



# **Emerging Markets Online**

GLOBAL ENERGY AND BIOFUELS INTELLIGENCE

## **Global Biodiesel Market Trends, Outlook and Opportunities**

**Will Thurmond**

The logo for Emerging Markets Online features a stylized orange and white graphic on the left, resembling a lens or a drop, with the text "Emerging Markets Online" in a bold, dark blue font to its right.

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**Will Thurmond**

President, Emerging Markets Online

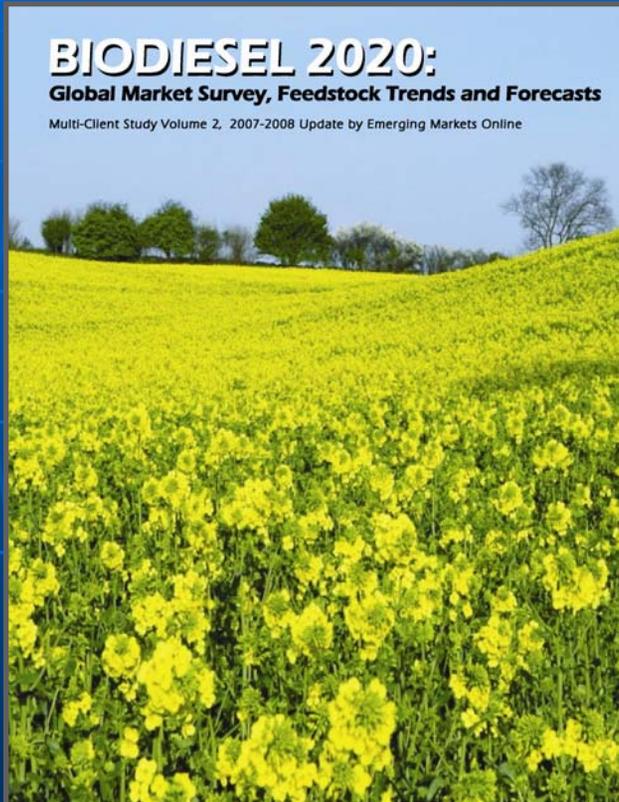
<http://www.emerging-markets.com>

**Author, Biodiesel 2020: A Global Market Survey**

Columnist, *Biofuels International*

HQ - Houston, TX

# BIODIESEL 2020: A GLOBAL MARKET SURVEY



- 685 page study, February 2008
- **Country Studies**  
US, Brazil, EU, China, India
- **Feedstock Markets and Trends**  
Soy, Rapeseed, Palm, Jatropha, Castor, Yellow Grease, Fats
- **2<sup>nd</sup> Generation Projects and Trends**  
Algae, Renewable Diesel, BioCrude, Biomass to Liquids, Green Diesel
- **Outlook and Opportunities**

# ***GLOBAL BIODIESEL MARKET OUTLOOK***



## ***Today' Presentation:***

1. **Global Biodiesel Growth**
2. **Emerging Feedstock Trends**
3. **Outlook & Opportunities to 2020**

# 1. GLOBAL BIODIESEL GROWTH



*Courtesy of bp.com*

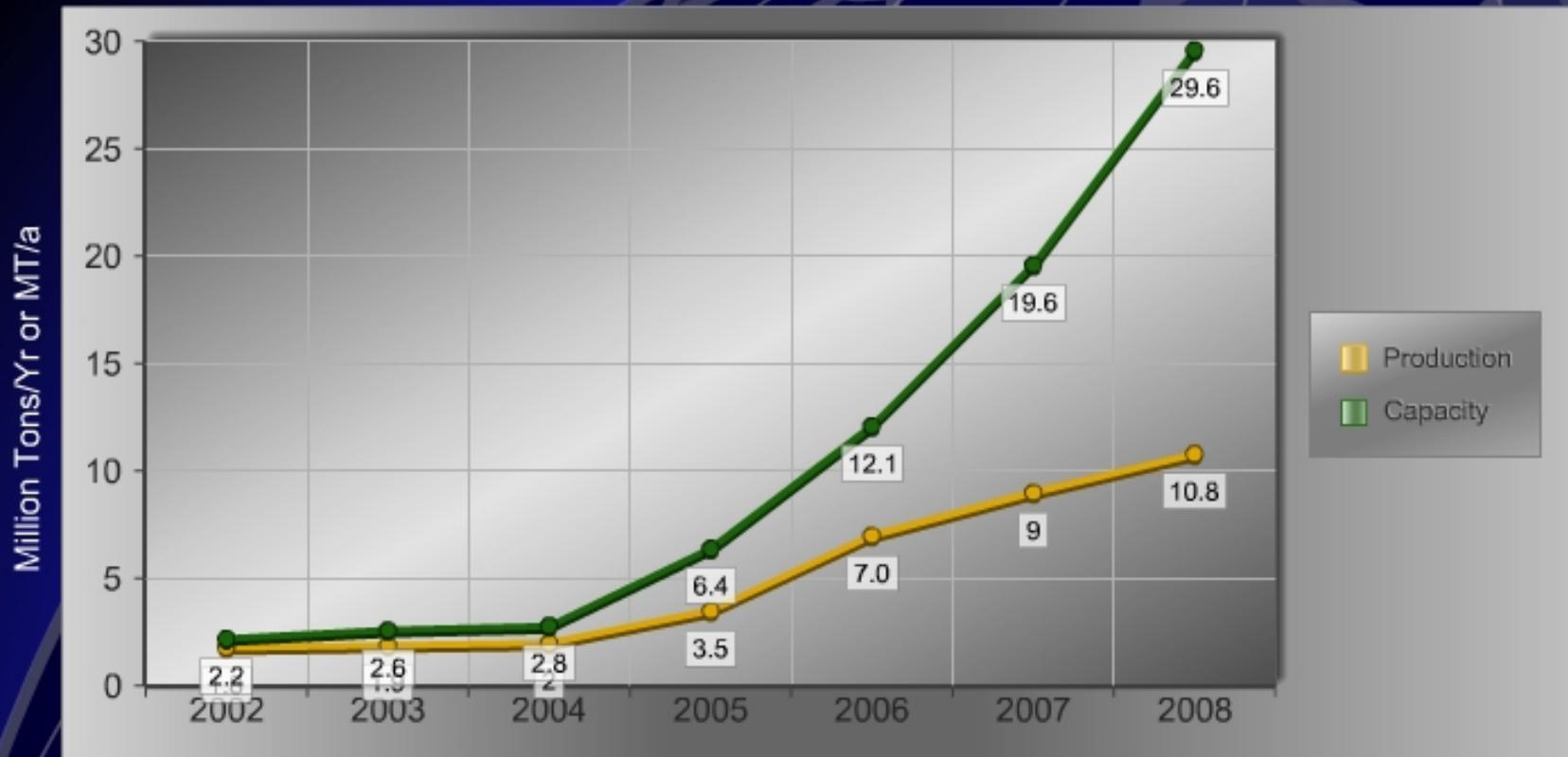
# What Are They Key Drivers of Global Biodiesel Market Growth?



