

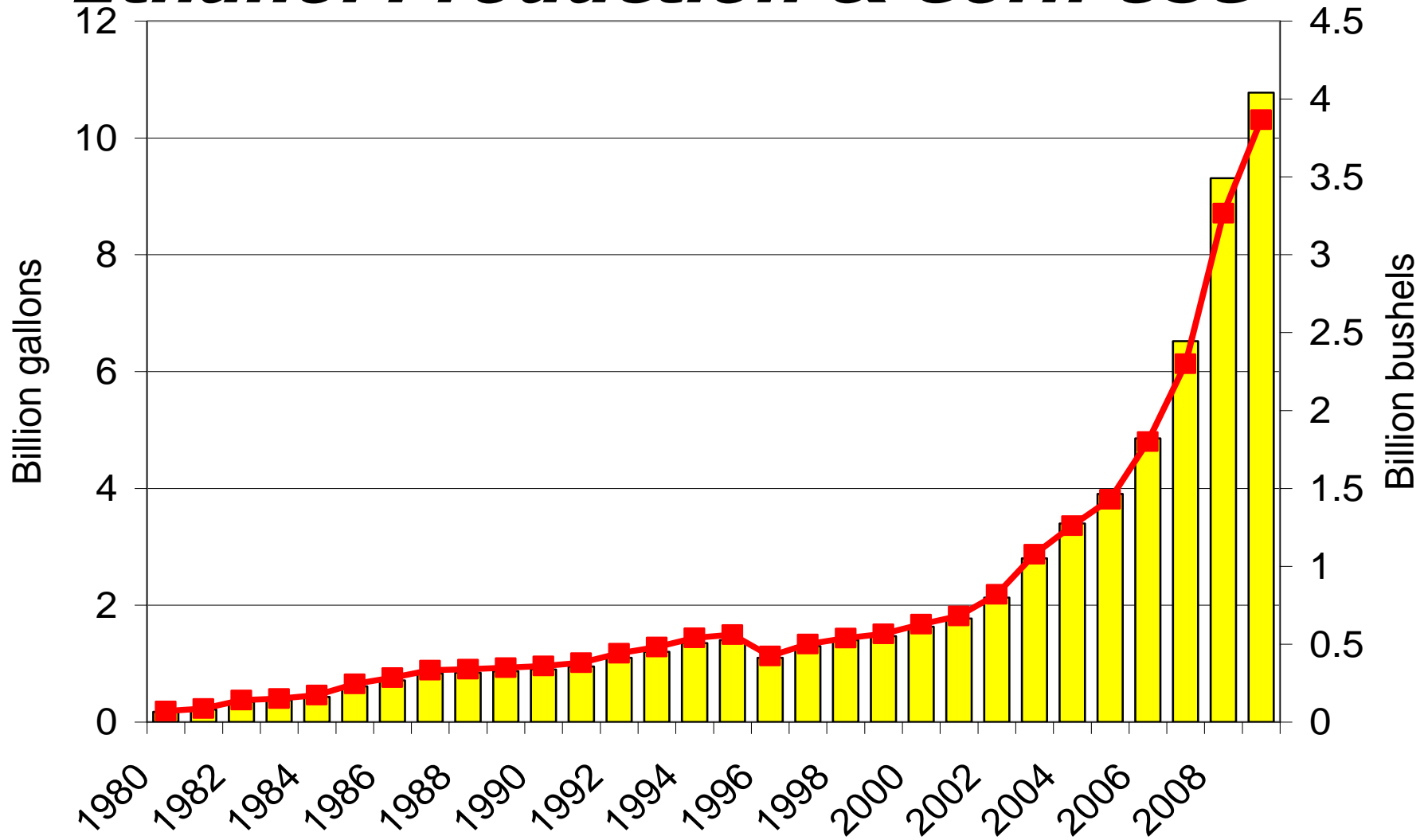
Current technologies and status of grain-based biofuels in Iowa

