The Role of Biofuels as an Energy Solution

NEW FUELS ALLIANCE

Overview

- Why Biofuels Make Sense
  - National
  - Wisconsin
- Biofuels & Food Prices
- Biofuels & the Environment
  - Climate Change
  - Air Quality
- Biofuels & the Economy

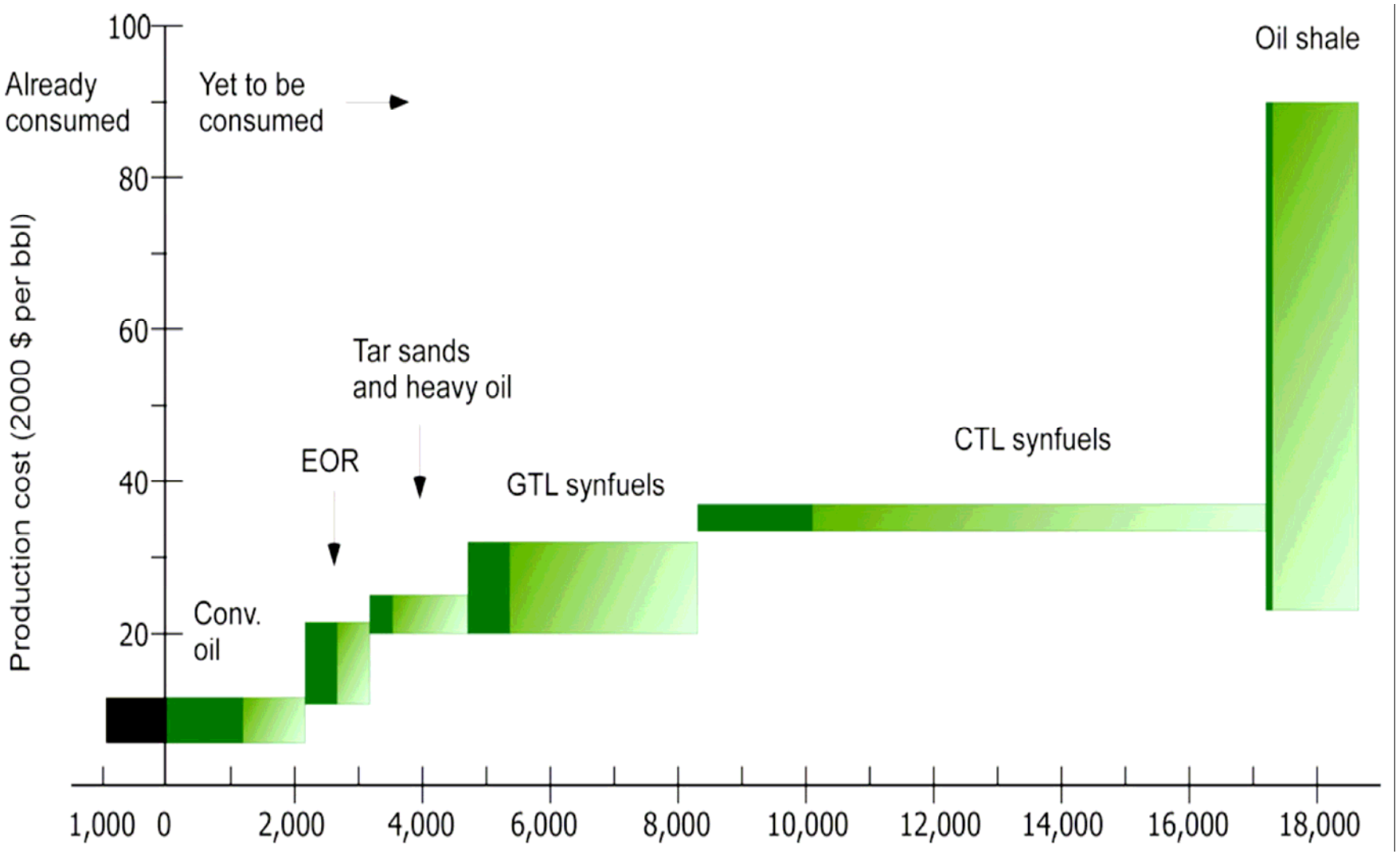
Why Biofuels Make Sense

- Oil Dependence Trends Are Not Good, Already Extremely Harmful
  - Major Impact on U.S. Economy
  - Major Impact on Environment & Getting Worse
  - National Security Implications Getting More Dire
- Biofuels Offer Immediate Term Solution with High Upside
  - Extends Fuel Supplies, *Bringing Down Gas Prices*
  - Reduce the Risk & Impact of Supply Shortages
  - Today's Biofuels De-Risk and Support Tomorrow's Biofuels
- Efficiency/Technology Gains Also Important, But No Silver Bullets
  - Plug-In Hybrids, Biofuels, Hydrogen, Natural Gas
  - Auto Companies & Oil Companies Slow To React
    - » Protected by Federal Preemption & Subsidies
    - » States must take initiative

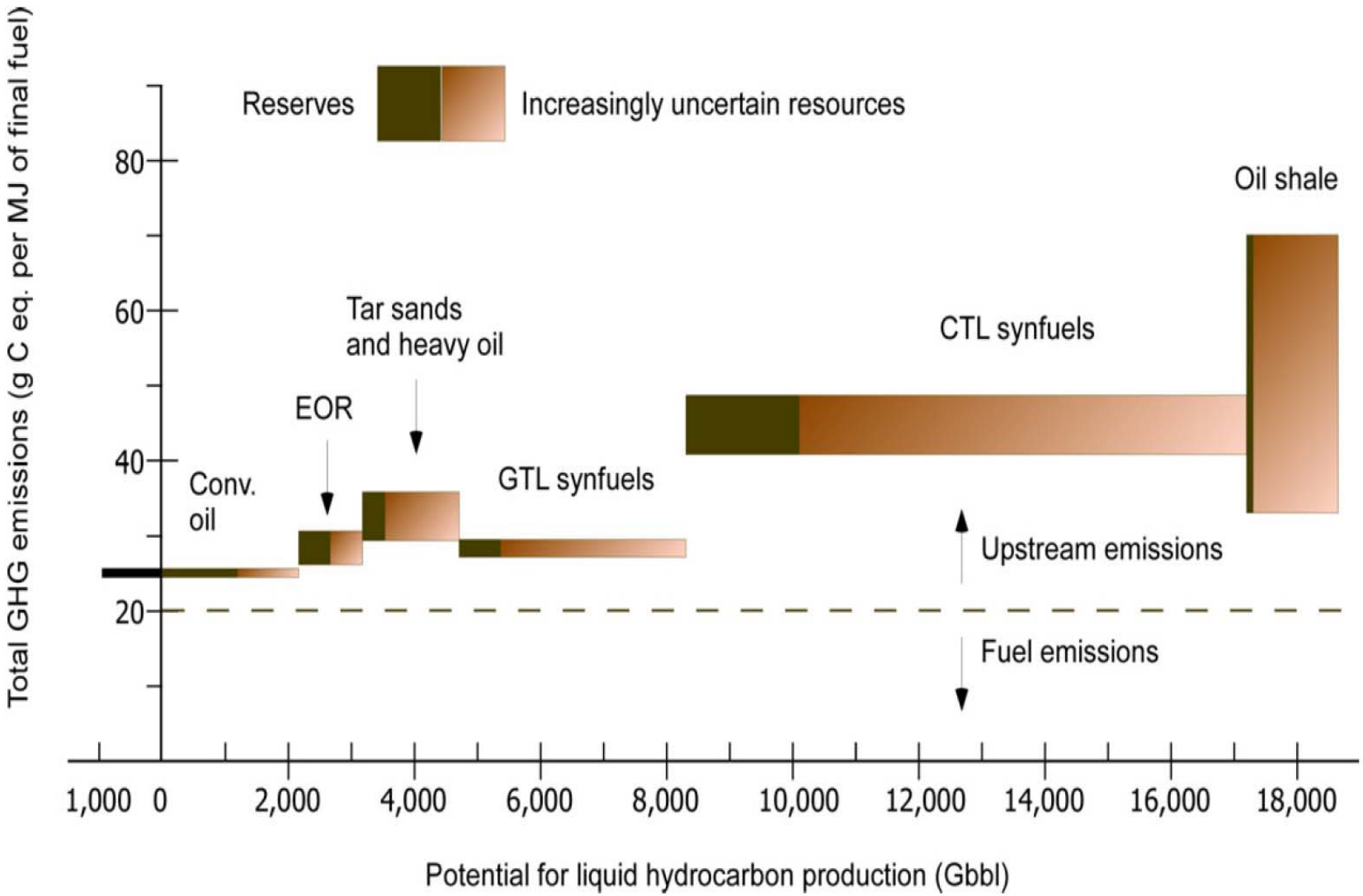
Oil Dependence Trends Damaging

- **U.S. Trade Deficit: $708.5 billion (2007)**
  - **Share Attributable to Foreign Oil: $293 billion (41%)**
  - **Loss of ~ 7.9 million jobs overseas to oil (U.S. DOE)**
- **Every $10 increase in the annual price of a barrel of oil costs the economy $75 billion.**
- **The U.S. will pay $800 billion for its oil supply, and the world as a whole will pay $3.2 trillion. These figures are up by a factor of ten from what they were in 1999.**
- **Middle East now controls 66% of proven oil reserves worldwide.**
- **Roughly 80 cents of every dollar spent on petroleum leaves the region for most states, and often the country (Source: ILSR)**
- **Oil is getting dirtier and more unsustainable**
  - **Heavy oil and thermally-enhanced oil recovery**

