The Economic Environment for Biodiesel: Plant Location Decisions and Feedstock Dynamics

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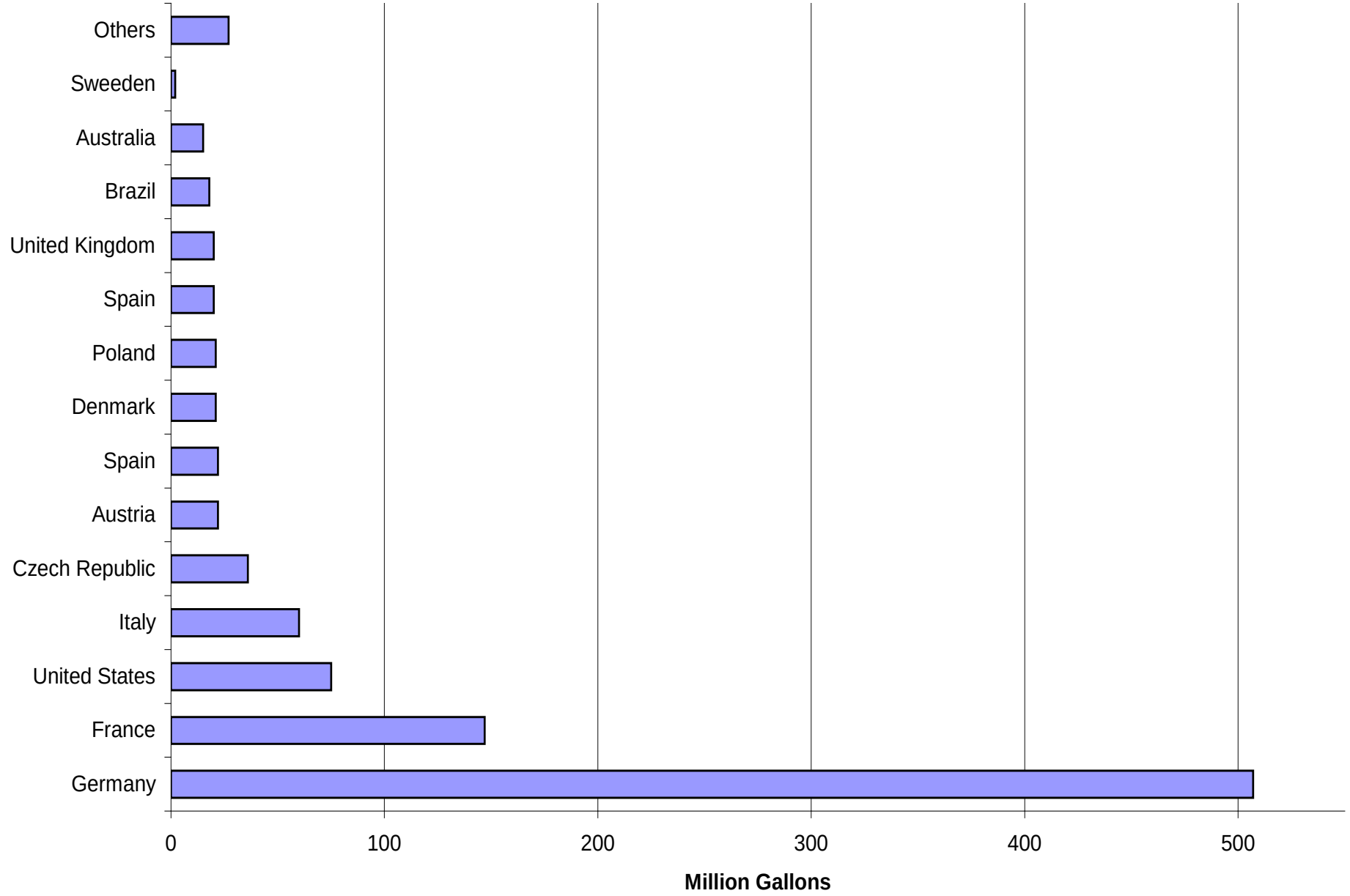
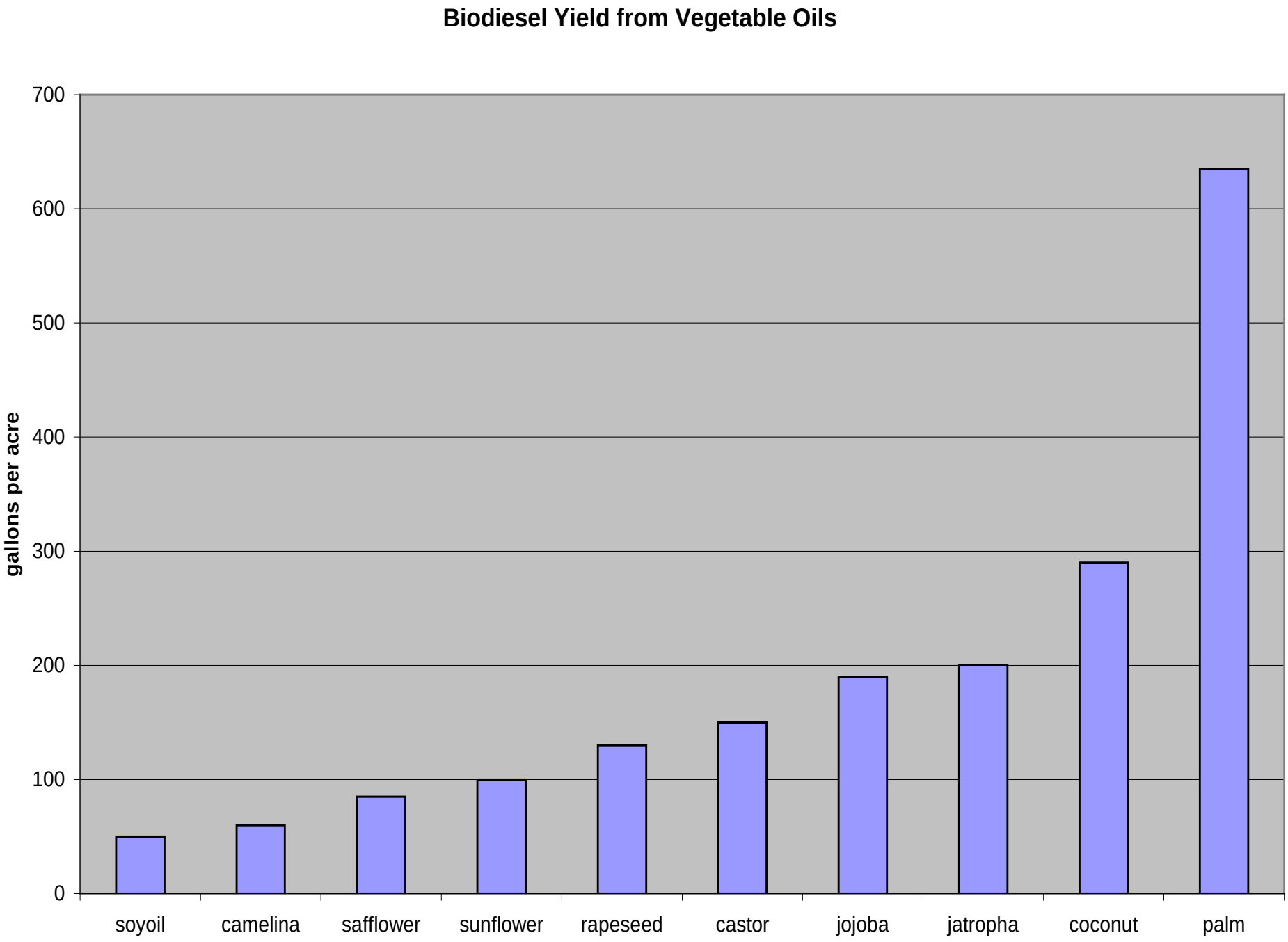
Background