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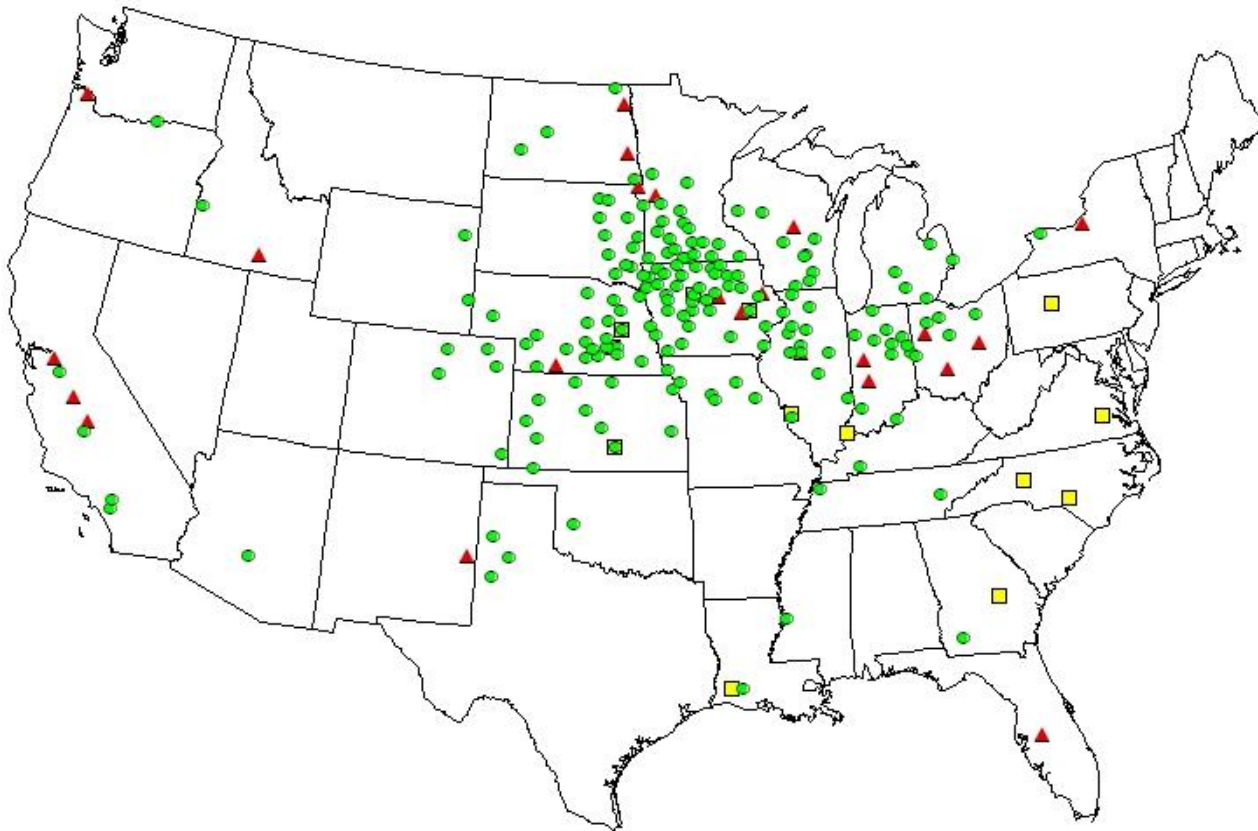
Ethanol Production & Corn Use



■ Ethanol ■ Corn



US Ethanol Plants



Operating plants
184 Plants in USA
in 26 states 11.7 BGY
40 Plants in Iowa 3.2 BGY