Oil Trends: Increasing Production Cost



Oil Trends: Increasing Climate Cost



SAFE Oil Shockwave Analysis

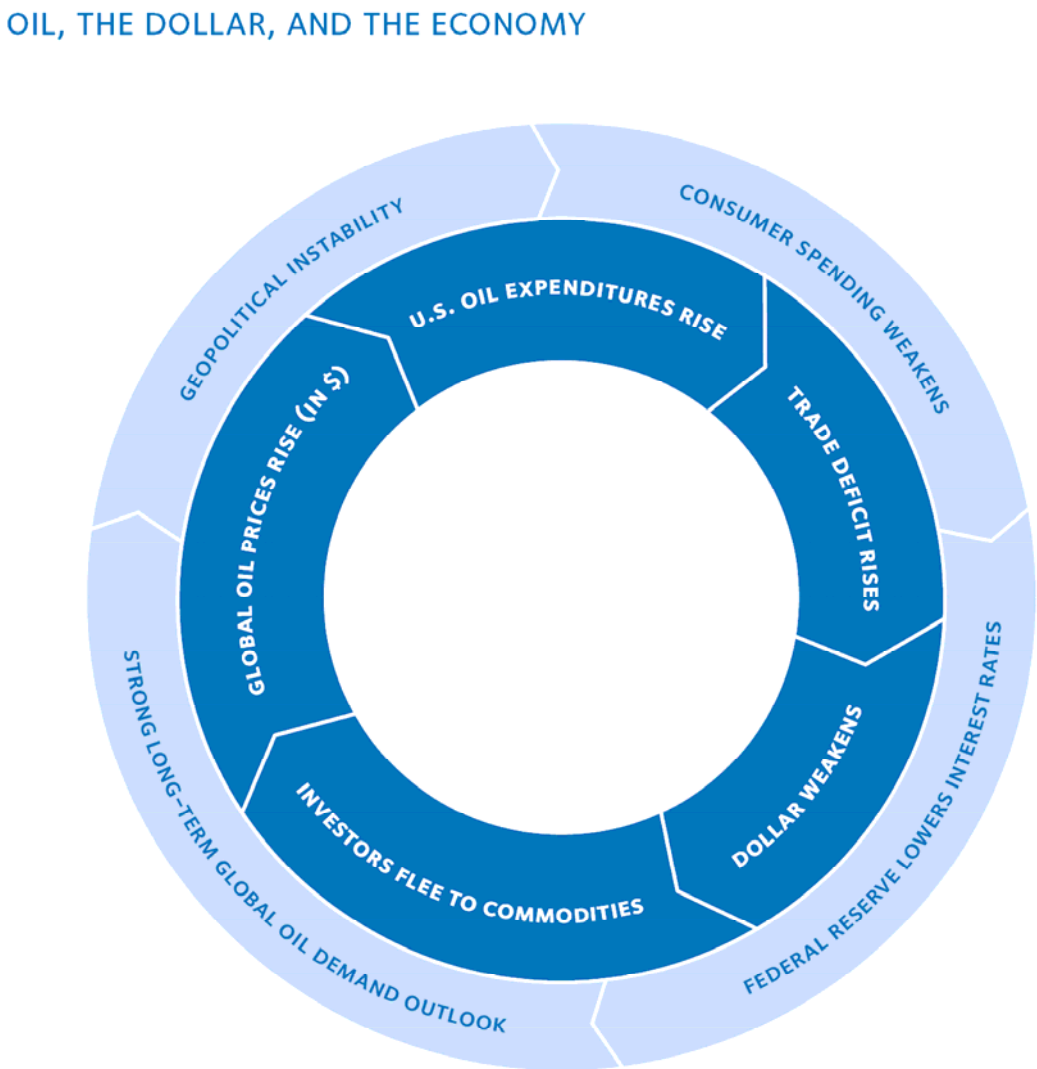
TRACKING KEY PRICES (PROJECTED)

DATE	CRUDE	GASOLINE	COST AT THE PUMP
AUGUST 7, 2009 (SEGMENT START)	$125 PER BARREL	$4.63 PER GALLON	$106.03 (MID-SIZE SUV)
AUGUST 7, 2009 (SEGMENT END)	$165 PER BARREL	$5.58 PER GALLON	$127.78 (MID-SIZE SUV)

"Given today's precarious balance between oil supply and demand, taking even a small amount of oil off the market could cause prices to rise dramatically. In Oil ShockWave, a simulated 1.2 percent disruption in global oil supplies caused prices to rise by 75 percent (from $95 to $165) in just four months."

- Oil Shockwave, Executive Crisis Simulation (November 2007)

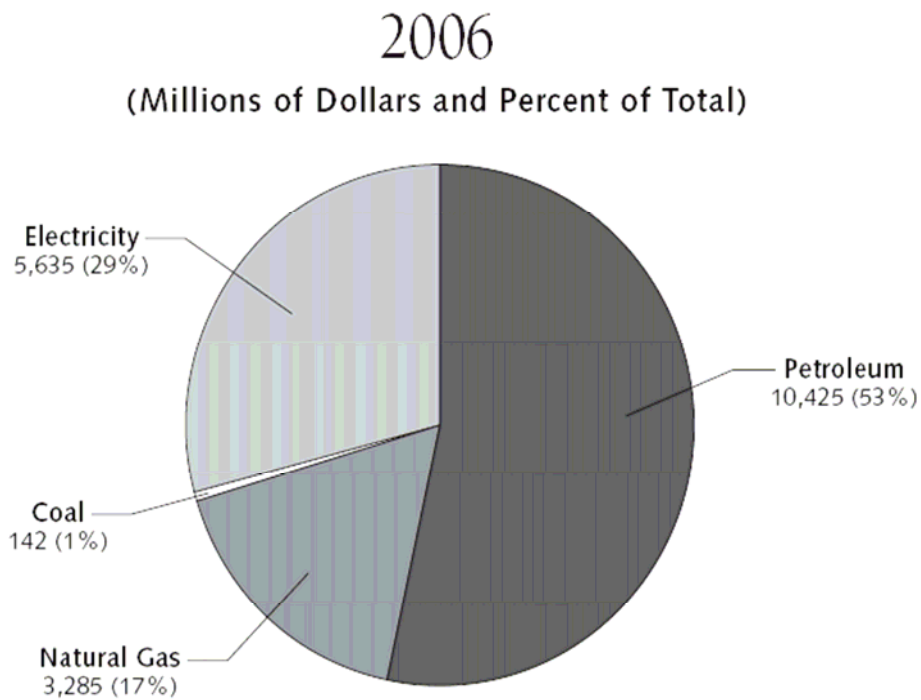
Oil Dependence As Vicious Circle



SRC: Securing America's Energy Future

Wisconsin Oil Dependence

Wisconsin Energy Expenditures, By Fuel Type



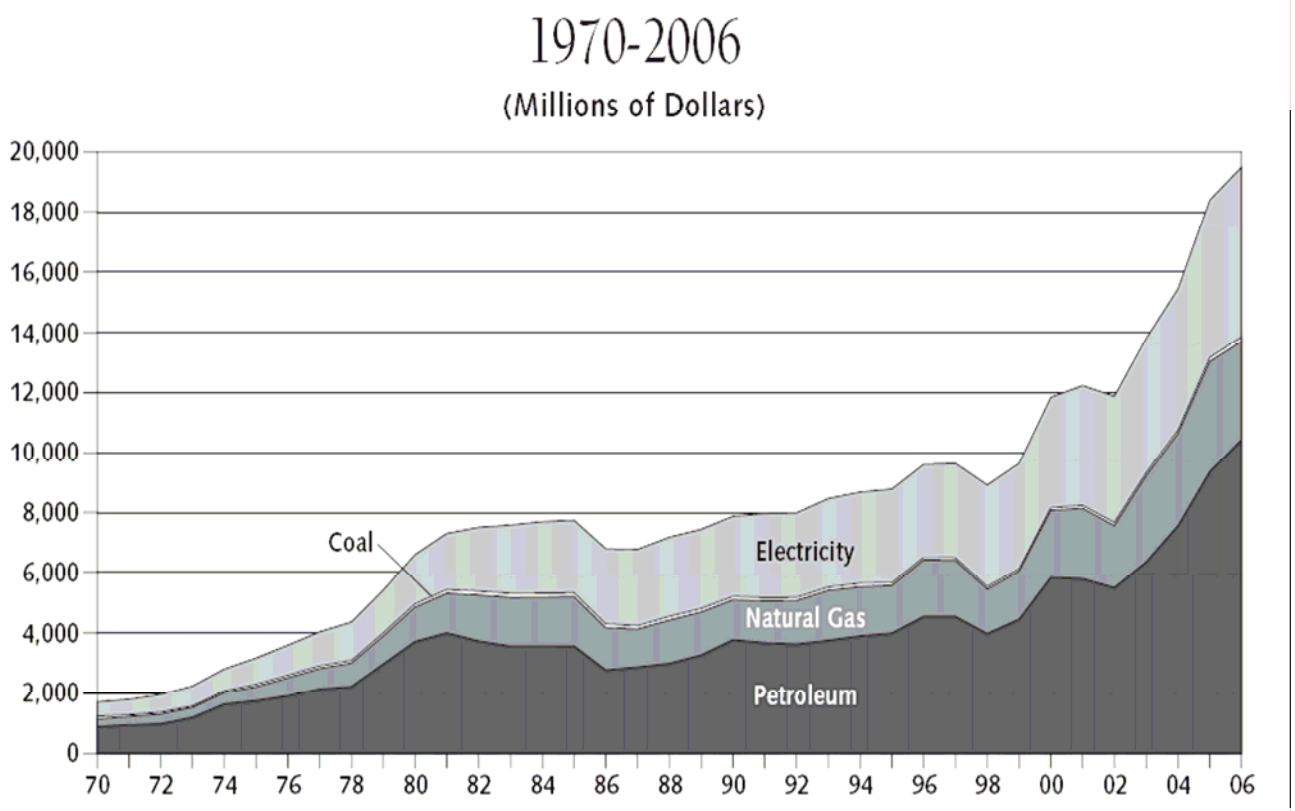
2006 Average Crude Oil: $58.30/barrel

Today's Crude Oil: ~ $112/barrel

Wisconsin Energy Expenditures

Wisconsin Energy Expenditures, By Fuel Type

2008? ➡



Source: Wisconsin Office of Energy Independence.