- The U.S. biodiesel industry has experienced tremendous growth in recent years.
- World production is now led by the U.S. This is in sharp contrast to just a few years ago.
- However, it still represents a very small percentage of total distillate fuel consumption in the U.S.
- Despite growth, there have been several false starts and failures.

2005 World Biodiesel Production




Biodiesel Yield from Vegetable Oils
gallons per acre
700
600
500
400
300
200
100
0
soyoil
camelina
safflower
sunflower
rapeseed
castor
jojoba
jatropha
coconut
palm

Amazon palm oil:
Palm oil industry moves into the Amazon rainforest

Rhett Butler, mongabay.com

July 9, 2008

Malaysia's Land Development Authority FELDA has announced plans to immediately establish 100,000 hectares (250,000) of oil palm plantations in the Brazilian Amazon.

The agency will partner with Braspalma, a local company, to form Felda Global Ventures Brazil Sdn Bhd. FELDA will have a 70 percent stake in the venture.

"As a start, 20,000ha in Tefe will be opened for oil palm planting. After that, between 3,000ha and 5,000ha will be opened yearly," said Deputy Prime Minister Datuk Seri Najib Razak. "Felda wants to emulate Petronas as a global player," he added, referring to Malaysia's national oil company.

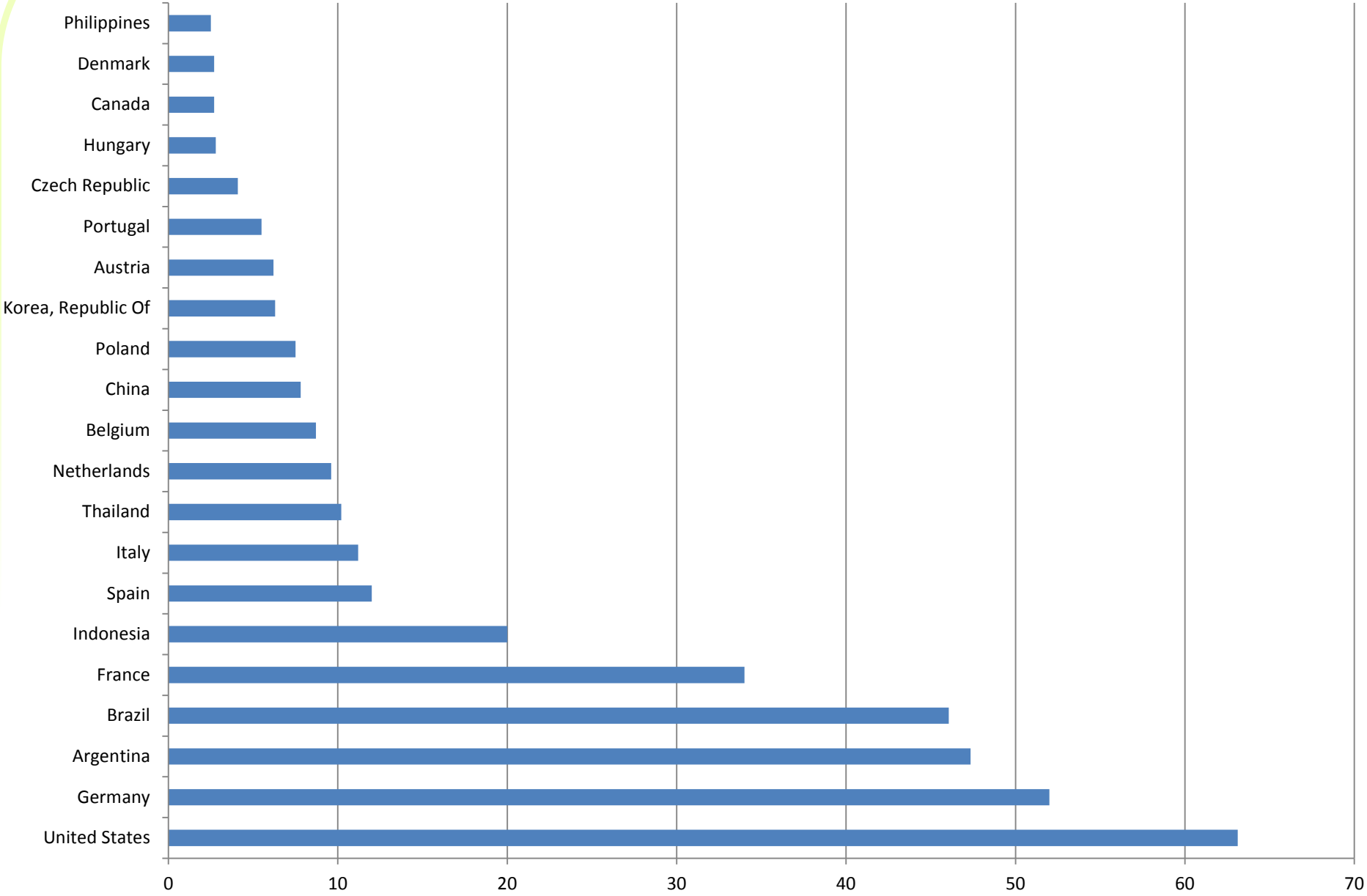
November 11, 2008
Monogabay.com

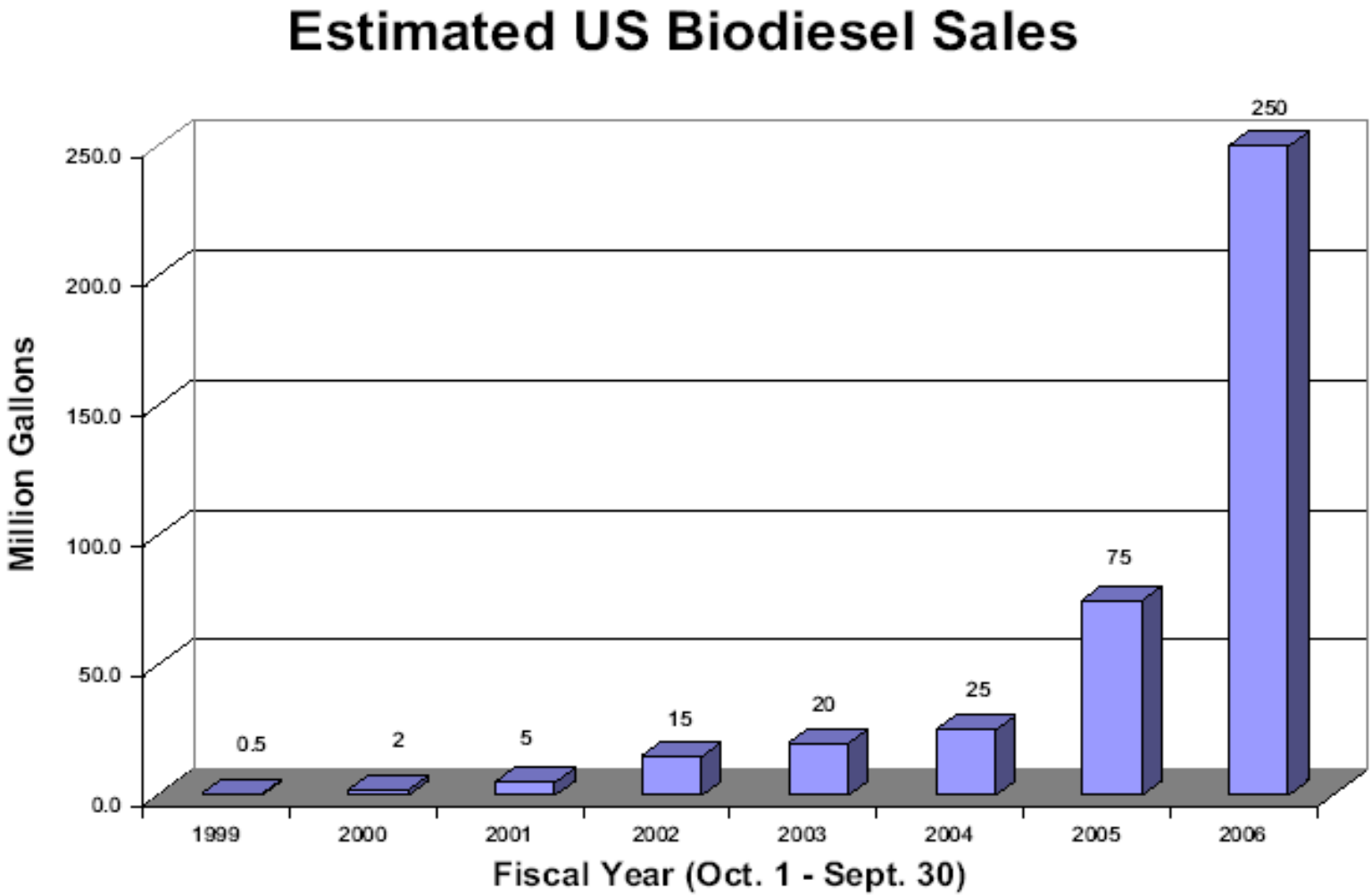
Malaysia, Indonesia to curtail palm oil production due to low prices

(11/8/2008) Malaysia and Indonesia ?countries that account for more than 85 percent of global palm oil production — will cut production in an effort to shore up collapsing palm oil prices, reports *The Jakarta Post*. The decline in palm oil prices is expected to slow expansion of oil palm plantations in Indonesia and Malaysia, a development that will please environmentalists who blame the palm oil industry for large-scale destruction of rainforests across Southeast Asia.