# Global Biodiesel Production and Capacity

Source: Biodiesel 2020, A Global Market Survey, 2nd edition

Global biodiesel production is expanding rapidly, along with increasing production capacities. Feedstocks are a major concern. High prices and feedstock shortages in Europe, the US and Asia are contributing to a growing delta between production and capacity in each region.

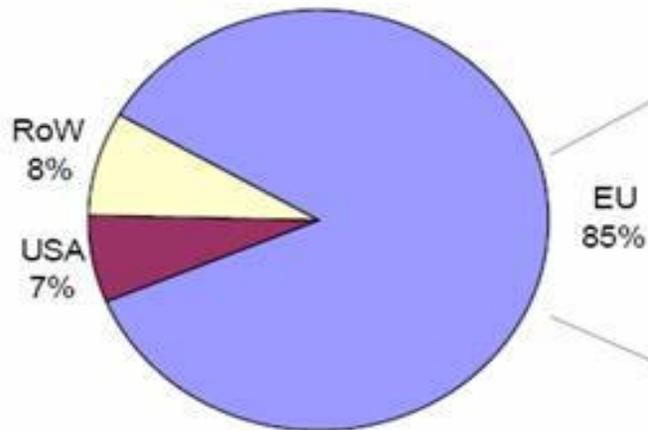


sources: Emerging Markets Online, Biodiesel 2020, NBB, EBB, USDA, FAS, Oil World

# GLOBAL BIODIESEL MARKET OVERVIEW

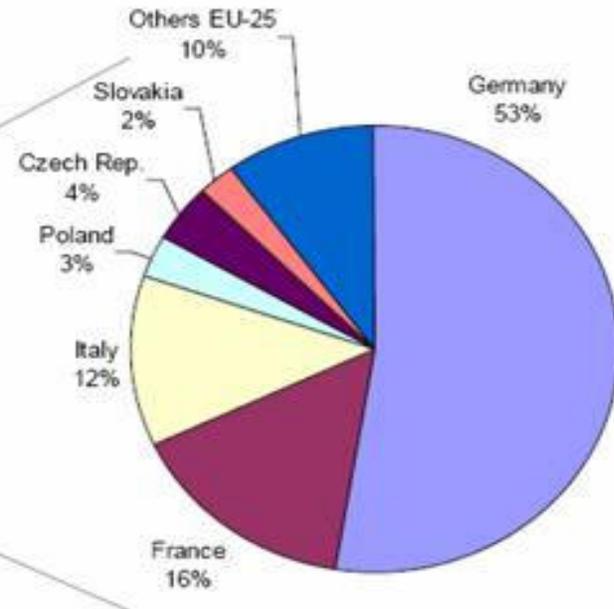
## Global Biodiesel Production by Country

Global biodiesel production has reached approx. 3.8 mill. tons in 2005



Europe produces and consumes 80% + of biodiesel world-wide

The EU biodiesel production has reached 3.2 mill. tons in 2005



# **EUROPEAN BIODIESEL GROWTH**

# EU BIODIESEL MARKET GROWTH TRENDS



## ➤ **EU Biofuels Targets:**

- Target 1 - 2% by 2005
- Target 2 - 5.75% by 2010
- Proposals: 10% by 2020 (EU Revision)