Biofuels & Wisconsin

- **A couple things are true for all states …**
  - Keeps "Fuel Dollars" In-State
    - » Reversal of 80/20 Rule
  - Keeps Fuel Prices Down
  - Creates Jobs & Economic Revenue, especially in rural areas
    - » 238,500 jobs nationally (SRC: LECG)
    - » $3.6 billion in tax revenue *for state & local governments* (LECG)
- **Biofuels in Wisconsin …**
  - 7th in the nation in ethanol production
  - Wisconsin food and agriculture = $51 billion/year industry
  - Paper and timber = $20 billion/year industry (potential biofuel feedstock)
  - *Wisconsin loses ~ 30,000 acres/year of farm land*
  - Farm acres in 1970: ~ 20 million … Farm acres in 2007: ~ 15 million
  - Nearly 60 percent of acres lost between 2000 and 2005 were in 19 counties, including counties near Twin Cities/Wausau and between Madison/Milwaukee.

Ethanol Estimated to Reduce Cost of Gasoline by $.50 per Gallon

- Merrill Lynch analyst estimates biofuels industry **<u>today</u> reducing crude oil prices by 15%**
  - Converts to roughly 50 cents per gallon
- Iowa State University (April 2008) study shows ethanol lowers price of gas to consumers between $.29 and $.40 per gallon
- Based on findings outlined above, biofuels result in estimated savings to US consumers of **$42 to $72 billion** annually, assuming a 145 billion gallon gasoline US market
- Current Wholesale Ethanol: ~ $2.18/gallon
- Current Wholesale Gasoline: ~ $2.82/gallon

Source: Wall Street Journal 3/24/08: Merrill Lynch Analyst Francisco Blanch; EIA: US gas price 4/14/08; Iowa State University, Xiaodong Du, Dermot J. Hayes April 2008

Ethanol's Impact on Household Spending (2007)

2007 ETHANOL IMPACT ON HOUSEHOLD GASOLINE SPENDING		
	VALUE USED	**SOURCE**
A. Avg. Miles per Household per Year	21,252 miles	FHWA (2001 NHTS)
B. Average Fuel Economy (2007)	20.2 mpg	EPA (2007)
C. Gallons Gasoline Purchased per Household	1,052 gallons	**A ÷ B**
D. Ethanol Savings per Gallon	$0.29-0.40 per gal.	Iowa State University (2008)
TOTAL SAVINGS PER HOUSEHOLD	**$305.08 – 420.83**	**D x C**

2007 ETHANOL IMPACT ON HOUSEHOLD FOOD SPENDING		
A. Avg. Household Spending on Food (2006)	$6,111	Bureau of Labor Stats ('08)
B. 2007 Food Inflation @ 4%	$244.44	USDA, ERS (2008)
NET INCREASE IN FOOD SPENDING DUE TO ETHANOL*	**$13.44****	White House Council of Economic Advisors (2008) **(B x .055)**

*The White House Council of Economic Advisors estimates that .25% of food price inflation is a result of US ethanol production.

** Not including the reductive effect of ethanol on fuel prices

Discussion of Recent Criticisms of Biofuels

- **Historical Criticisms of Biofuels**

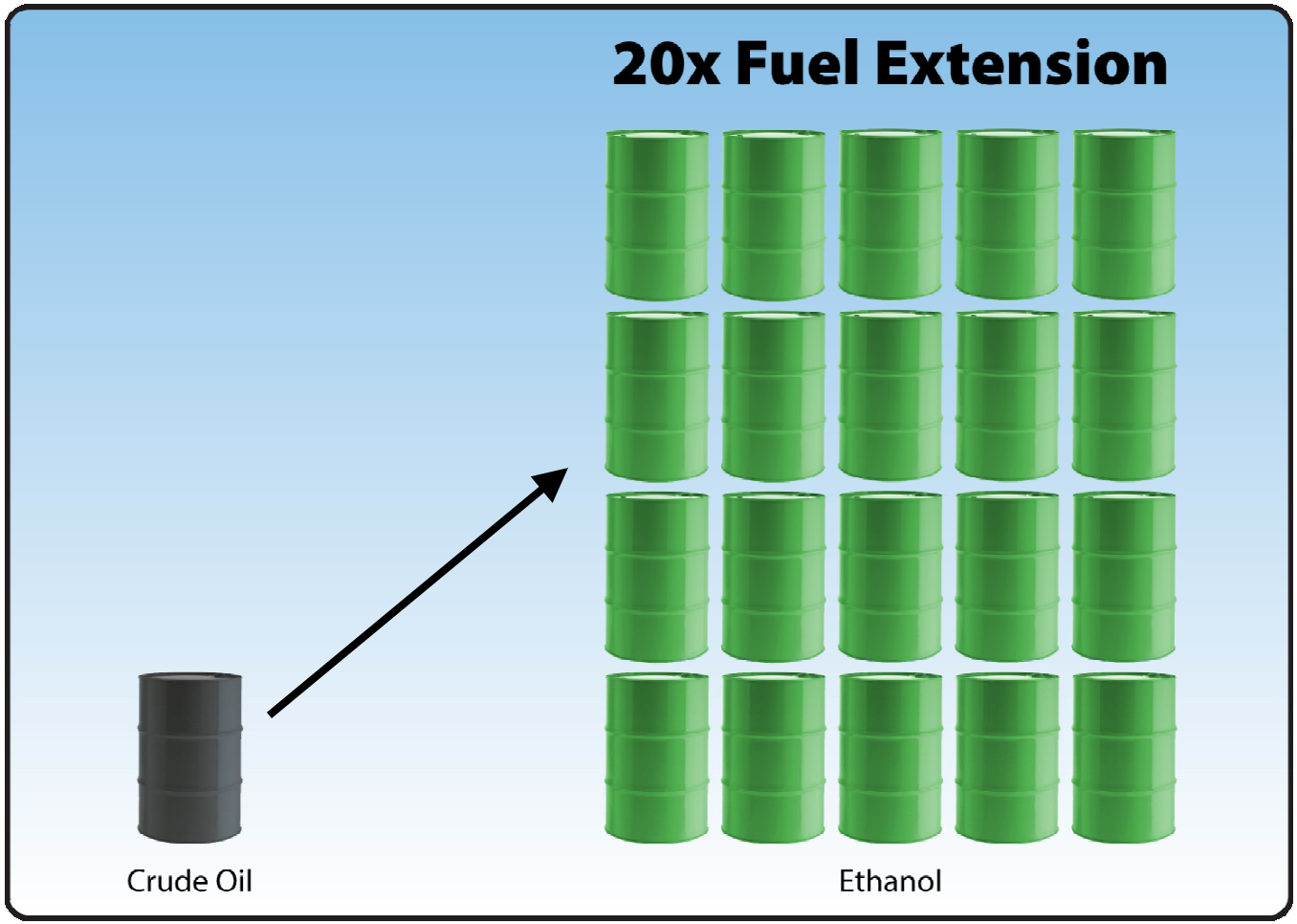
  - Energy Balance
  - Air Quality
  - Subsidies

The New Criticisms

- "Worse than Gasoline" for Climate (Land Use)
- "Increases Food Prices"

Ethanol Reduces Dependence on Oil

20 BTUs of ethanol from 1 BTU of petroleum



Source: Adapted from Farrell, et al (2006)

Biofuels & Air Quality

Common Pollutant Responses to Adding Biofuels to Petroleum (compared to a 100% petroleum fuel baseline, by fuel type)						
Fuel	CO	Tailpipe VOC	Evap VOC	NOx	Total Toxics	PM
Ethanol						
E10 Blend	Decrease	Decrease	Increase	(Increase)	Decrease	Decrease
E85 Blend	Decrease	Decrease	Decrease	(Decrease)	Decrease	?
Biodiesel						
B5 Blend	Decrease	Decrease		No Impact	Decrease	Decrease
B20 Blend	Decrease	Decrease		?	Decrease	Decrease
B100	Decrease	Decrease		Increase	Decrease	Decrease

(1) Pollutant responses shown are generalizations based on the U.S. EPA Complex Model (which regulates federal RFG) and the California Predictive Model (which regulates California RFG only), and assume all other fuel parameters (e.g. sulfur, aromatics) are held constant.
(2) "( )" indicates a "likely" impact; "?" indicates incomplete data or scientific uncertainty.

A True Comparison of Common Biofuels

What If Take Biofuels *Out* of the Blend?

Common Pollutant Responses to Removing Biofuels from Petroleum (compared to a biofuel blend baseline, by fuel type)						
Fuel	CO	Tailpipe VOC	Evap VOC	NOx	Total Toxics	PM
E10 Baseline	-	-	-	-	-	-
Take Ethanol Out	Increase	Increase	Decrease	(Decrease)	Increase	Increase
B20 Baseline	-	-	-	-	-	-
Take Biodiesel Out	Increase	Increase		(No Impact)	Increase	Increase

(1) Pollutant responses shown are generalizations based on the U.S. EPA Complex Model (which regulates federal RFG) and the California Predictive Model (which regulates California RFG only), and assume all other fuel parameters (e.g. sulfur, aromatics) are held constant.
(2) "( )" indicates a "likely" impact; "?" indicates incomplete data or scientific uncertainty.