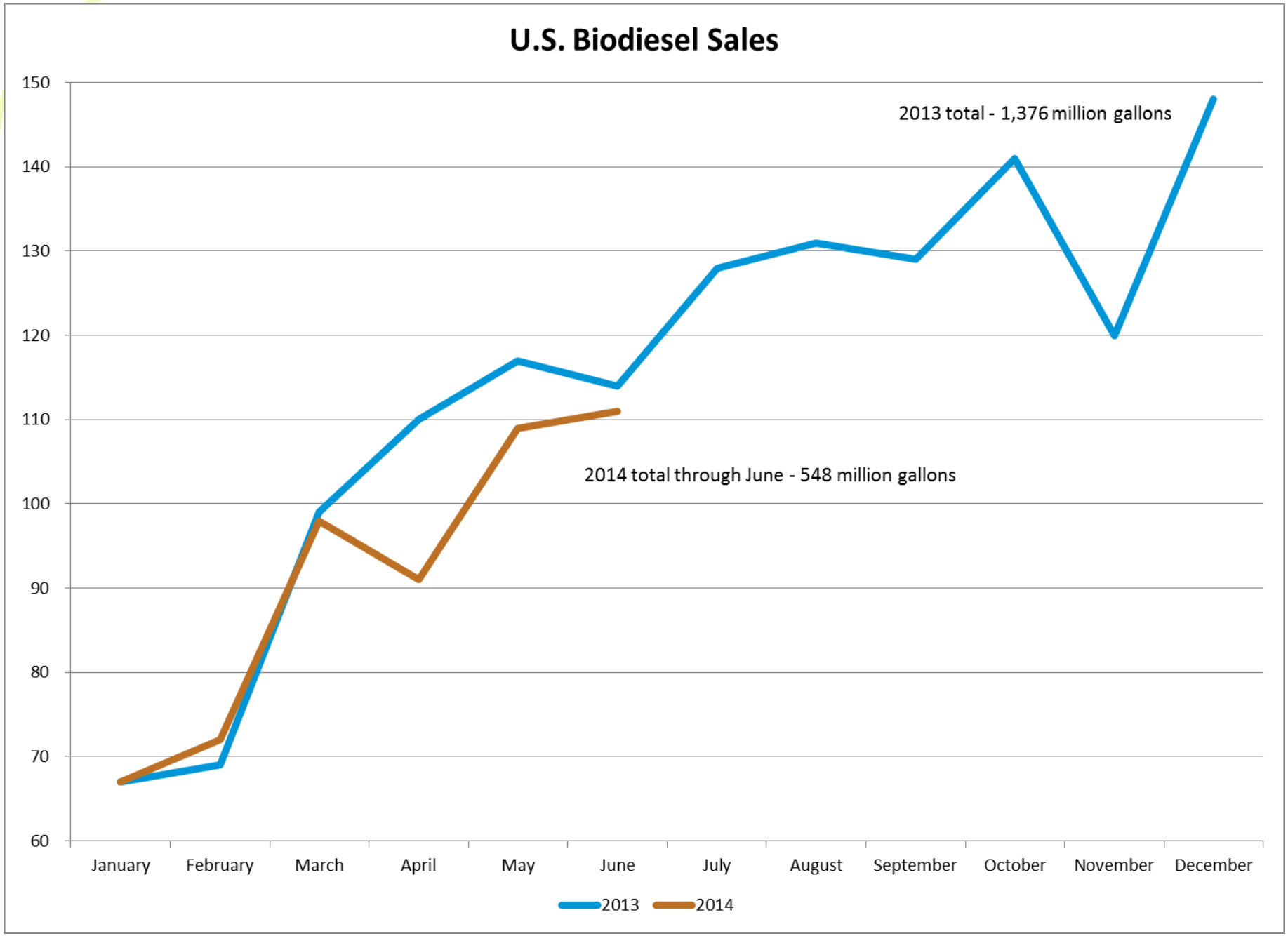
World Biodiesel Production 2011

Thousand Barrels per Day





Source: National Biodiesel Board


U.S. Biodiesel Sales
150
140
130
120
110
100
90
80
70
60
2013 total - 1,376 million gallons
2014 total through June - 548 million gallons
January
February
March
April
May
June
July
August
September
October
November
December
2013
2014

A Public Policy Driven Industry

Growth in the US and global biodiesel industries have been associated/supported with favorable public policies. Both direct and indirect policy changes have impacted on the competitive position of biodiesel relative to petroleum diesel.

US Policies

- Direct
  - Blenders Credits
  - Renewable Fuels Standards
- Indirect
  - Ultra-Low-Sulfur-Diesel Mandate

Early Objectives of US Bio-Fuels Policy

Increase demand for agricultural commodities

Promote rural economic development

Reduce reliance on foreign oil.

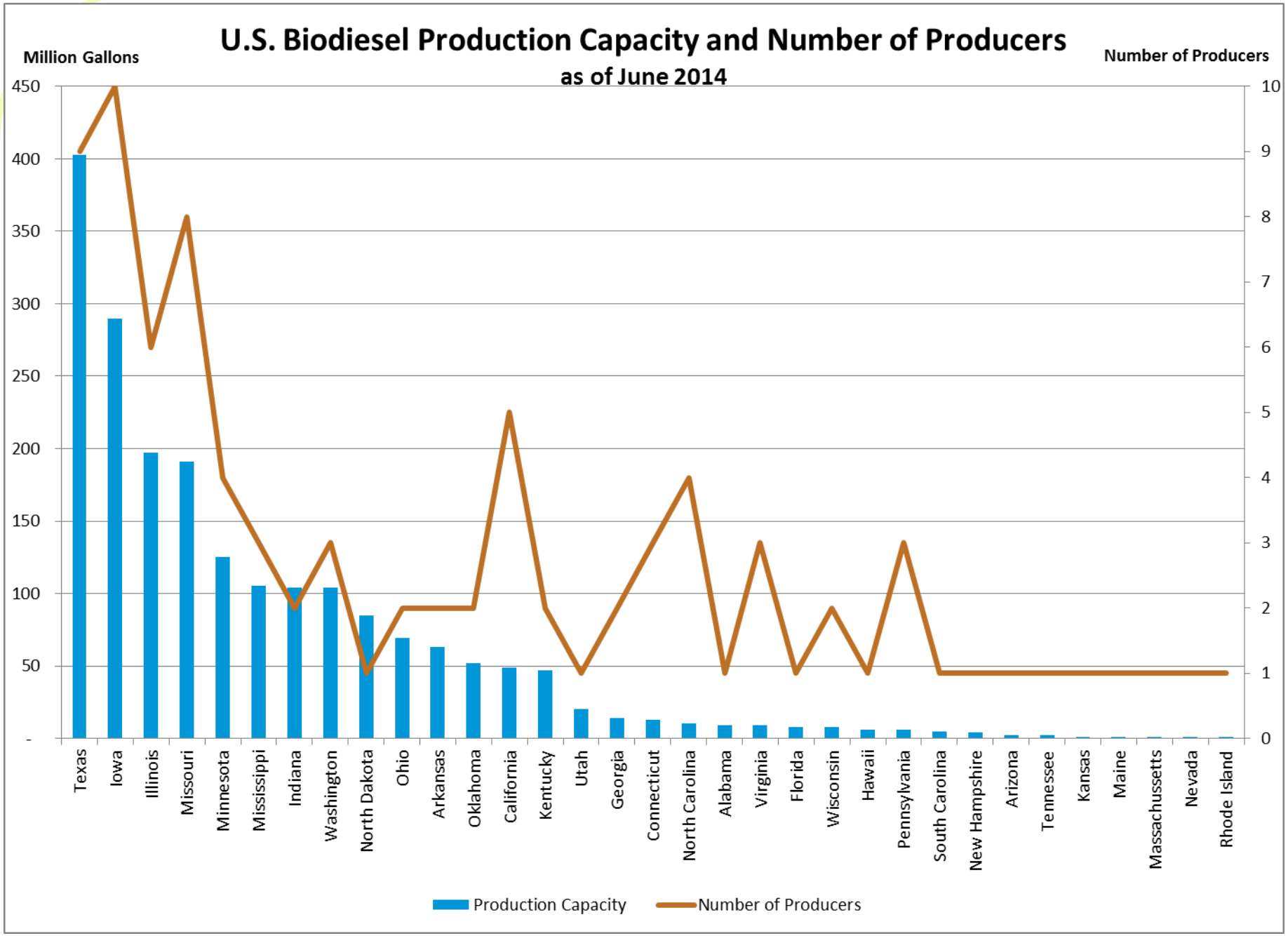
Reduce noxious emissions

Reduce Reliance on Foreign Oil

- U.S. consumption of diesel is about 60 billion gallons per year, not counting jet fuel (EIA).