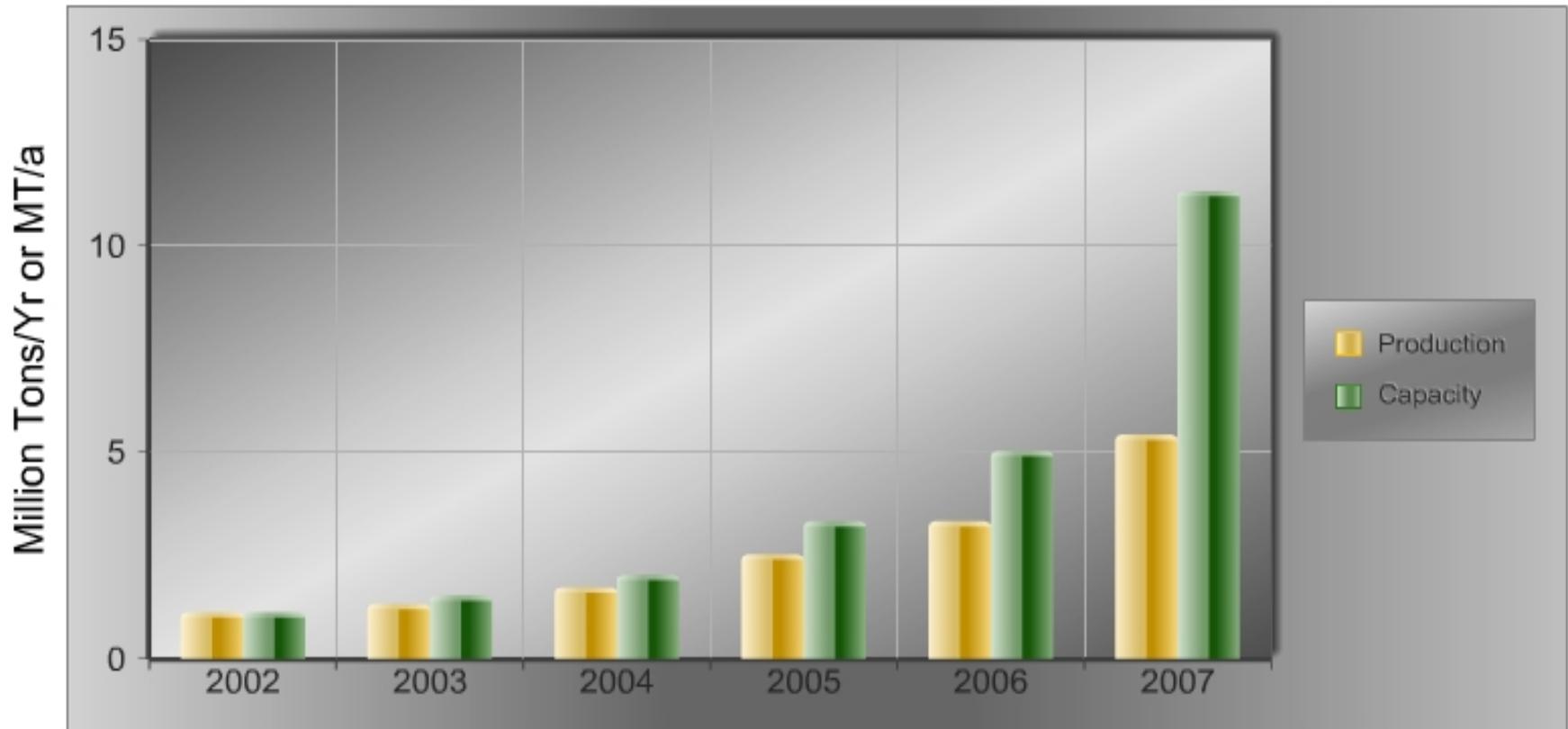
## ➤ **EU Biofuels Markets:**

- More than 50% of cars run on diesel
- 70% of biodiesel from rapeseed
- *increasing growth in imports*  
soy from USA, Brazil, Argentina ; palm from Asia, eventually Jatropha from Asia, Africa
- **Feedstock sustainability concerns #1 for 2008**



# EUROPE BIODIESEL MARKET GROWTH TRENDS

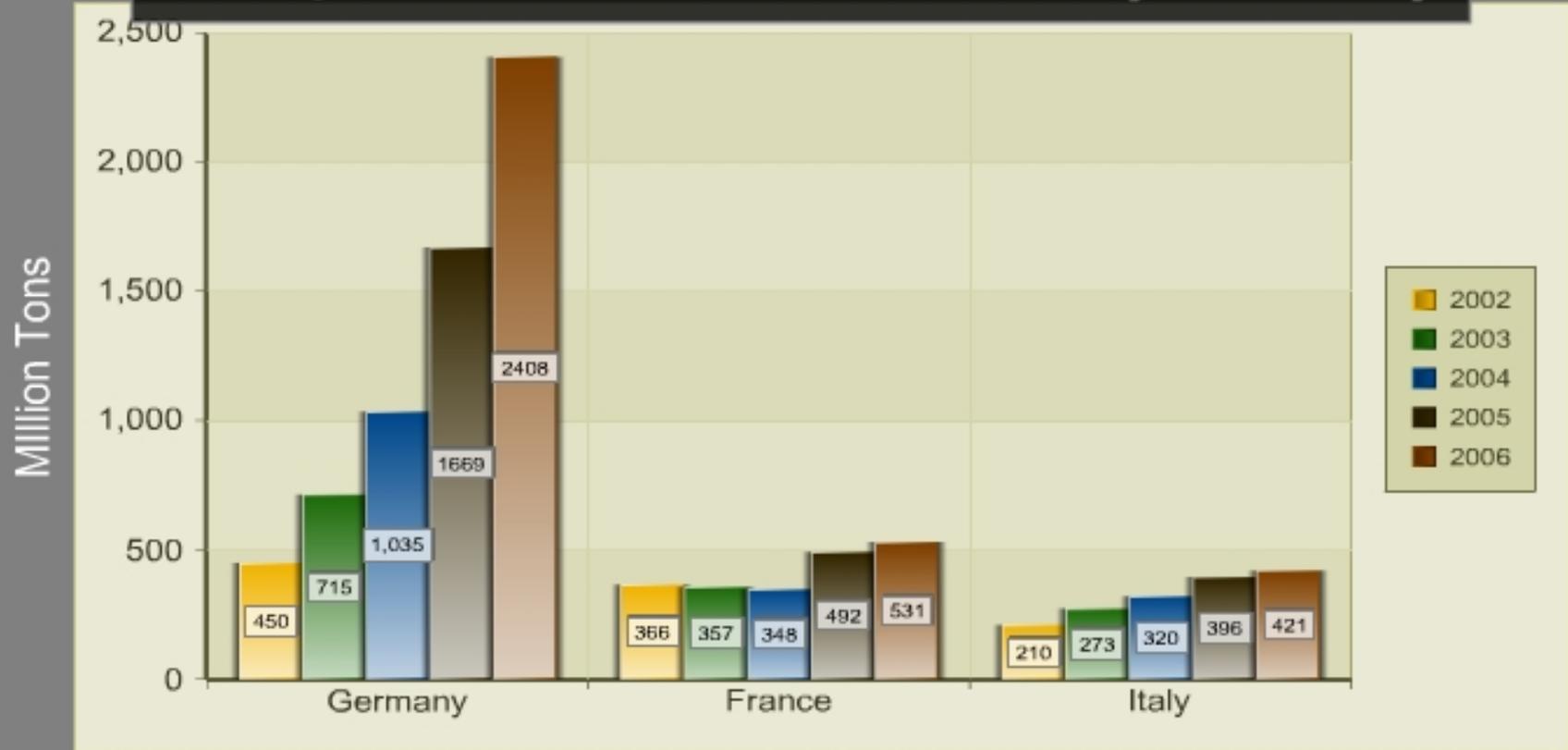
## Europe Biodiesel Production and Capacity