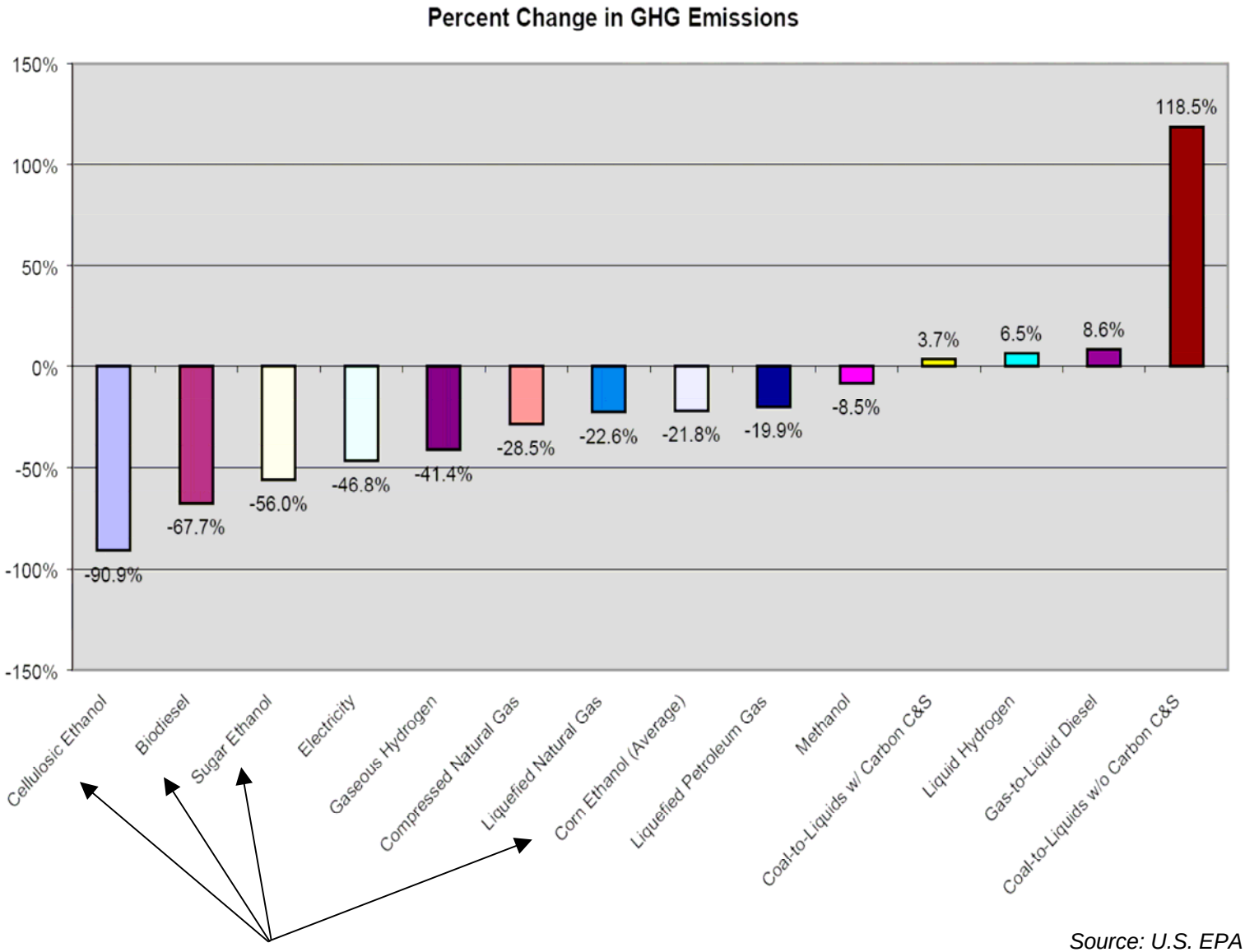
What About NOx & Ozone Concentrations?

Summary of Recent Airshed Model Runs for Ethanol and Biodiesel					
Report	Fuel Tested	Region Modeled	Model Used	Results	Comments
EPA RIA (2007)	E0 E10	National	CAMx	E10: no measurable impact (< .5 ppb) on 8-hour design value ozone concentrations	Modeled several penetration scenarios only in regions where ethanol use would change (areas with no change = no impact).
MI DEQ	E0 E10	Southeast Michigan	CAMx	E10 penetration from 25% to 100% produced no discernable result on 8-hour ozone levels	Very basic inputs; not published. Permeation increase did not increase ozone (suggesting CO decrease offset permeation).
Environ (2005)	E0 E10	Denver Metropolitan	CAMx	100% E10 market penetration: no effect on ozone concentrations	Run did not account for permeation increase, or for CO decrease in new cars.
NREL (2003)	B0 B20	Northeast Lake Michigan Southern CA	CAMx	B20: no measurable adverse impact on 1-hour or 8-hour ozone in S. CA or Eastern U.S.	Assumed a 2% NOx increase for B20, which NREL now believes does not exist (based on current data).
CARB (1999)	MTBE E0, E6 E10	Southern CA	UAM	E6/E10: no measurable effect on peak 1-hour ozone concentrations	Run did not account for (1) permeation increase; (2) CO decrease in new cars.

Biofuels & Climate

- **Old Argument: Biofuels Reduce Lifecycle GHG emissions**
- **New Argument: Biofuels "worse than gasoline" for climate**
- **What happened?**
  - **- The debate moved from direct to indirect impacts**
  - **- The debate has been skewed and misrepresented**
- **"Biofuels Worse Than Gasoline" Argument Is Totally Misleading**
  - **- Apples to Oranges Comparison**
  - **- Based on indirect, market-mediated effects (controversial)**
  - **- Based on 2 studies that were *very* limited in scope**
  - **- Media ran with the story without asking good questions**

Direct Emissions: Biofuels Reduce GHG



Source: U.S. EPA (2007)

Direct + Indirect GHG Emissions:

If these values are used, most biofuels have *higher* GHG emissions than do fossil fuels

- If corn grown on CRP land is used for ethanol, total lifecycle emissions, including indirect LUC, are
  - 88 + 140 = 228 g/MJ
  - 2.4 x gasoline ← !
- If replacing corn used for ethanol causes tropical deforestation, total lifecycle emissions, including indirect LUC, are
  - 88 + 540 = 628 g/MJ
  - Over 6 x gasoline ← !
- Renewable diesel using palm oil has total lifecycle emissions, including indirect LUC, of
  - 21 + 197 = 220 g/MJ
  - 2.3 x diesel ← !

Note: Text Box From Univ. of California Presentation

Major Problems w/ Analysis

- Compares biofuels with indirect impacts to petroleum without them
- Elasticity assumptions are highly questionable, and in some cases, missing
- Some very basic methodological problems
- No scientific consensus that indirect effects can be predicted with any level of certainty
- Still major questions about how indirect effects should be accounted for in policy

About "Indirect Effects"

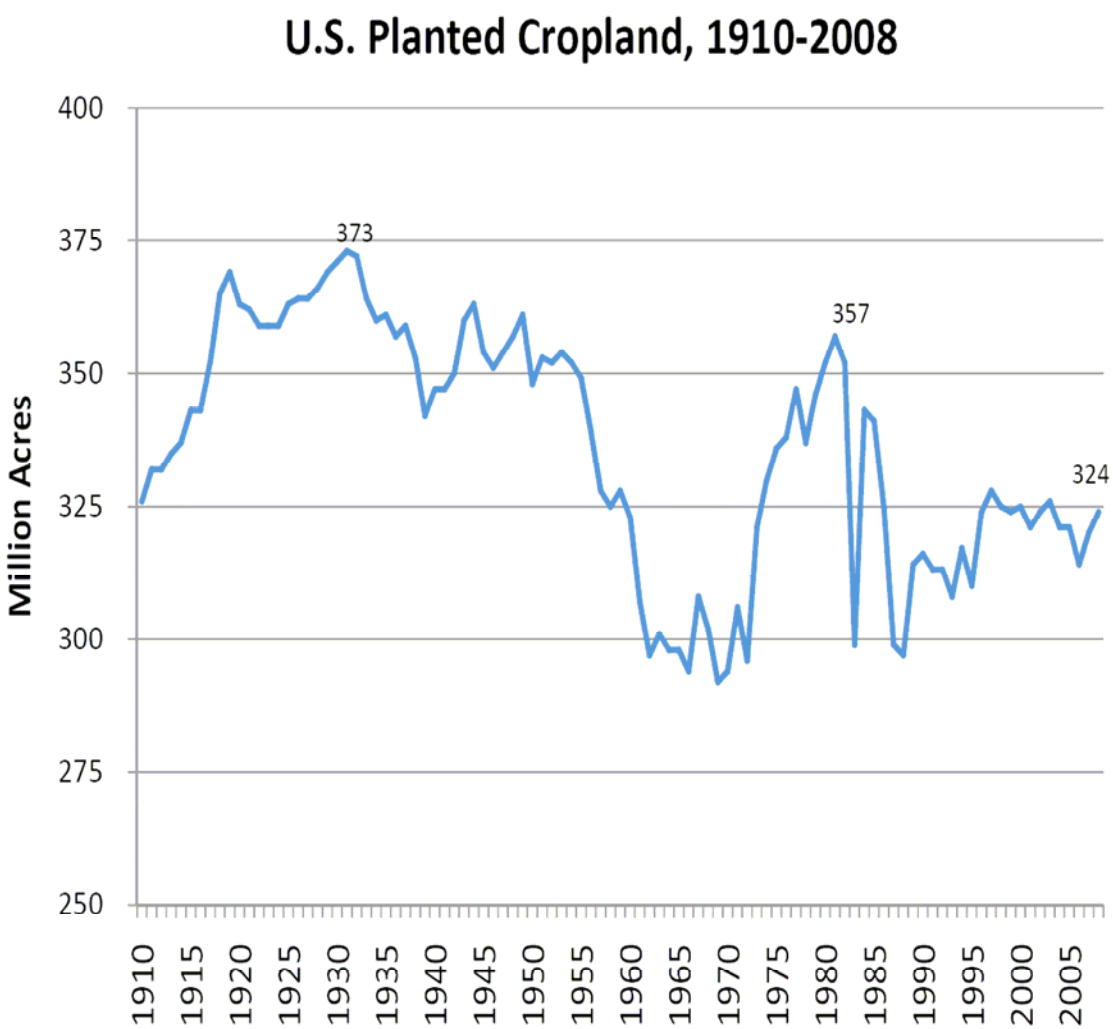
Extending beyond direct effects invites all the vagaries of market- and policy-mediated impacts into the question …

"At the underlying level, tropical deforestation is … best explained by multiple factors and drivers acting synergistically rather than by single-factor causation, with more than one-third of the cases being driven by the full interplay of economic, institutional, technological, cultural and demographic variables." - BioScience Magazine