- U.S. bio-diesel sales in 2006 totaled 250 million gallons – 0.4 percent of total diesel consumption.

  - Biodiesel production in 2014 represents about 2 percent of consumption. Production was down 9 percent in 2014, and is projected to stay flat the next couple of years.


U.S. Biodiesel Production Capacity and Number of Producers
as of June 2014
Million Gallons
Number of Producers
450
400
350
300
250
200
150
100
50
-
10
9
8
7
6
5
4
3
2
1
0
Texas
Iowa
Illinois
Missouri
Minnesota
Mississippi
Indiana
Washington
North Dakota
Ohio
Arkansas
Oklahoma
California
Kentucky
Utah
Georgia
Connecticut
North Carolina
Alabama
Virginia
Florida
Wisconsin
Hawaii
Pennsylvania
South Carolina
New Hampshire
Arizona
Tennessee
Kansas
Maine
Massachussetts
Nevada
Rhode Island
Production Capacity
Number of Producers

THE LOCATION DECISIONS OF BIODIESEL REFINERIES

(Fortenbery, Deller, and Amiel – Land Economics 2012)

- As excitement over the future of biodiesel grew many communities began to look at ways to encourage a plant siting.

- Using data on every biodiesel plant in operation in 2010, we examined the conditions that were common among plant locations, and used spatial econometrics to measure the “importance” of those attributes.

THE LOCATION DECISIONS OF BIODIESEL REFINERIES

(Fortenbery, Deller, and Amiel – Land Economics 2012)

To measure the impacts of input access the following proxies were used:

- Number of Soybean (or other oilseed) Crush Plants per 10K Persons
- Number of Restaurants and Food Service Firms per 10K Persons
- Average Farm Sales
- Acres of Crops Harvested
- Farm Share of Total County Income

Location Decision cont.

- The output markets are measured by:

  Number of Tank Farms per 10K Persons

  Number of Trucking and Busing Firms per 10K Persons

  Number of Fuel Pipeline Firms per 10K Persons

- Socio-economic variables
  - Population in 2005
  - Percent of Houses Owner-Occupied
  - Bachelor's degree or higher (percent)
  - Percent of Workers Who Drove to Work Alone
  - Percent of Votes cast for President 2004 Republican
  - Persons 5 years and over residing in same house in 1995 and 2000 (percent)
  - Net nonfarm business job growth 2000-2004
  - Local Government Total Revenue Per Capita
  - Percent of Local Government Revenue from the Property Tax