sources Biodiesel 2020: A Global Market Survey, EBB, USDA, OilWorld, FAS

# EU BIODIESEL MARKET GROWTH TRENDS

## European Biodiesel Growth by Country



Source Biodiesel 2020: A Global Market Survey

## EUROPE FEEDSTOCK LEADER - RAPESEED



Europe is the largest producer and consumer of *rapeseed* accounting for 75% of biodiesel consumption.

Growing imports of soybean oil and SME biodiesel from Americas, and palm oil/PME from Asia are blending in.

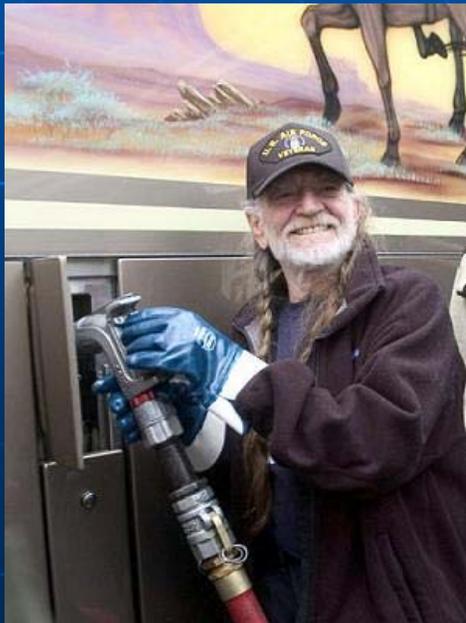
# **USA BIODIESEL MARKET GROWTH**

# USA BIODIESEL MARKET GROWTH TRENDS



## ➤ ***USA Biofuels Targets***

- Federal RFS – 36 billion gallons by 2022
- 22 Billion Gallons from “2<sup>nd</sup> Generation” Fuels

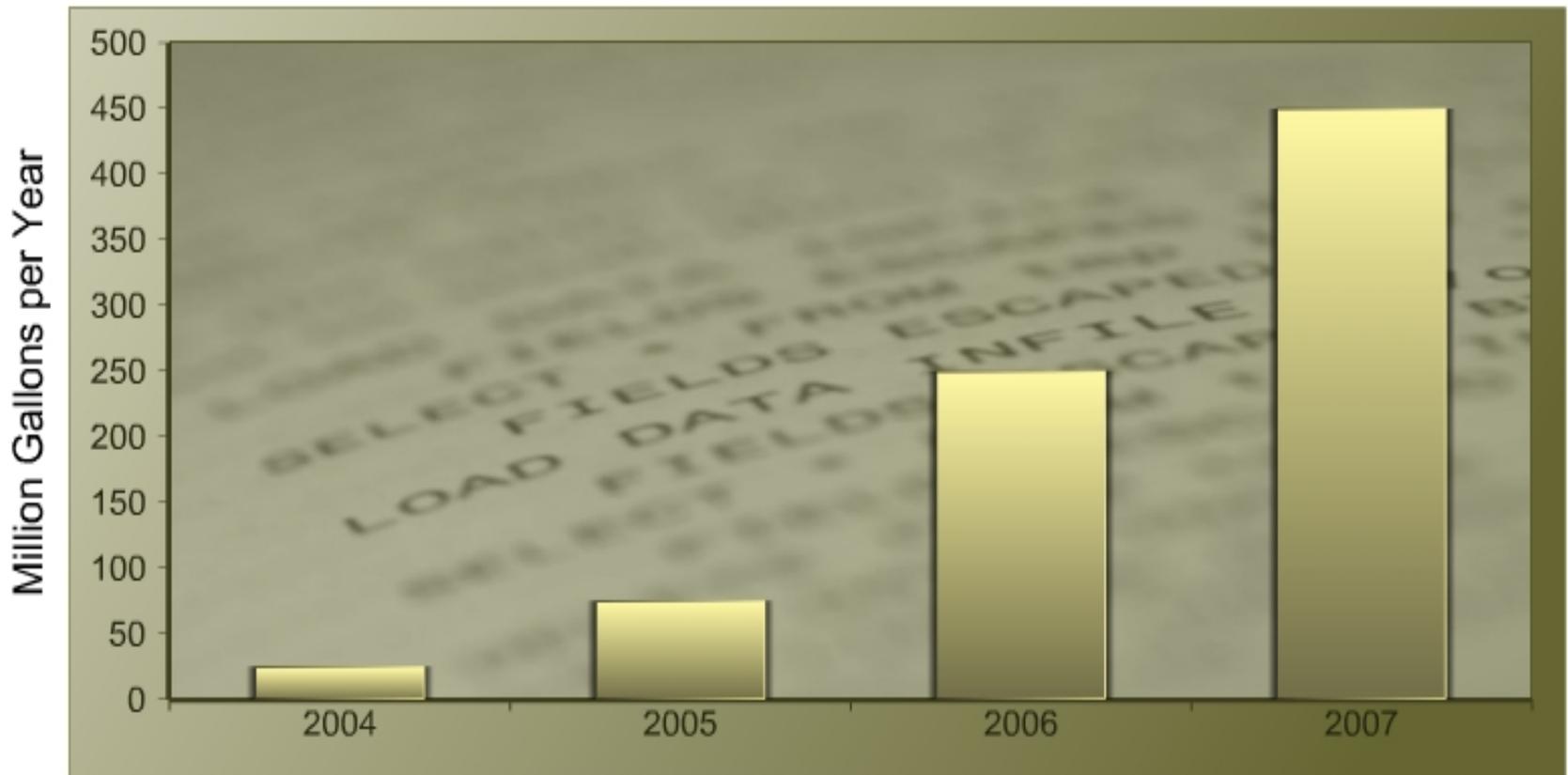


## ➤ ***USA Biofuels Market Growth***

- Production growth 25mgy 2004 to 450 mgy 2007
- Retail Growth 350 pumps 2005 to 1000+ 2007
- Biodiesel Export Growth to Europe
- Increase in multiple feedstock uses