"Indirect land use changes are much more difficult to model than direct land use changes. To do so adequately, researchers must use general equilibrium models that take into account the supply and demand of agricultural commodities, land use patterns, and land availability (all at the global scale), among many other factors. Efforts have only recently begun to address both direct and indirect land use changes … [w]hile scientific assessment of land use change issues is urgently needed in order to design policies that prevent unintended consequences from biofuel production, conclusions regarding the GHG emissions effects of biofuels based on speculative, limited land use change modeling may misguide biofuel policy development." - Michael Wang, Argonne National Lab, Author of GREET

"There remain great uncertainties and challenges in combining [land use change] and [lifecycle carbon assessment] models that make their use highly problematic, particularly if the outputs of these models are used as a basis for policy decisions, or for comparing indirect impacts between fuel types." - 27 scientists to CA Air Resources Board in letter dated June 2008

U.S. Cropland: Room For Growth



- U.S. planted cropland typically ranged between 350 and 375 million acres from 1920 to mid-1950s
- Cropland dropped to about 300 million acres during the 1960s as a result of higher agricultural productivity
- Cropland surged in mid-1970s due to grain export boom
- Trend since 1985 has been between 300 and 325 million acres

Biofuels & Climate: Bottom Line

- **On balance, biofuels have greenhouse gas (GHG) benefits based on full lifecycle *direct* effects …**
  - **Direct effects include upstream land use attributable to fuel production, production, transport, combustion**
- **Indirect, market-mediated effects should not be included in the lifecycle analysis until they can be quantified with a requisite level of certainty and can be enforced against all fuels …**
  - **Given the number of variables, this will be difficult**
  - **Indirect effects must be enforced against all fuels, including petroleum, electrification for plug-ins, hydrogen, and other**
- **There may be other, better ways to prevent pristine land degradation**
  - **Carbon may not be best policy solution for land use**

Biofuels & Food Prices

- U.S. Food Inflation: 4.5%
- International Grain Inflation: Up to 40%
- Argument: "Biofuels Are Driving Food Prices Up"

Fact: PR Campaign Against Biofuels Led By GMA

Fact: Food Company Profits Are Way Up During "Crisis"

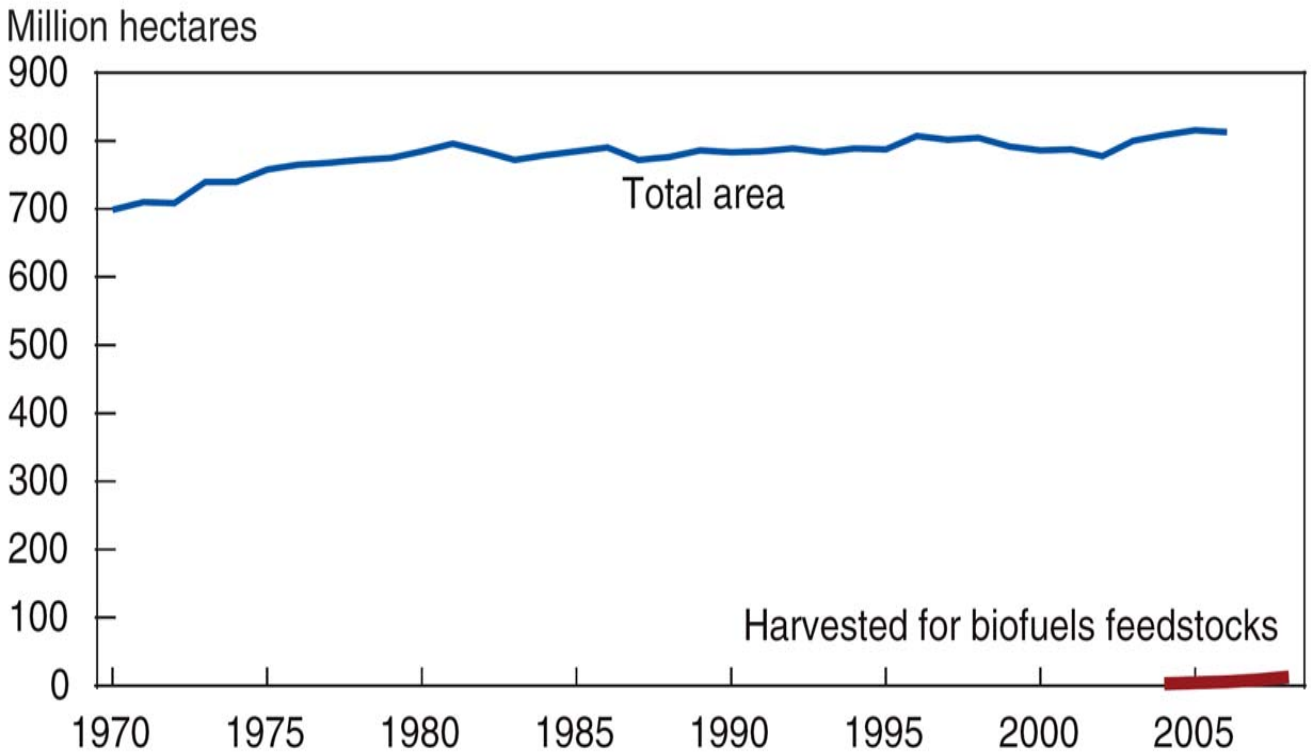
Fact: Biofuels Have Little to do with Rice Riots or Wheat Protests

Fact: Food Prices Historically Track to Oil Prices, Not Grain Prices

Biofuels In The Context of Global Harvest

Global area harvested

Including for biofuels feedstocks[1]



[1]Crops include: Wheat, rice, corn, barley, sorghum, other cereals, soybeans, rapeseed, sunseed, and cotton.

Source: USDA Agricultural Projections to 2017.

Biofuels Not Even Driving Corn Prices

- **Corn Prices Jumped from $2 to $7/bushel in last 2 years**
- **Now ~ $5.50/bushel**
- **Leading Economists Blame Oil Prices for Corn Prices**

"We have evaluated the impacts of the [ethanol] subsidy and Renewable Fuel Standard on corn price and many other variables. Most of the corn price increase is due to the higher oil price, not the subsidy. In fact, moving from $40 to $120 oil with no subsidy or mandate in effect still leads to a tripling of corn price. With no subsidy or mandate, corn moves from $1.71 at $40 oil to $5.26 at $120 oil. With the subsidy, corn moves from $2.26 at $40 oil to $6.33 at $120 oil."

- Wally Tyner, Economist, Purdue University

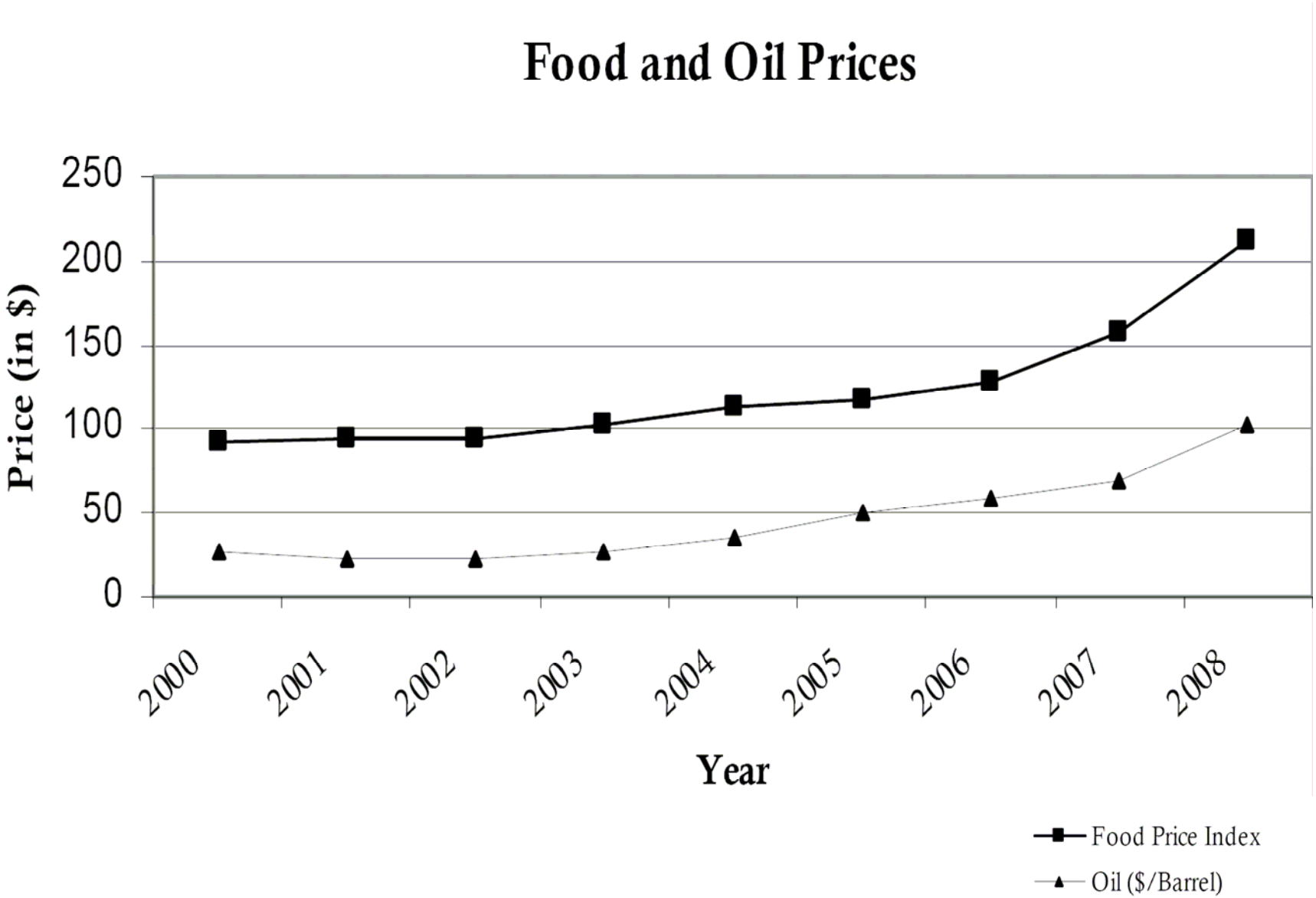
Texas Analysis of Food Versus Fuel

- **"This research supports the hypothesis that corn prices have had little to do with rising food costs."**