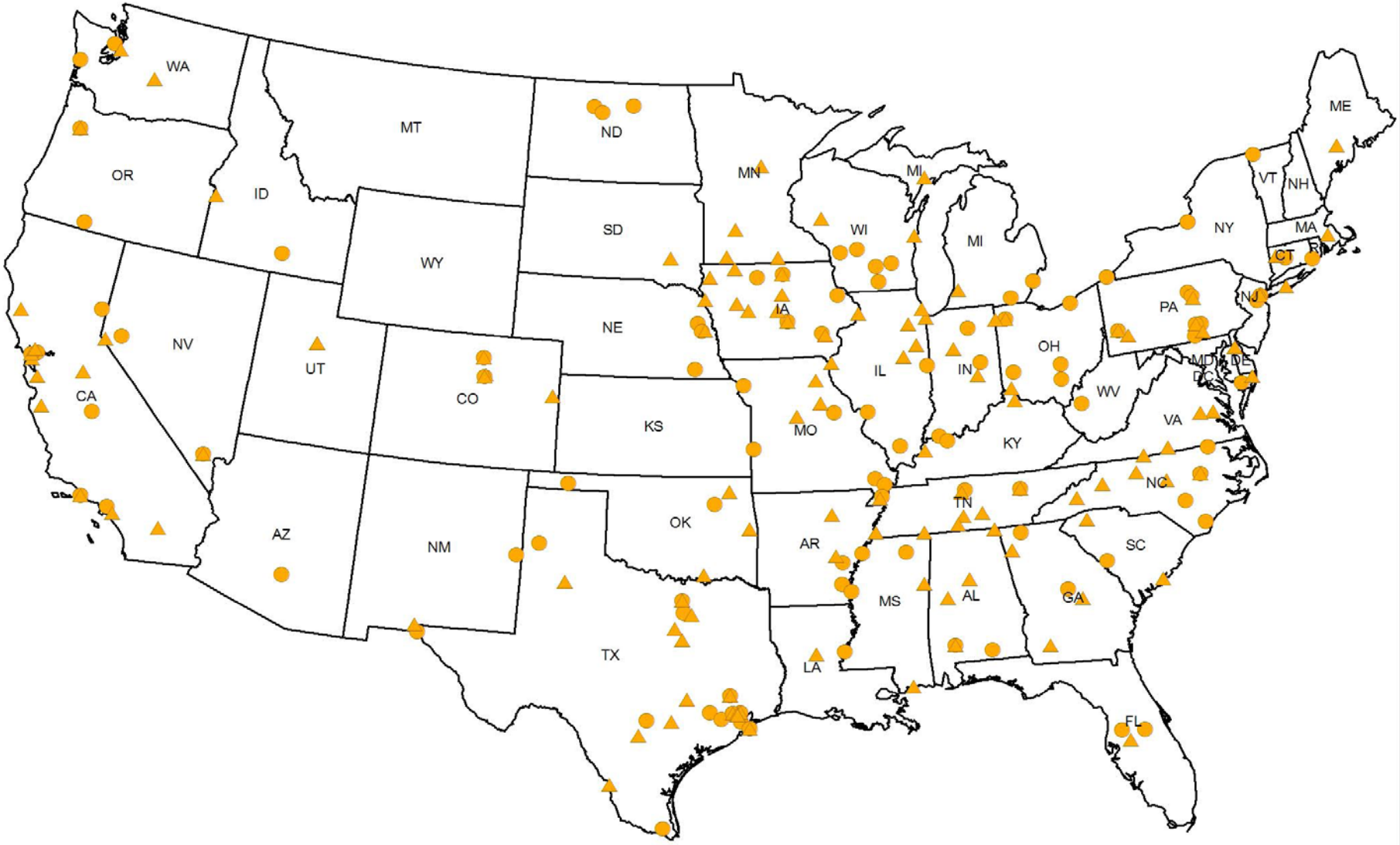
General Results

- Number of crush plants, crush capacity, or local waste grease does not seem to influence the location of a plant.
- Number of tank farms is not important.
- Biodiesel plants are less sensitive than ethanol plants to being near either feedstock production or final market.
- Population is positive and significant.
  - (challenges the notion that biodiesel should can be promoted as a rural development policy)
- Education and wealth are significant and NEGATIVE

General Results

- Access to rail is critical – makes sense if locating away from feedstock production centers and demand centers.
- Public incentives – tax policy, production subsidies – do not increase the likelihood of a siting or the sustaining a plant.
- Public investments in infrastructure (specifically transportation infrastructure) appear much more important.
- Consumption mandates are positivity associated with plant sitings.