# USA BIODIESEL MARKET OVERVIEW

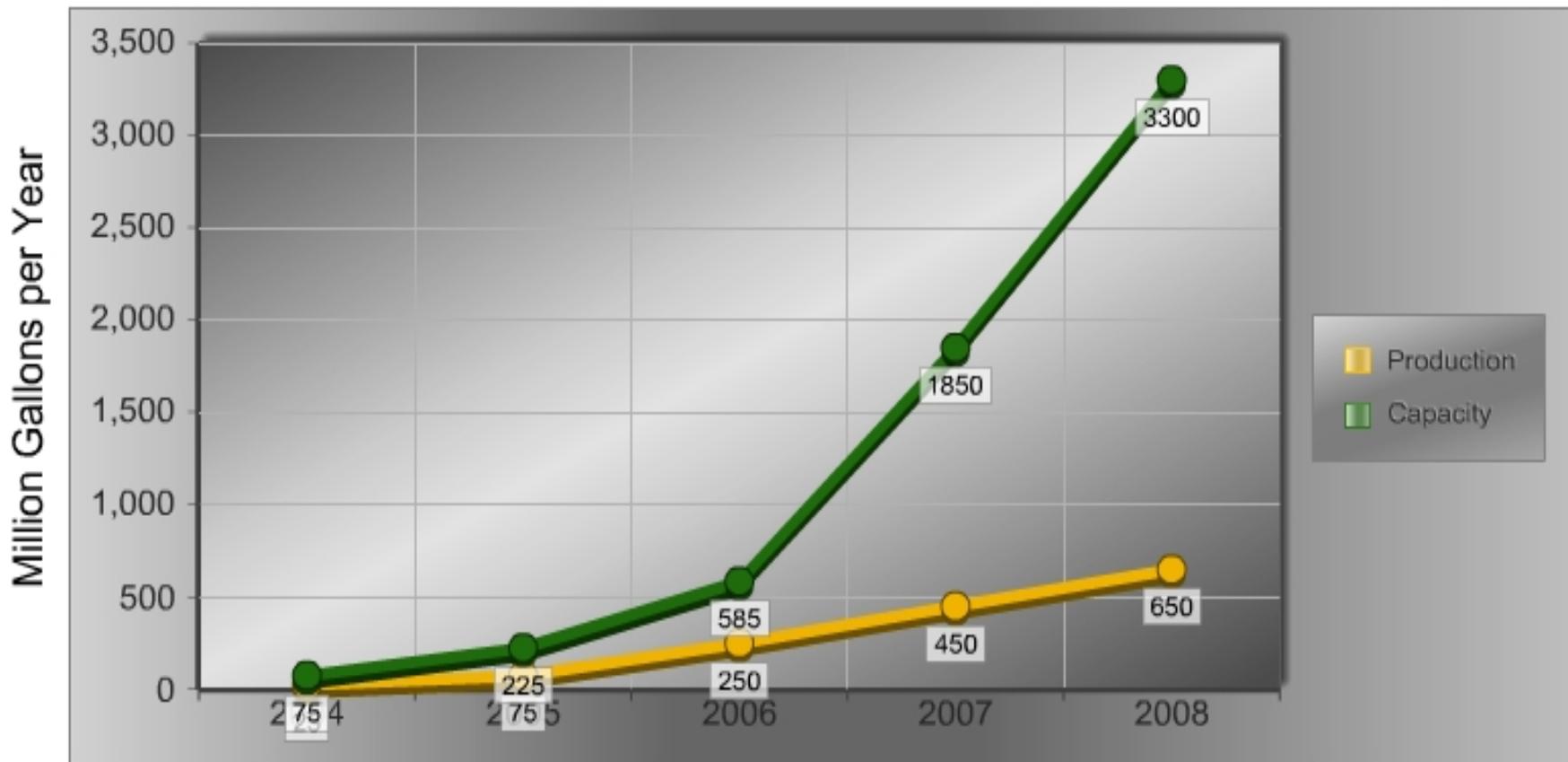
## US Biodiesel Production 2004 to 2007



sources Biodiesel 2020: A Global Market Survey, NBB, USDA, Worldwatch

# USA BIODIESEL MARKET OVERVIEW

## US Biodiesel Production and Capacity



sources Biodiesel 2020: A Global Market Survey 2nd Edition, NBB, USDA

# USA FEEDSTOCK LEADERS – SOYBEAN SME + MULTI-FEEDSTOCK



In the USA, *soybean oil* SME accounted for 64% of dedicated biodiesel production in 2005, but only 44% in 2006.

Trend in USA is moving toward multi-feedstock plants. A move towards diversity of feedstock is the primary choice among new biodiesel producers, and expanding operations.