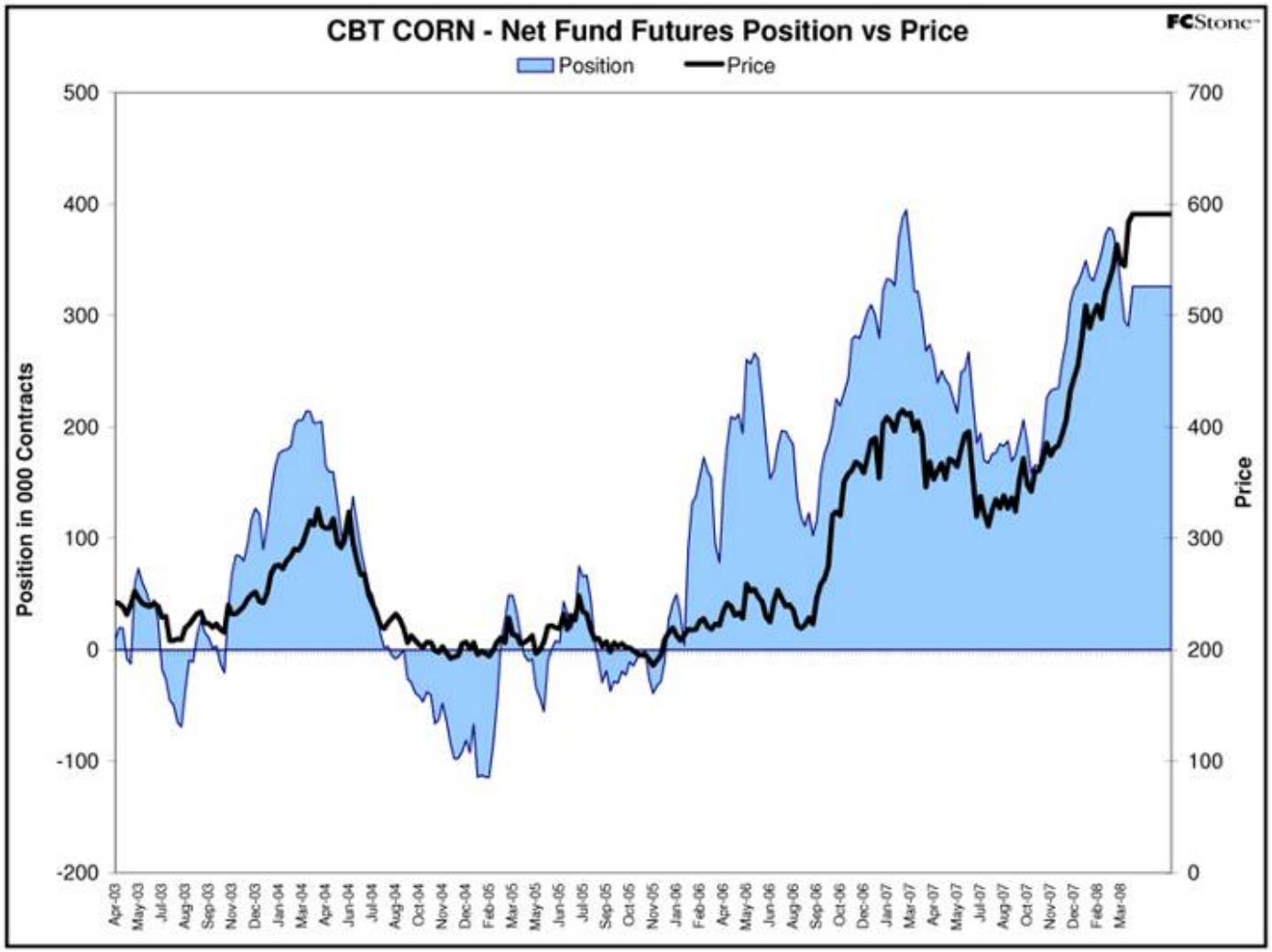
- **"The underlying force driving changes in the agricultural industry, along with the economy as a whole, is overall higher energy costs, evidenced by $100 per barrel oil."**

Source: "The Effect of Ethanol on Texas Food and Feed," Agricultural Food and Policy Center, Texas A&M University, April 10, 2008.