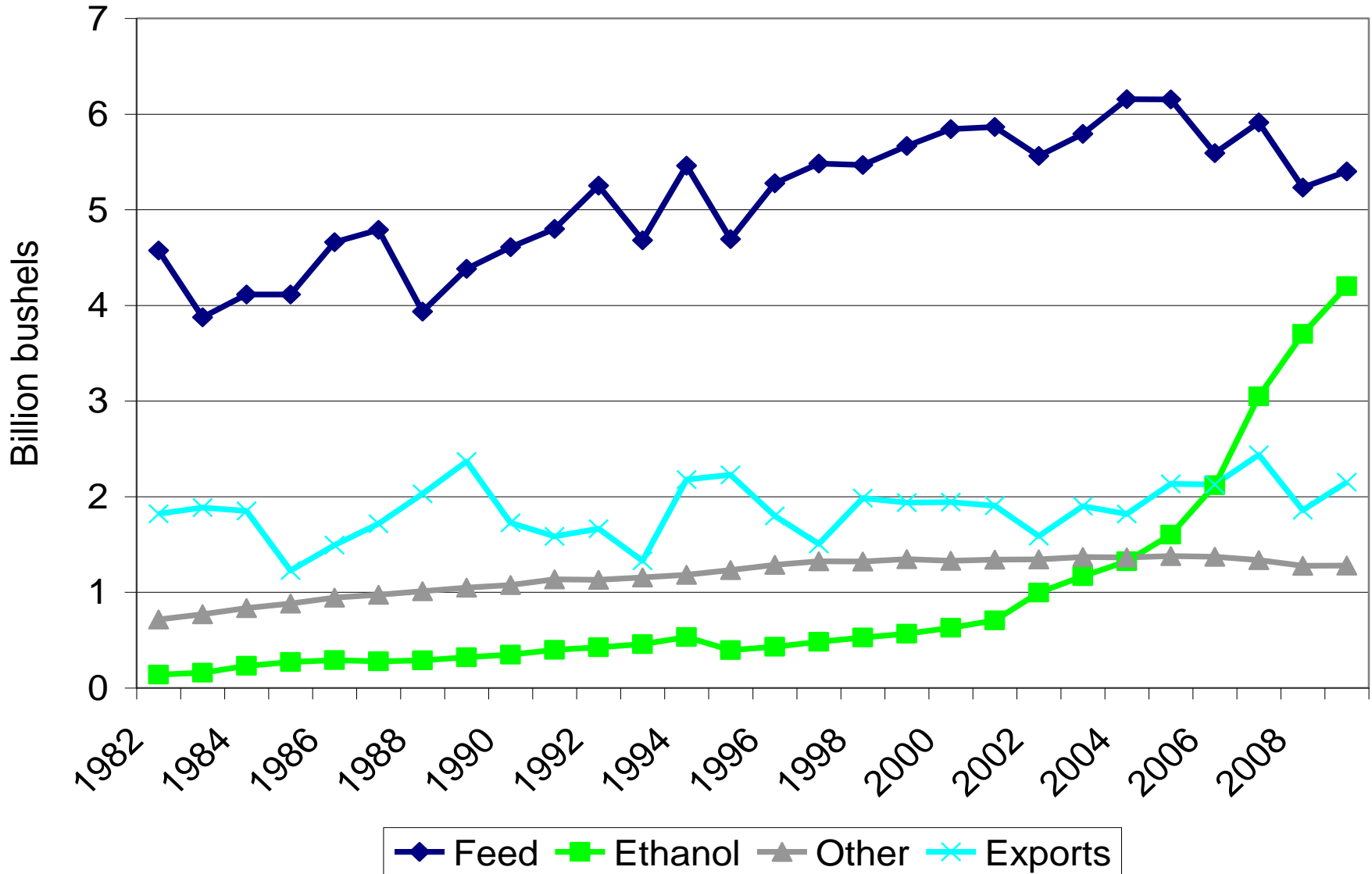
Construction/expansion
21 Plants in USA 1.4 BGY
2 Plants in Iowa 0.4 BGY