United States Biodiesel Production Facilities



▲ Biodiesel Plant - Existing

● Biodiesel Plant - Expanding/Under Construction

Data Source: National Biodiesel Board and Biodiesel Magazine, March 2007

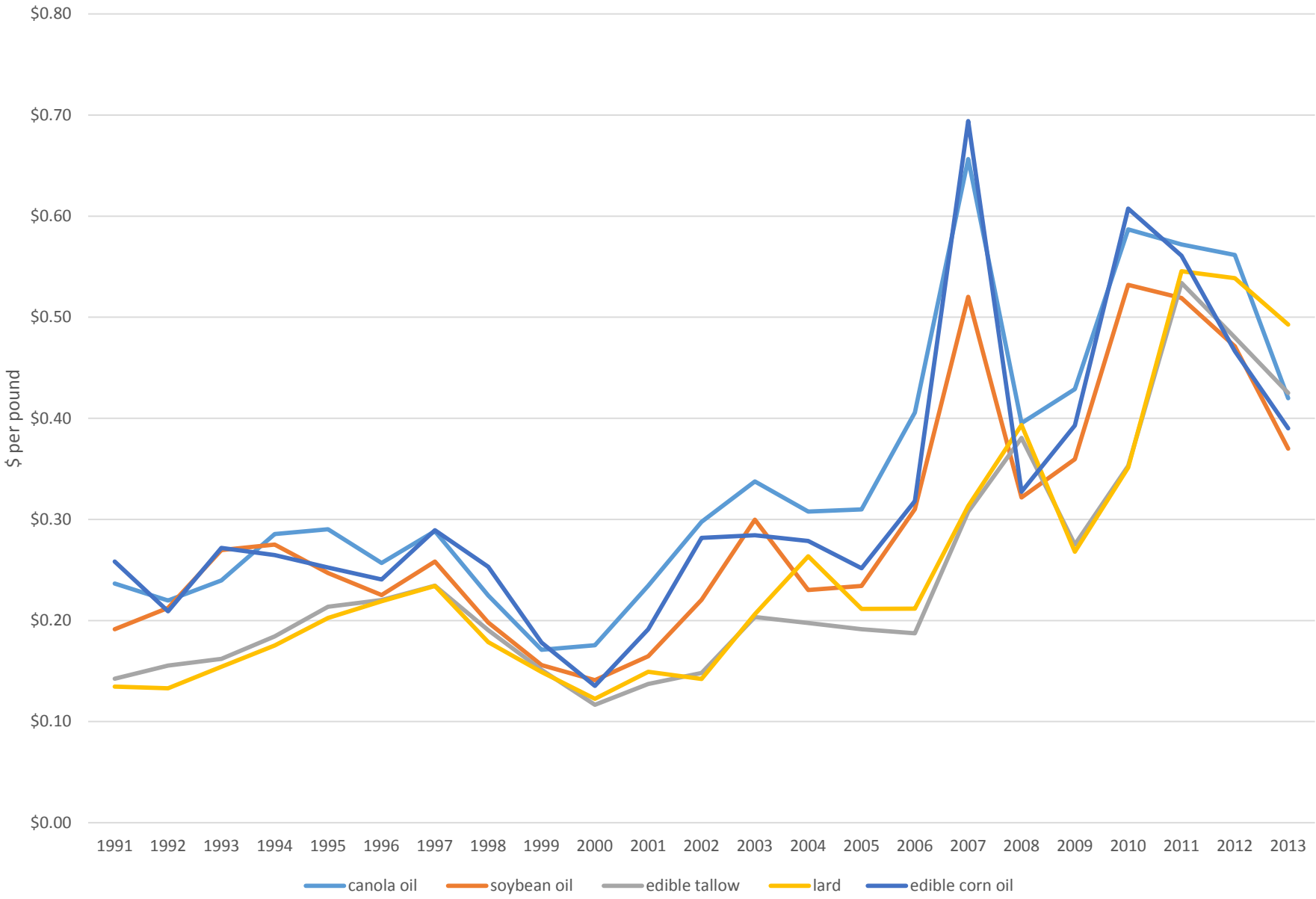
NREL

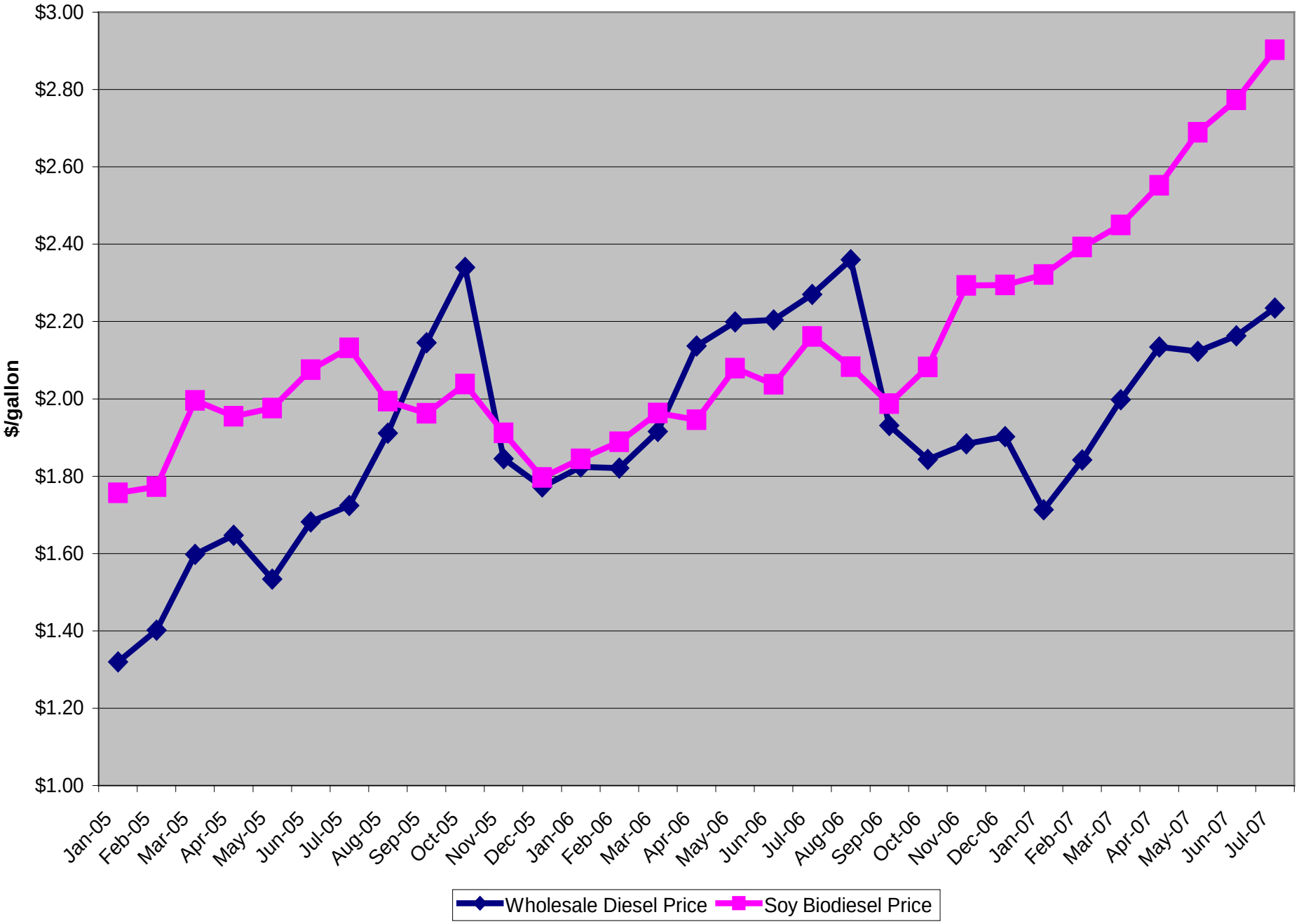
