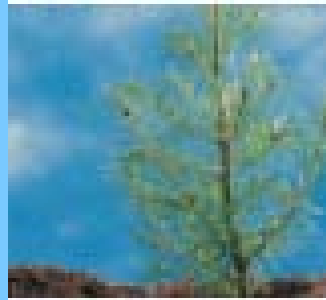
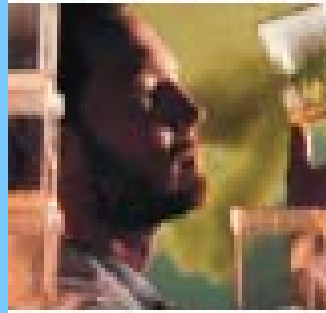
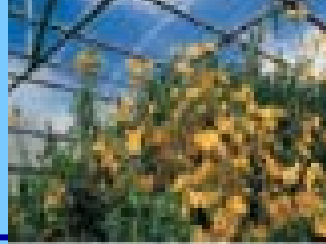
# Wisconsin Strengths

- Agriculture, Food, and Forestry
- Existing Manufacturing Infrastructure
- Emerging Ethanol and Biodiesel Industry
- World Class University
  - Plant genome
  - Engineering
  - Licensing



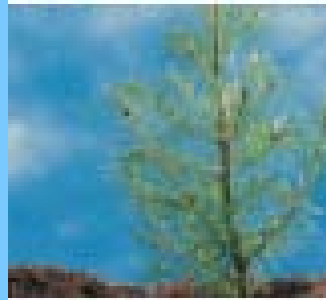
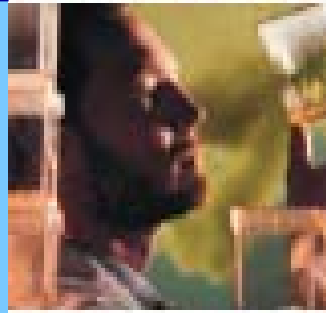
# Wisconsin Strategies

- Apply Technologies to Existing Industries
  - Reduce energy costs
  - Make new coproducts
  - Increase competitiveness
- Strengthen Emerging Industries to Leadership Positions
  - E.g.. Ethanol
- Develop “Leap Frog” Technologies
  - E.g.. enzymes, hydrogen



# Bioeconomy Values

- **Industry driven**
- **Long-term undertaking**
- **Maximize ownership opportunities for Wisconsin farmers and foresters**
- **Competitive**
  - Global awareness
  - Continual innovation



# Challenge to UW

- Inventory of relevant players
- Internal coordination
- External relationships
- Commercialization focus
  - Technology
  - Business