● Operating ▲ Not Operating ■ Under Construction

Iowa Ethanol Production and Corn Usage

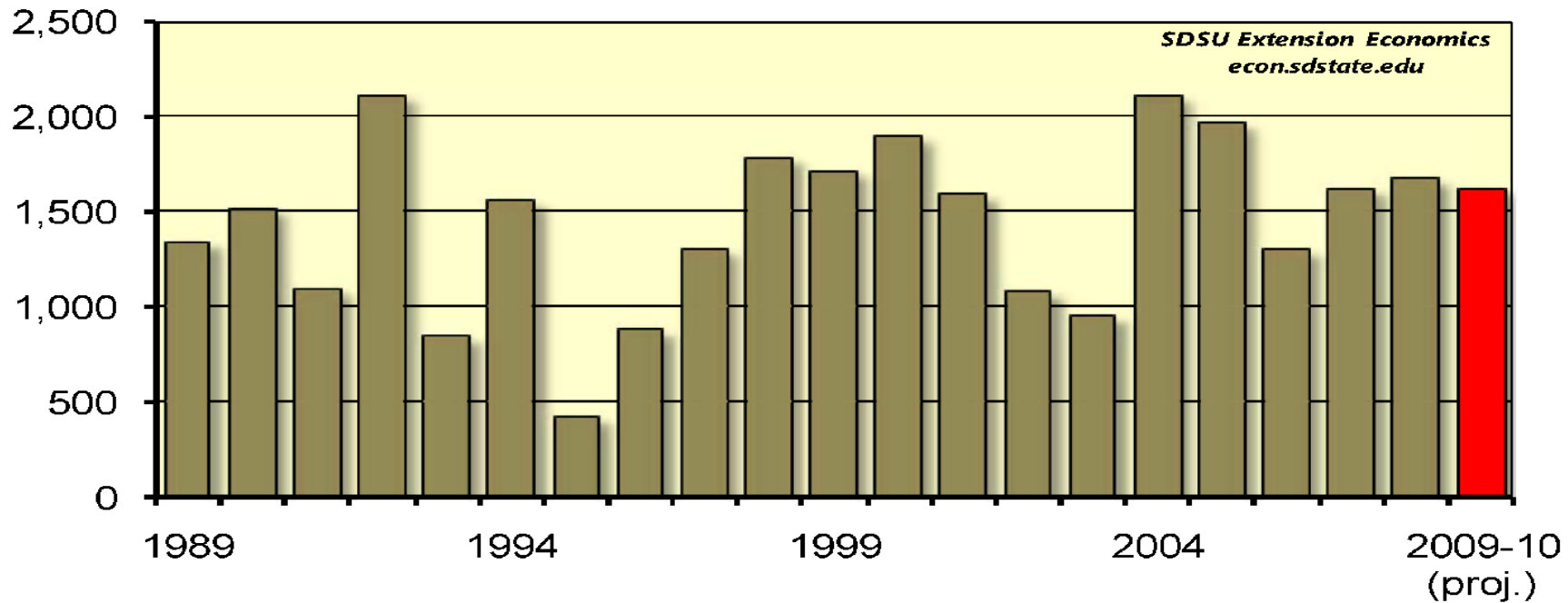
<i>Summary Statistics - July 2009</i>	<i>n</i>	<i>Ethanol Produced mil gal/yr</i>	<i>Corn Used mil bu/yr</i>	<i>DGS 000 tons/yr</i>
<i>Current Dry-grind Plants</i>	<i>35</i>	<i>2,706</i>	<i>982</i>	<i>8,278</i>
<i>Expansions and new construction</i>	<i>2</i>	<i>375</i>	<i>134</i>	<i>1,139</i>
<i>Wet Mills</i>	<i>5</i>	<i>490</i>	<i>175</i>	<i>1,487</i>
<i>Nearby Iowa</i>	<i>11</i>	<i>636</i>	<i>227</i>	<i>1,931</i>
<i>Subtotal</i>	<i>53</i>	<i>4,207</i>	<i>1,518 (~65%)</i>	<i>12,835</i>