May 2007

Biofuels markets are commodity markets

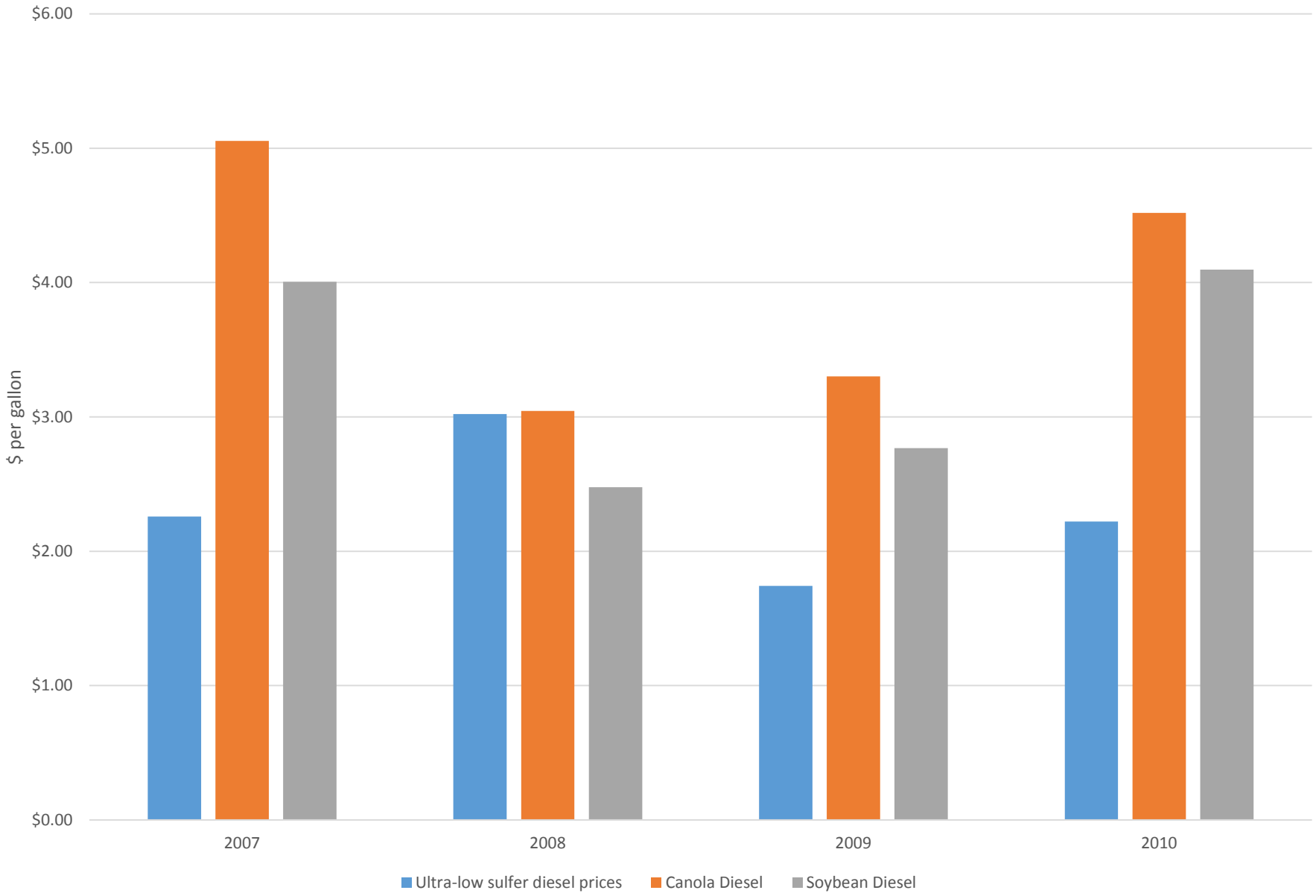
- Relatively low rates of return (not necessarily bad – Cargill deals in commodity markets).
- Must be a low cost producer.
- Must be aggressive at managing price risk.