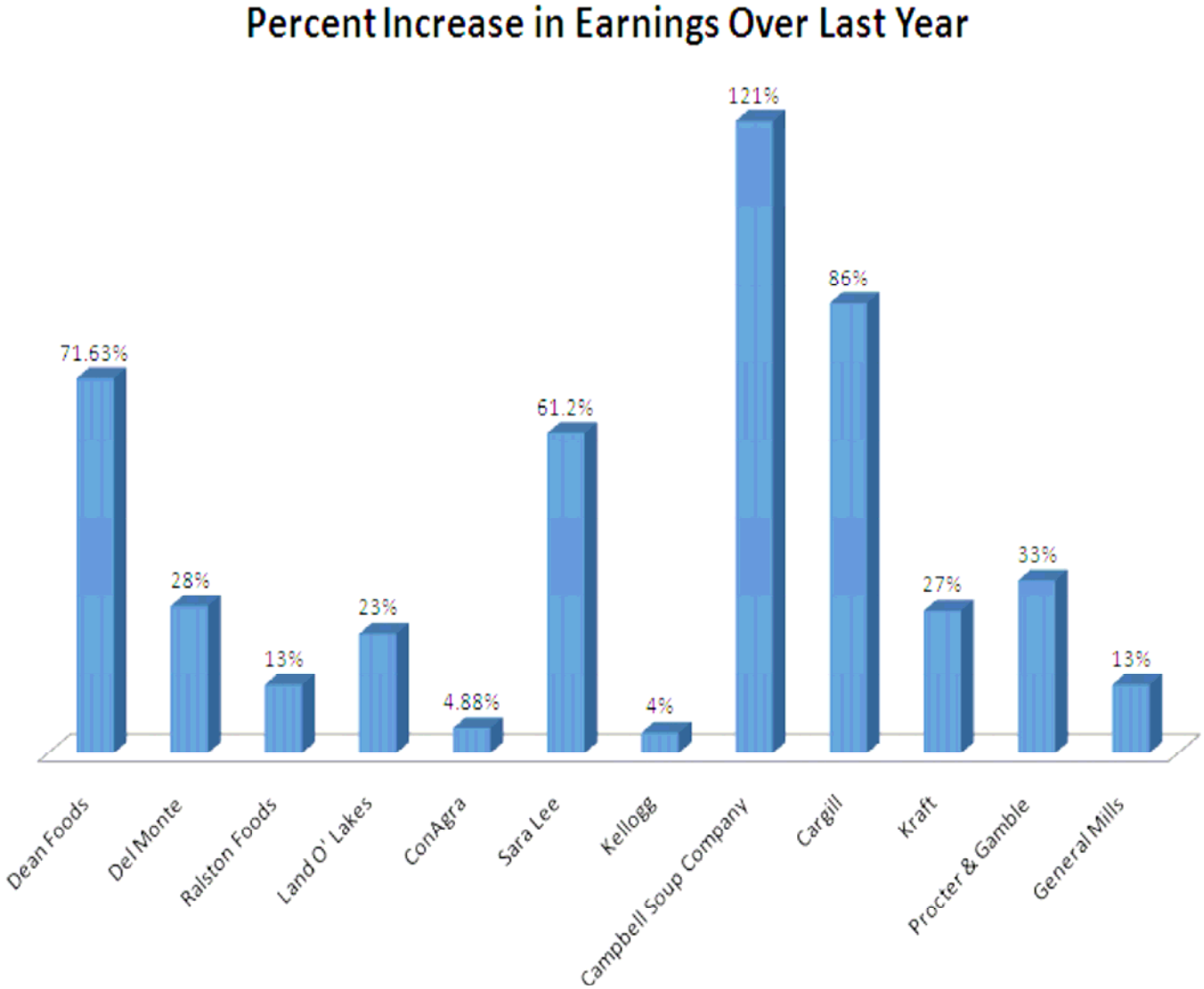
Food Index & Oil Prices



Corn Prices Correlate with Speculative Fund Positions

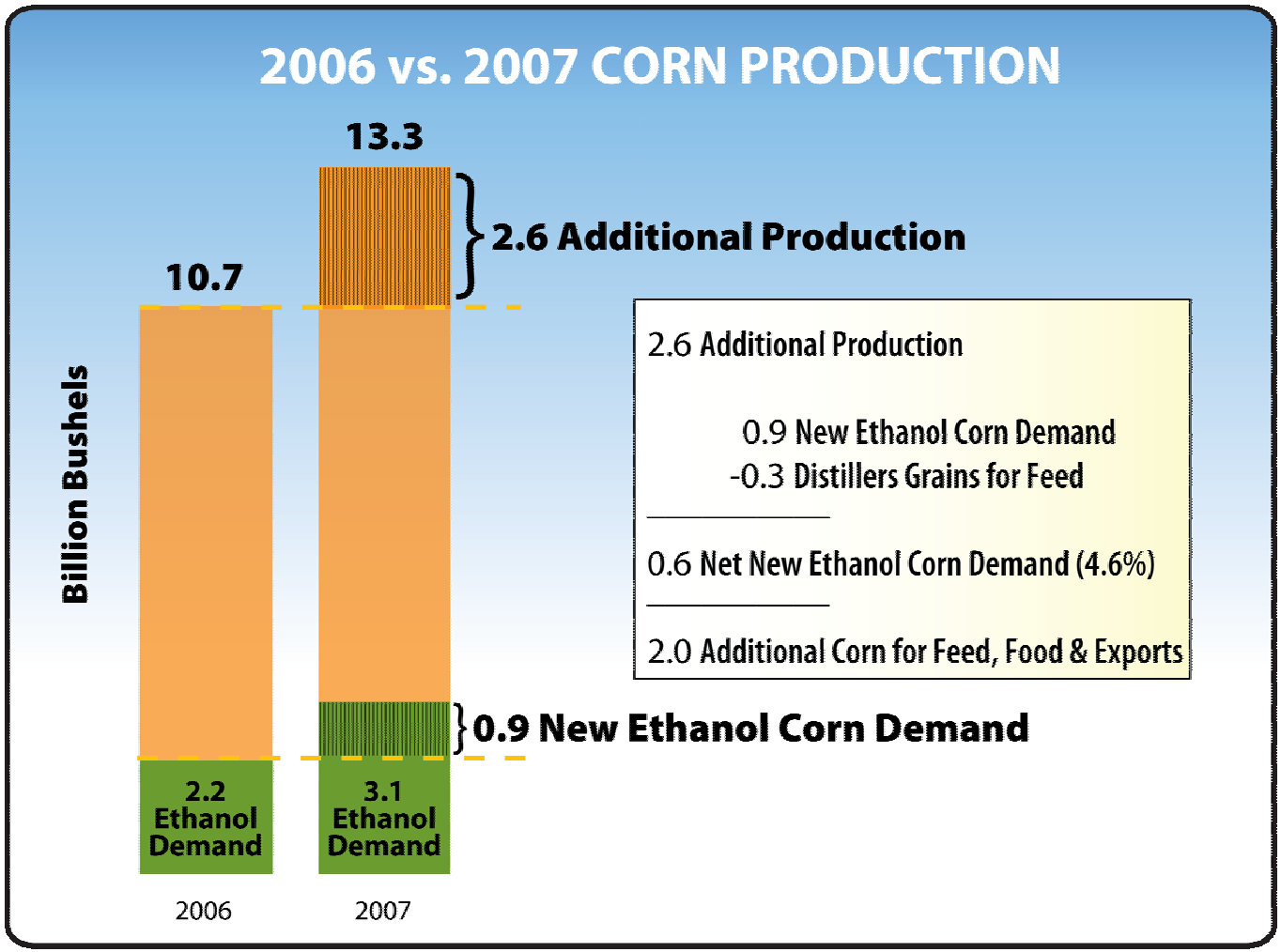


Food Company Profits Are Rising



U.S. Corn Production Outpaces Demand

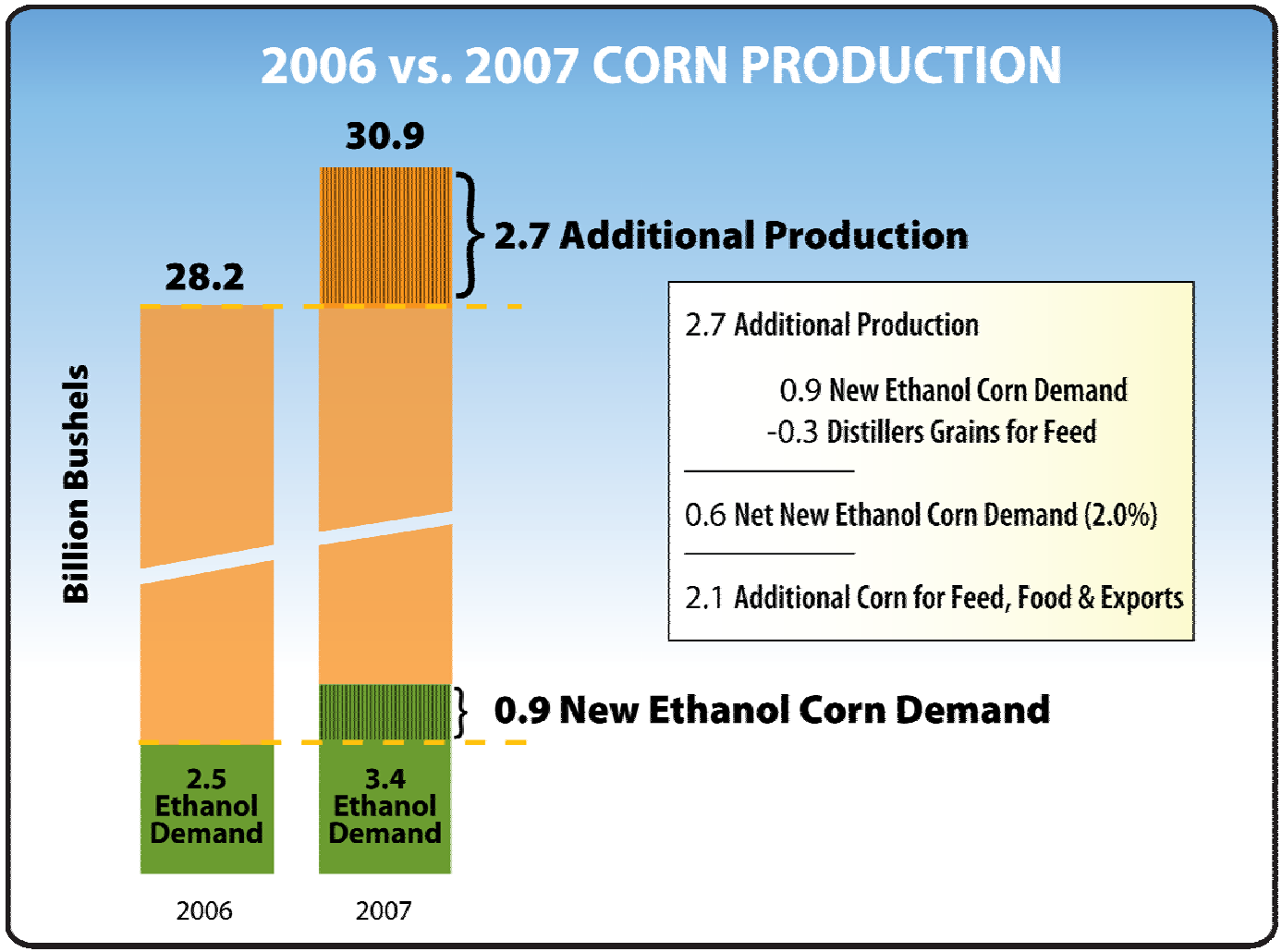
Only 4.6% net new ethanol corn demand



Source: USDA, Goldman Sachs Commodities Research Report, April 10, 2008

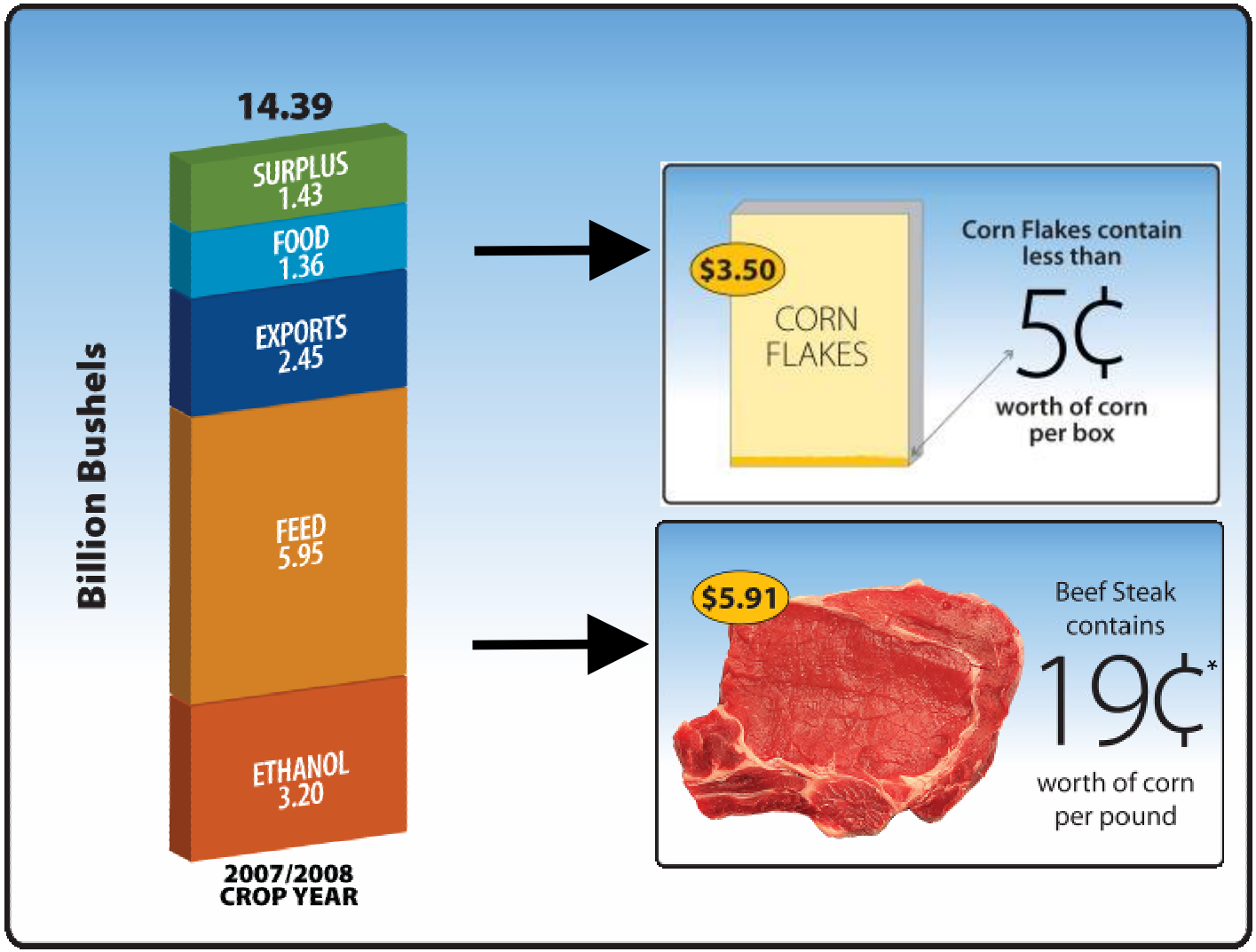
World Corn Production Outpaces Demand

Only 2% net new ethanol corn demand



Source: USDA, Goldman Sachs Commodities Research Report, April 10, 2008

Minor Impact on Retail Food Price



Source: USDA,NCGA

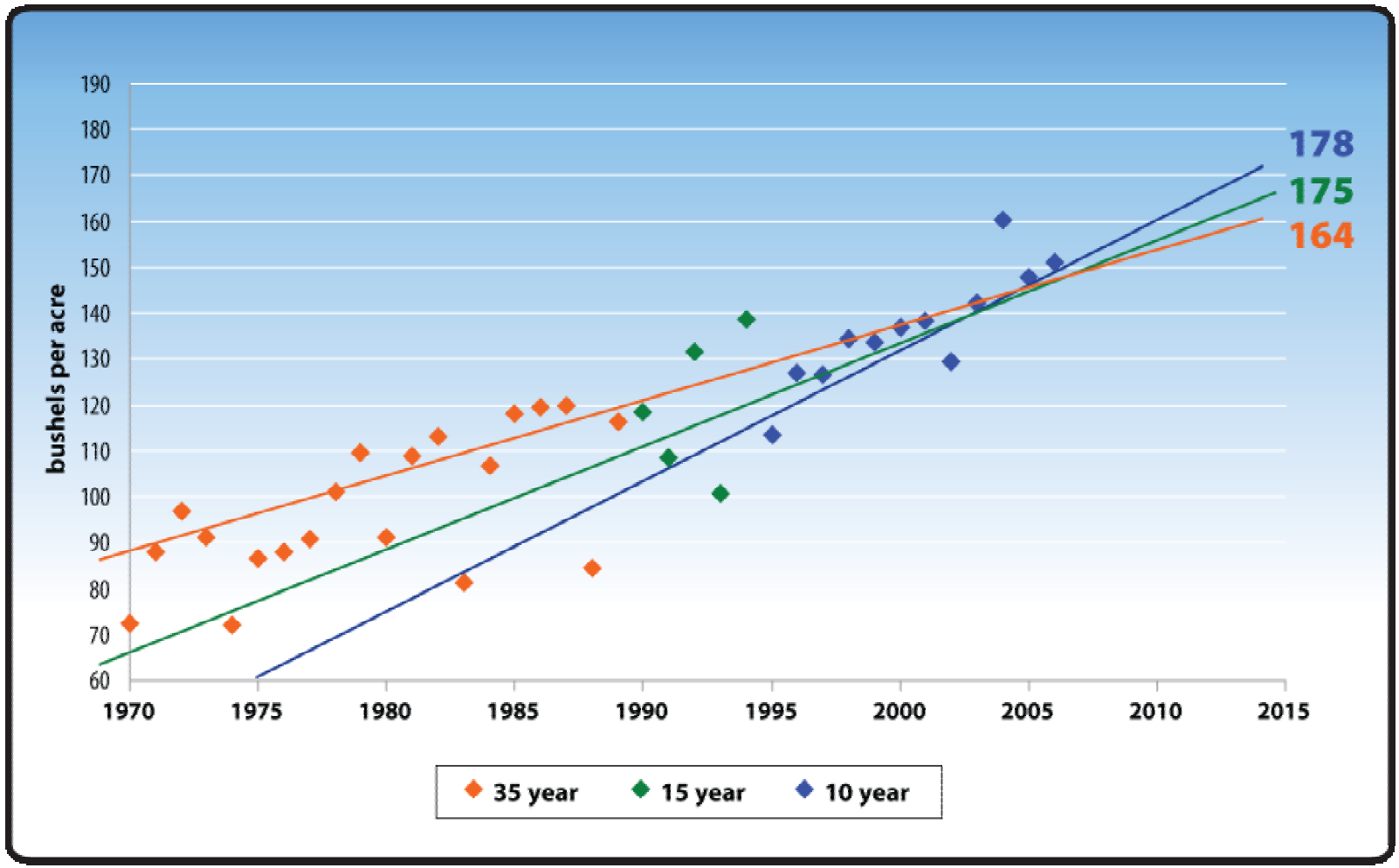
** Based on corn value of $4/bushel. USDA choice boneless sirloin steak. Feb. 08;*

Biofuels & Food: Bottom Line

- ~ .25% of 4.5% U.S. Food Inflation from Biofuels
- ~ 2% of global food price increases
- Effects probably offset by reductive effect on fuel prices
- Average Consumer: Any slight impact on food price more than offset by reduced pump prices
- Major Catalysts of Food Price Increases …
  - Oil Prices
  - Weak Dollar (Increases Demand on Commodities)
  - Speculation