Corn Use



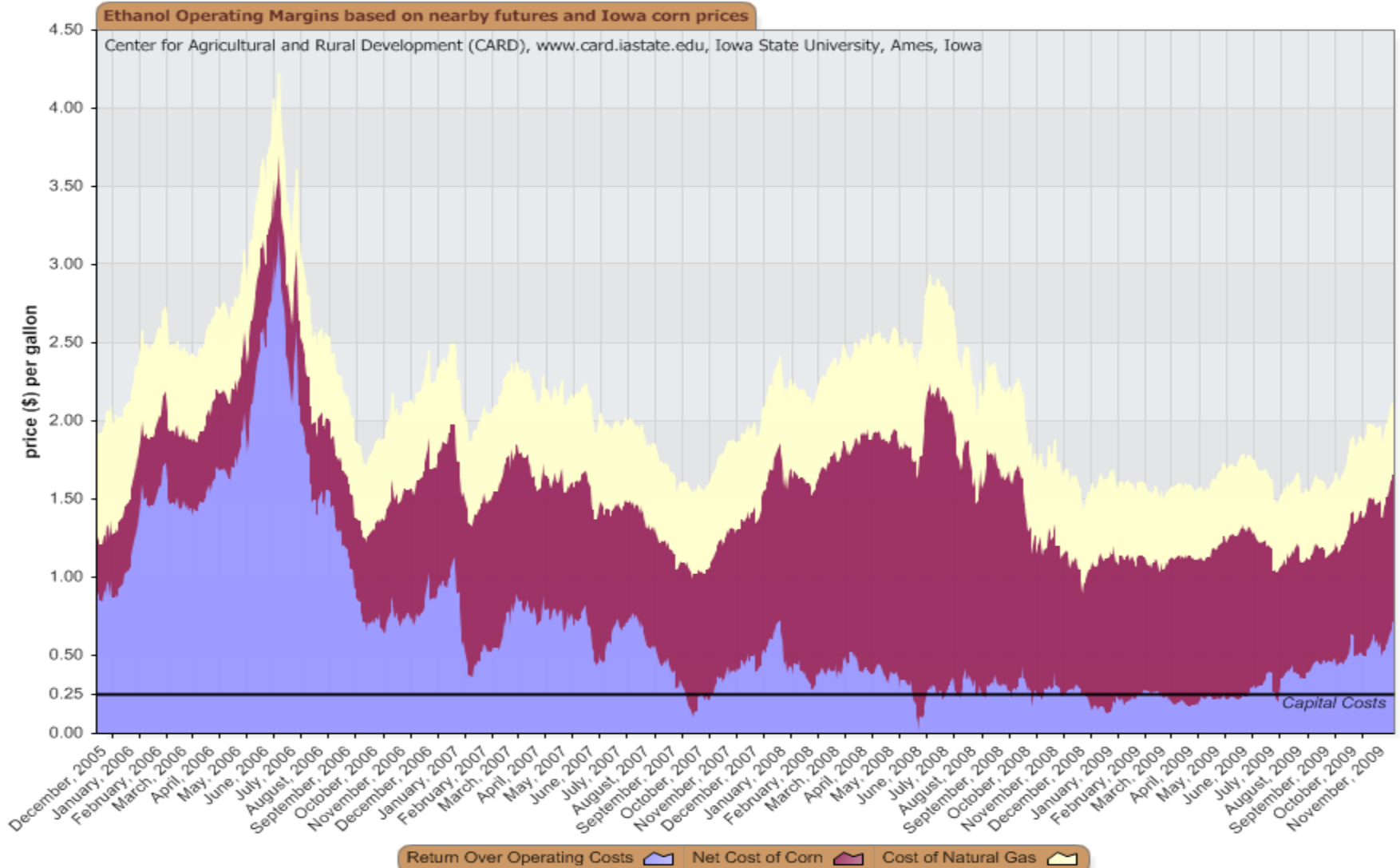


U.S. Corn Ending Stocks (million bushels)



Sources: USDA - National Ag Statistics Service and Economic Research Service

Ethanol Margins



What About the Acreage Split?

	DDGS (mln ton)	SBM (mln ton)	Protein (mln ton)	Oil (bln lb)	Lysine (bln lb)
2006	17.4	11.3	9.9	9.8	1.14
2007	20.8	9.8	10.1	9.7	1.07

Issues: Protein quality (amino acids)
Energy content (starch, oil)

What's fractionation?

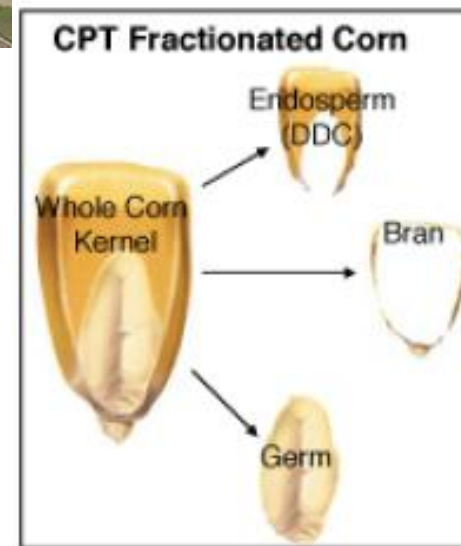
Process by

*which **bran,***

germ and endosperm...

*are separated, usually at the
beginning of the process.*

- We have a distribution issue.
Not a total quantity issue.