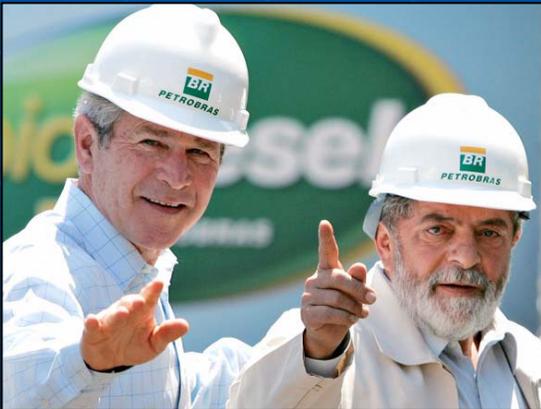
# **BRAZIL'S EMERGING BIODIESEL MARKETS**

# BRAZIL - BIODIESEL MARKET GROWTH TRENDS



## ***Brazil Biodiesel Targets:***

- National program starts with 2% blend in 2008 approximately 211 million gallons
- Next target – 5% by 2013 (660 million gallons)
- Government, Petrobras, Farmers harmonize production in collaborative framework
- Socio-economic benefits for rural farmers

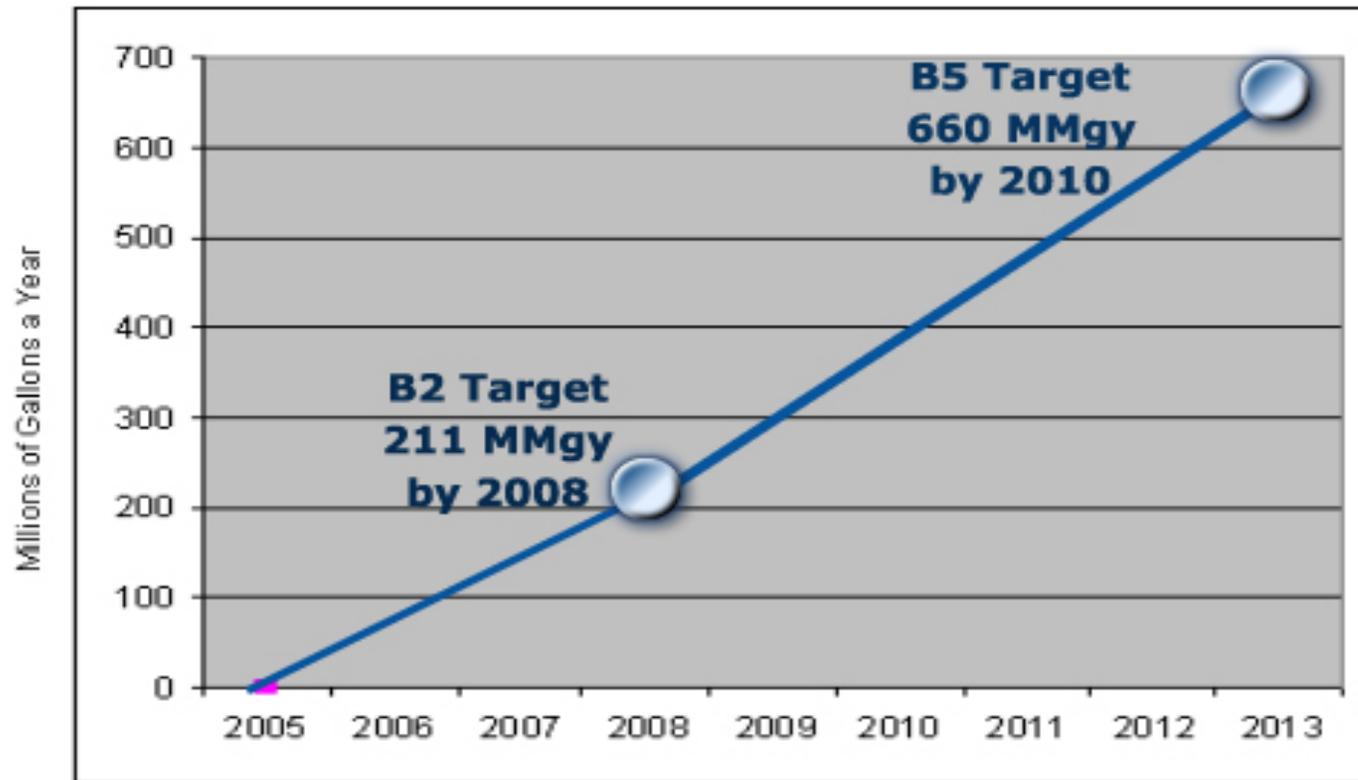


## ***Brazil Biodiesel Markets:***

- Growth of 100+ biofuels plants by 2012
- Biodiesel export growth plans for soy, jatropha