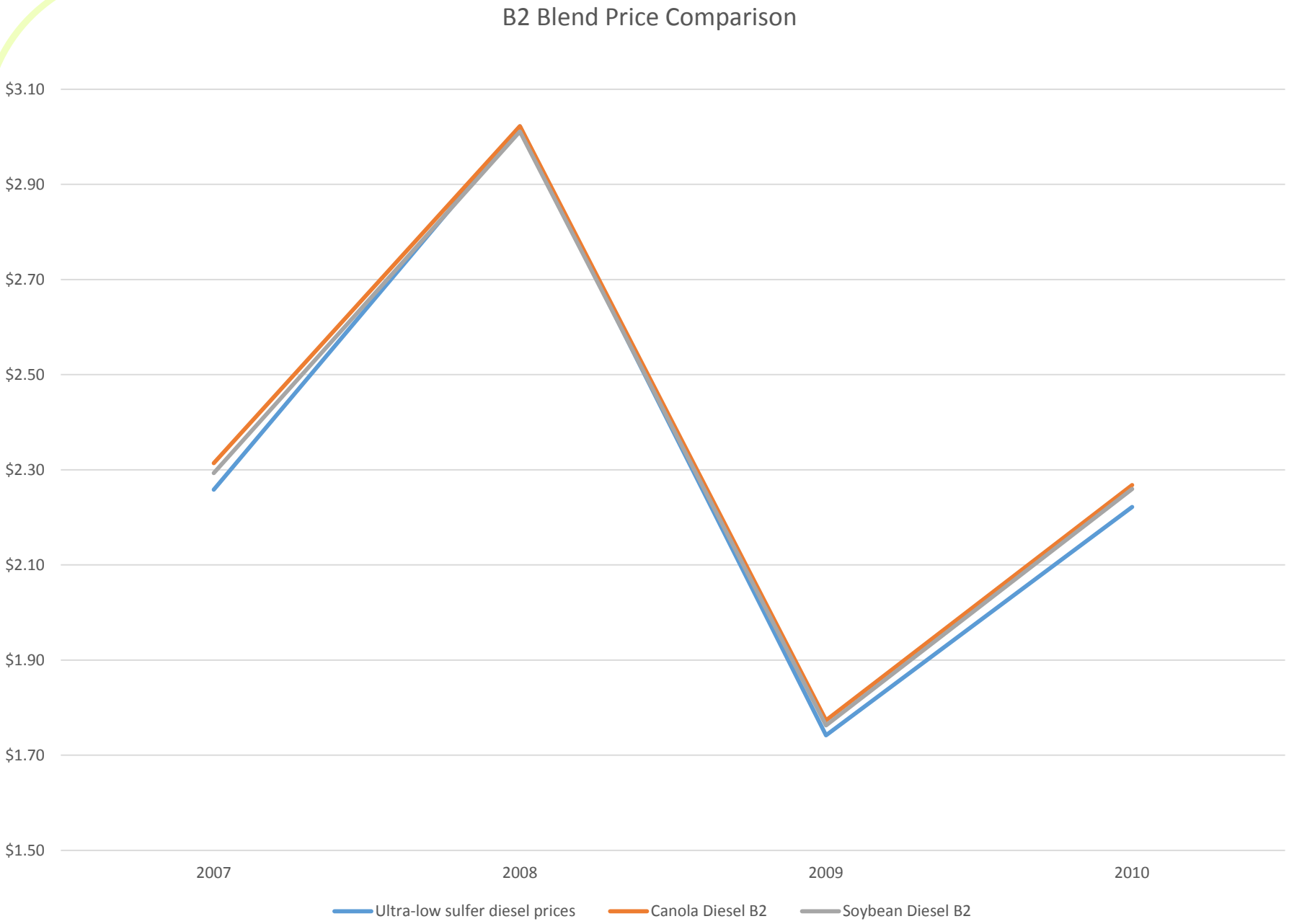
Biodiesel Feedstock Prices




$3.00
$2.80
$2.60
$2.40
$2.20
$2.00
$1.80
$1.60
$1.40
$1.20
$1.00
$/gallon
Jan-05
Feb-05
Mar-05
Apr-05
May-05
Jun-05
Jul-05
Aug-05
Sep-05
Oct-05
Nov-05
Dec-05
Jan-06
Feb-06
Mar-06
Apr-06
May-06
Jun-06
Jul-06
Aug-06
Sep-06
Oct-06
Nov-06
Dec-06
Jan-07
Feb-07
Mar-07
Apr-07
May-07
Jun-07
Jul-07
Wholesale Diesel Price
Soy Biodiesel Price

Diesel Prices by Feedstock




B2 Blend Price Comparison
$3.10
$2.90
$2.70
$2.50
$2.30
$2.10
$1.90
$1.70
$1.50
2007
2008
2009
2010
Ultra-low sulfer diesel prices
Canola Diesel B2
Soybean Diesel B2

Industry Challenges

- Land and Water Resources
- Environmental Sustainability
- **Competing Uses (food production or fuel production)**
- Delivering a Compelling Message
- Public Policy Initiatives

Firm Challenges

- Feedstock Production Systems
- **Aggregation and Processing Systems**
- **Plant Location and Scale Issues**
- **Transport and Storage Issues**
- **Understanding RIN’s**

SUPPLY CHAIN MANAGEMENT

How Should We Organize?

- Very large bio-refineries producing multiple products and sourcing feedstocks from large geographical areas:
  - Local processor/aggregator facilities to serve the input needs of the large bio-refinery.
- Relatively small bio-fuels plants using local production as feedstocks and distributing product across a relatively small area.

Conclusions

- The development of efficient supply chains, and strategies for risk sharing will be critical to the long run survival of any technology or feedstock deployed.
- Being able and willing to manage multiple feedstocks is important to long term survivability.
- Public policies focused on development of infrastructure and consumption appear more important than direct subsidization of production in both attracting and keeping a biodiesel refinery.

Thanks