Source: Cereal Process Technologies, Bridgeton, MO

Corn Composition

	Starch	Protein	Oil	Ash	Sugar	Fiber	Total	% Total
Whole Corn	73.4	9.1	4.4	1.4	1.9	9.8	100	100
Endosperm	87.6	8.0	0.8	0.3	0.6	2.7	100	82.9
Germ	8.3	18.4	33.2	10.5	10.8	18.8	100	11.0
Bran	7.3	3.7	1.0	0.8	0.3	86.9	100	6.1

Why
Fractionate?

Looking for:

- ✓ Improved efficiency
- ✓ Reduced energy usage
- ✓ Reduced water usage
- ✓ Diversified product stream

Fractionation Technologies

- MOR Technologies
- Corn Value Products
- Langhauser Associates
- FC Stone Carbon LLC and Maize Processing Innovations
- Buhler Inc.
- Cereal Process Technologies
- FWS Technologies
- American Milling Group
- ICM Inc.
- POET
- Renessen LLC
- Delta-T Corporation

Capital Costs

- Range from \$10 million to \$40 million for a 50 million gallon ethanol plant
- The inclusion of corn oil extraction technologies moves costs to the higher end of the spectrum
- Most vendors point to a payback period of under 3 years

Variable Costs

- Decreased energy needs per gallon for:
 - Liquidification and cooking
 - Distillation
 - Drying of distillers grains and solubles
- Possible energy generation from bran
- Could reduce energy demand by nearly 50%

Product Streams

Corn costs: \$3.75 per bushel, Illinois ethanol plant report
(USDA-AMS, as of Nov. 20, 2009)

Traditional ethanol plant:

2.8 gallons of ethanol @ \$2.17/gallon	= \$6.08
17.75 lbs. of DDGS @ \$130/ton	= <u>\$1.15</u>
Revenues per bushel	= \$7.23

Ethanol plant w/ fractionation:

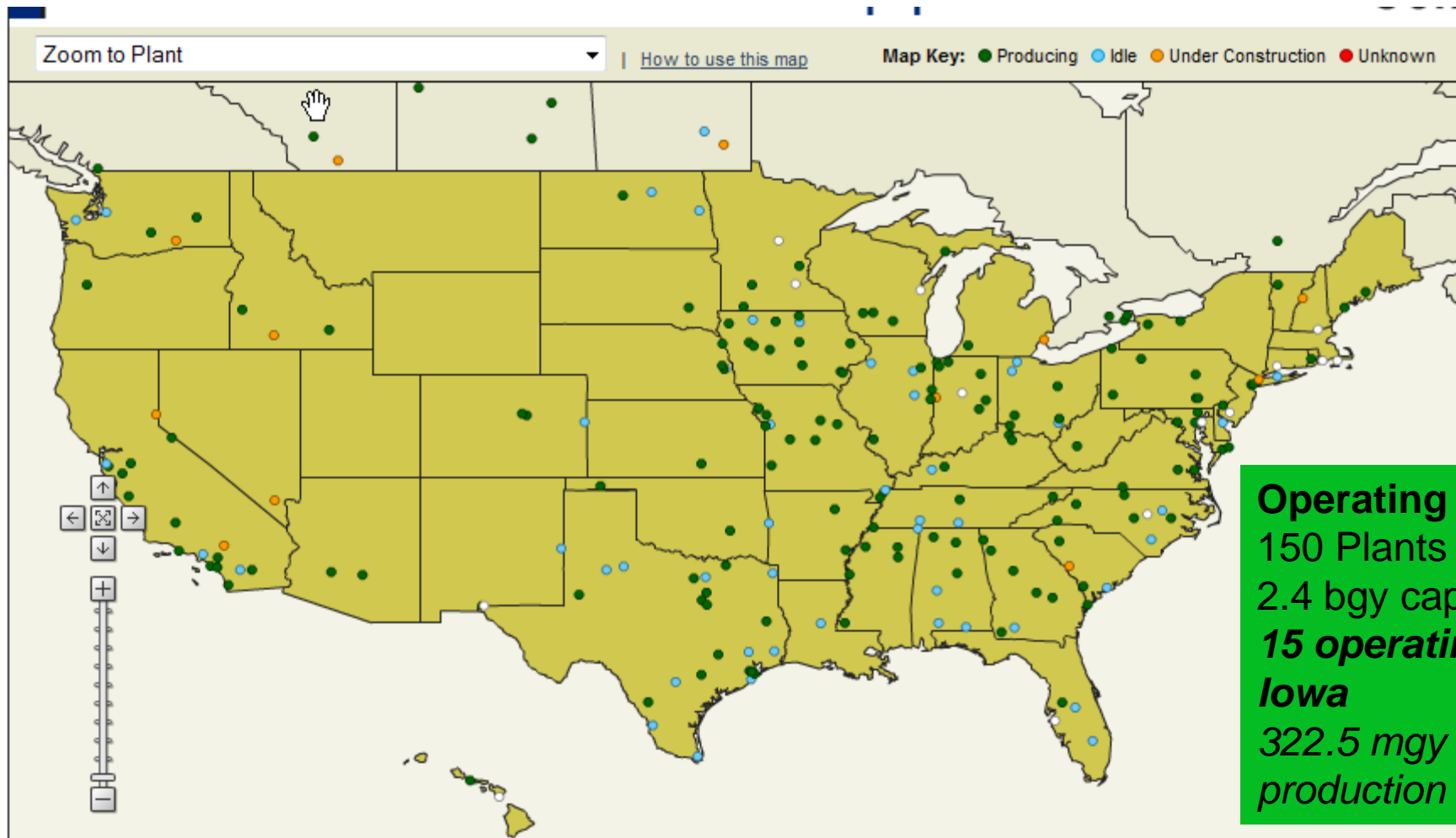
2.72 gallons of ethanol @ \$2.17/gallon	= \$5.90
13.5 lbs. of high protein DG @ \$140/ton	= \$0.95
5 lbs. of germ @ \$155/ton	= \$0.39
3 lbs. of bran @ \$80/ton	= <u>\$0.12</u>
Revenues per bushel	= \$7.36