# BRAZIL BIODIESEL MARKET OVERVIEW

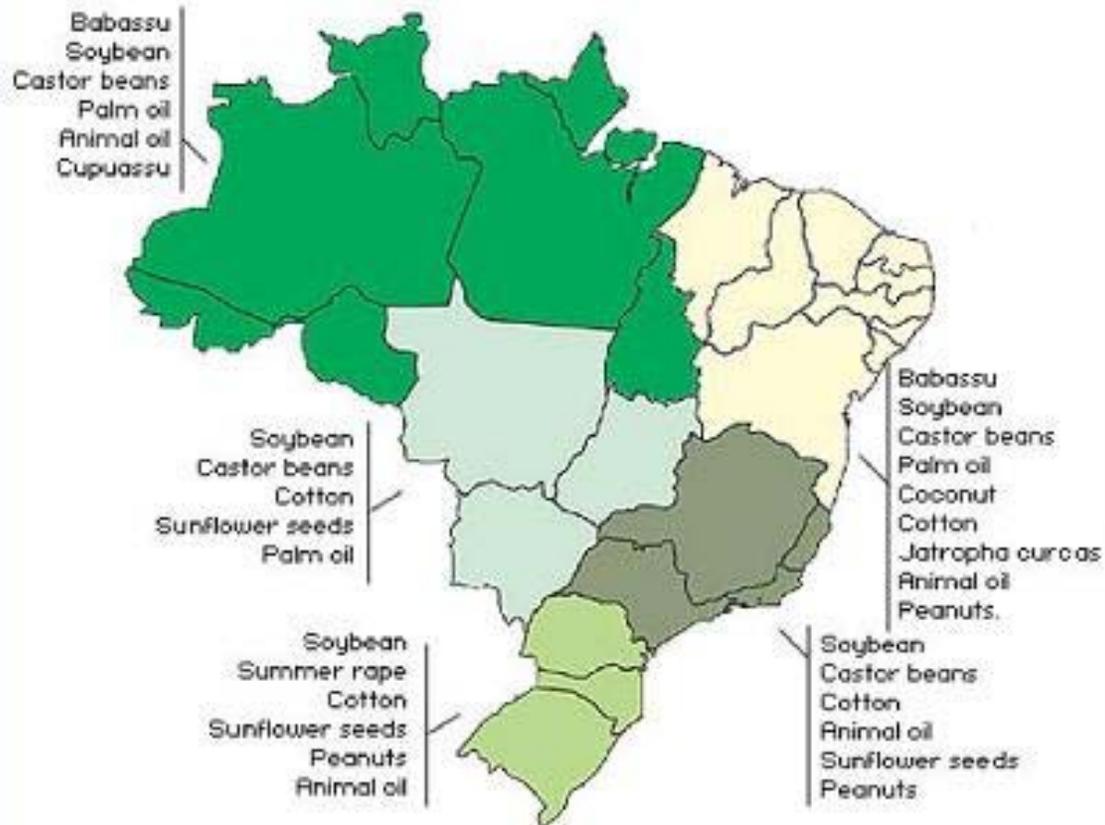
## Brazil Biodiesel Targets



Source: Emerging Markets Online, Petrobras

# BRAZIL BIODIESEL MARKET OVERVIEW

## Biodiesel Feedstock Options by Region - Brazil



Source: Petrobras, Biodiesel 2020: A Global Market Survey

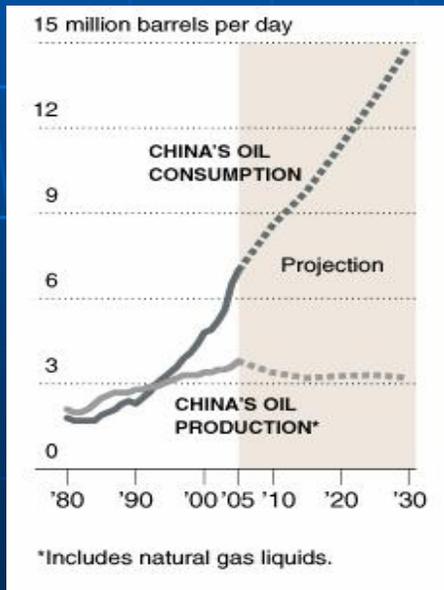
# **CHINA'S EMERGING BIODIESEL MARKETS**

# CHINA'S BIODIESEL MARKET OVERVIEW



## ■ *China's Biodiesel Targets*

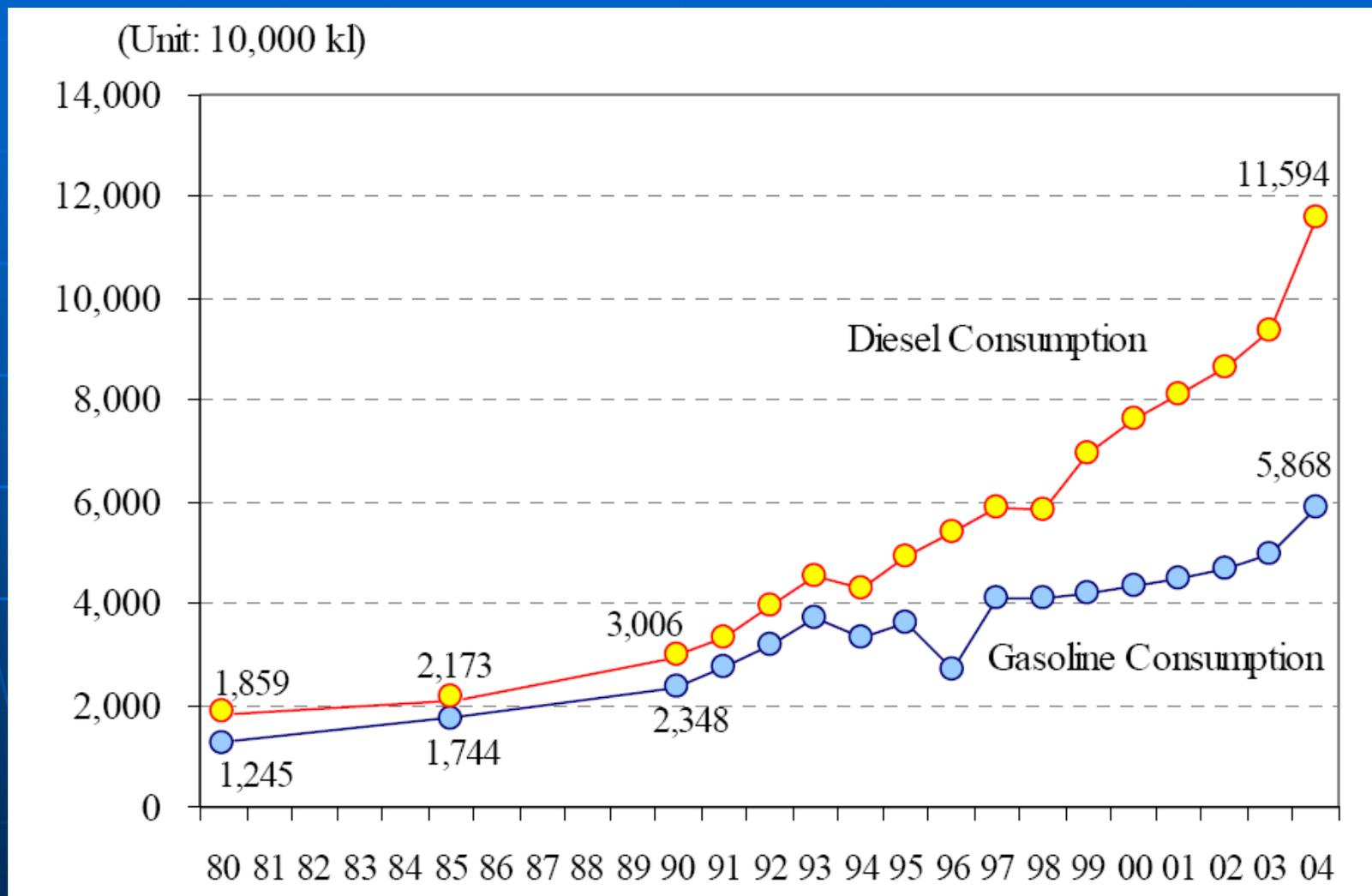
- 2010 - to increase biofuels production to nearly 4 million MT by 2010
- 2020 - produce 12 million tons of biofuels, targeted to replace 15 percent of China's transportation energy needs
- Socio-economic benefits for rural farmers