  - Increasing Demand from Developing Countries
  - Major Policy Shifts in Developing Countries
  - Drought (especially re: wheat/Australia)

Corn Yields Accelerating

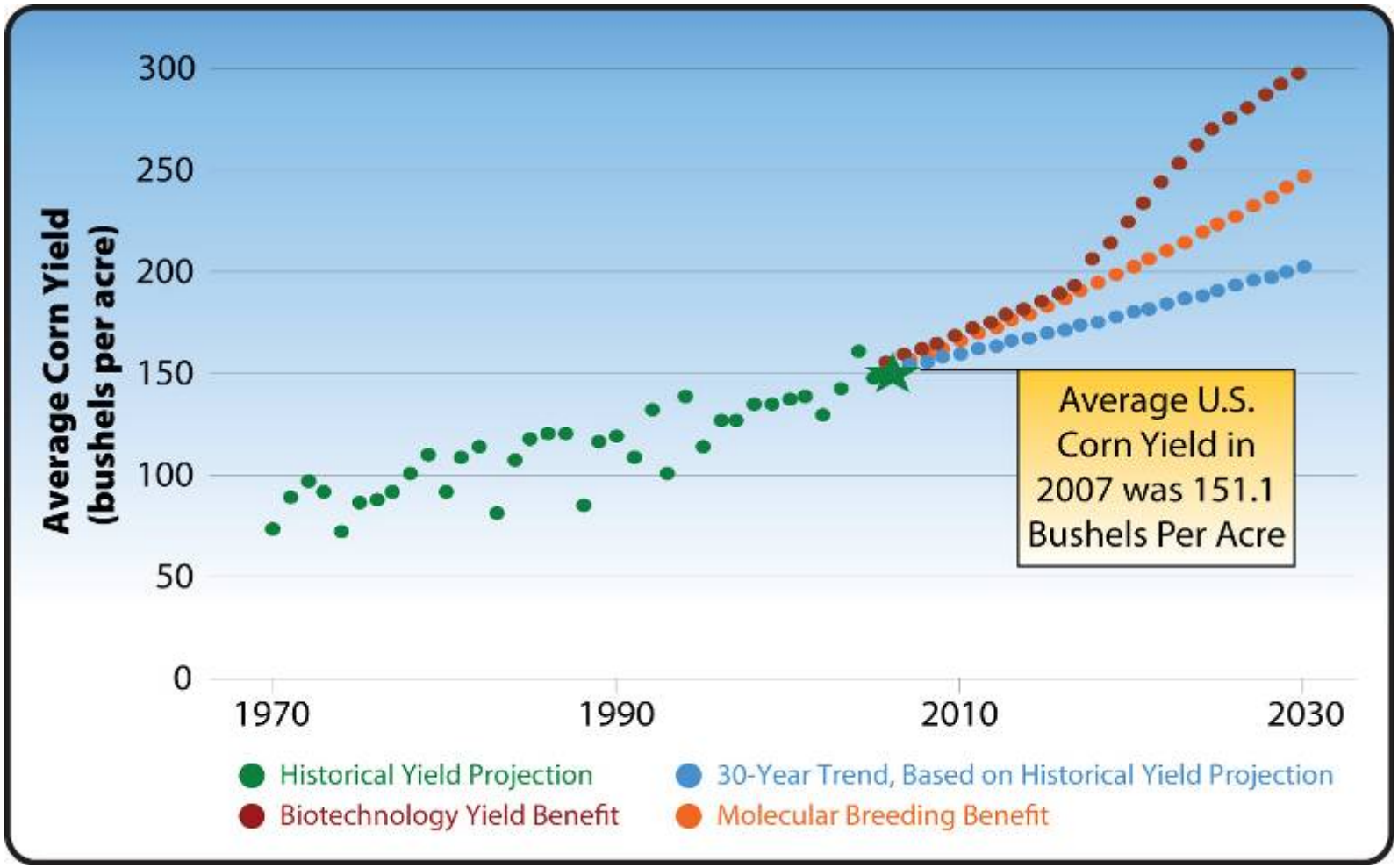
USDA predicts 178 bushels/acre by 2015



Source: USDA

Corn Yields Accelerating

Monsanto predicts 300 bushels per acre by 2030



Source: Monsanto

Corn Ethanol Production Potential

		2007	2015	2030
Billion bushels	Acres (millions)	86.5	86.5	86.5
	Bushels Per Acre	151.1	178.0	300.0
	Corn Production	13.1[1]	15.4	26.0
	Base Demand - Uses Other Than Ethanol	9.8	9.8	9.8
	Available For Ethanol	3.3	5.6	16.2
	DDGS Returned as Feed (1/3)[2]	1.1	1.9	5.3
	Total Bushels Available For Ethanol	4.4	7.5	21.5
	Potential Ethanol Production[3]			
	Gallons (billions)	**12.3**	**21.0**	**60.3**
	Thousand barrels per day	**802**	**1,370**	**3,933**

Source: USDA, FC Stone Research, VeraSun projections

(1) Does not include 1.3 billion bushel carry-in

(2) DDGS will displace corn and/or soybean meal. Soybean displacement will reduce acres needed for soybeans and provide for more corn production. Results could vary based on other feed supply and demand.

(3) Assumes 2.8 gallons per bushel yield.