Distillers Grains Properties

Constituent	Typical Value*	Fractionation Change
Dry matter	90%	No change
Crude Protein	26%	Increase
Crude Fat	9%	Decrease
(germ)		
Crude Fiber	15%	Decrease (bran)
Ash	5.5%	Decrease (bran)
Flowability	Poor	Better (oil out)
<i>Ethanol Yield (cook)</i>	<i>2.8 g/bu</i>	<i>Less (0.1-0.2)</i>
<i>Ethanol Yield (cold)</i>	<i>3.0 g/bu</i>	<i>Less (0.1-0.2)</i>

*Source: Hawkeye Renewables, Iowa Falls, IA

US Biodiesel Production



Operating Plants
150 Plants in USA
2.4 bgy capacity
15 operating in Iowa
322.5 mgy production

U.S. & Canada Biodiesel Plant Map

BIODIESEL
MAGAZINE

Iowa Biodiesel Production

15 soy biodiesel plants

322 mgy total capacity

Production capacity for 64% of the maximum biodiesel that could be made from Iowa's soybean oil production (June 2008 – May 2009)

What Could Corn Oil Add?

	Grain Yield (bu/acre)	Oil Yield
(lb/acre)		
Soybeans	46	501
Corn	171	342

2008 Avg. Yields

10.9 lb oil/bu soybeans

2.0 lb oil/bu corn

What Could Corn Oil Add?

	Max. Oil (MM lbs)	Biodiesel (MM gal)
Soybeans	4845 (4870)	497 (499)
Corn	4377 (4583)	449 (587)
	9222	946 (1086)

Plant capacity

322 mgy

34% (30%)

Assume 7.8 lb/gal oil and 80% biodiesel yield

USDA – NASS:

9.67 mil ac soybeans; 12.80 mil ac corn harvested in 2008

9.72 mil ac soybeans estimated' 13.40 mil ac corn estimated in 2009

Supporting the Industry

- **On Dec 3, 2009, US-EPA stated that its testing so far showed no problems with 15% Ethanol Blends**
- **Decision in May but signs favorable.**
- **E15 means 50% more ethanol with blender credit (45 cents/gal = \$1.20/bu).**
- **Agronomics and traits to support ethanol.....**