## ■ *China's Biodiesel Markets*

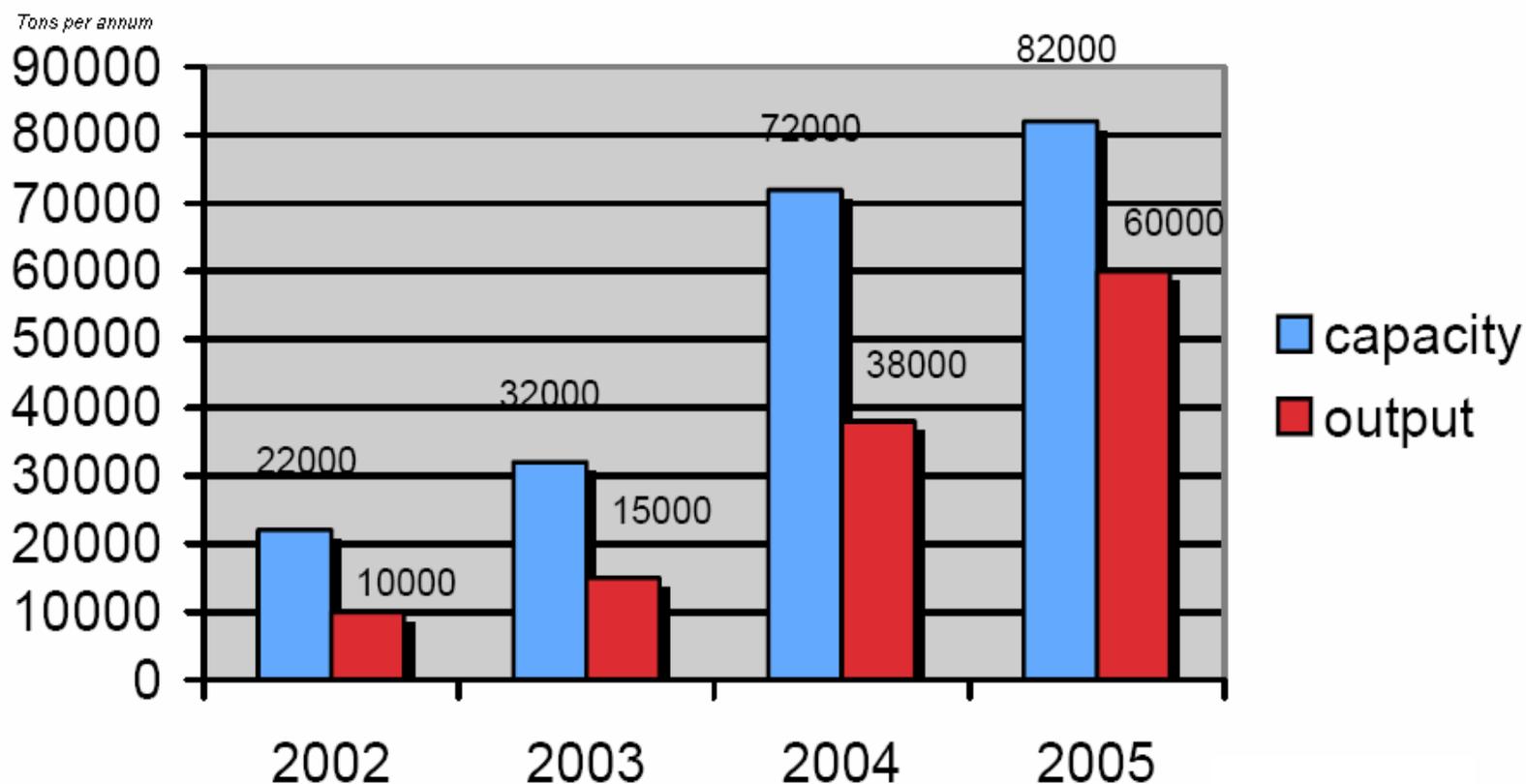
- Traditional use of waste vegetable oil
- Plans for bigger plants using non-food sources such as jatropha, recycled waste and sewage feedstock
- **China's enormous Jatropha project at 13 million hectares or the size of England**

# China – Fast Growth in Diesel Market In Last 25 Years



## China – Fast Growth in Biodiesel Market

### China Biodiesel Production Capacity and Output 2002-2005



# **INDIA'S EMERGING BIODIESEL MARKETS**

# INDIA'S BIODIESEL MARKET OVERVIEW



## ■ **India's Biodiesel Targets:**

- National Biodiesel Program started 2006
- Two Phases – jatropha plantation program
- Target – 20% of diesel fuel by 2012
- Growth for rural, city and regional areas
- Socio-economic plans for growth in marginal areas to benefit rural farmers



## ■ **India's Biodiesel Markets:**

- Key focus: Jatropha plantation, production
- Biodiesel Export Interest in Jatropha

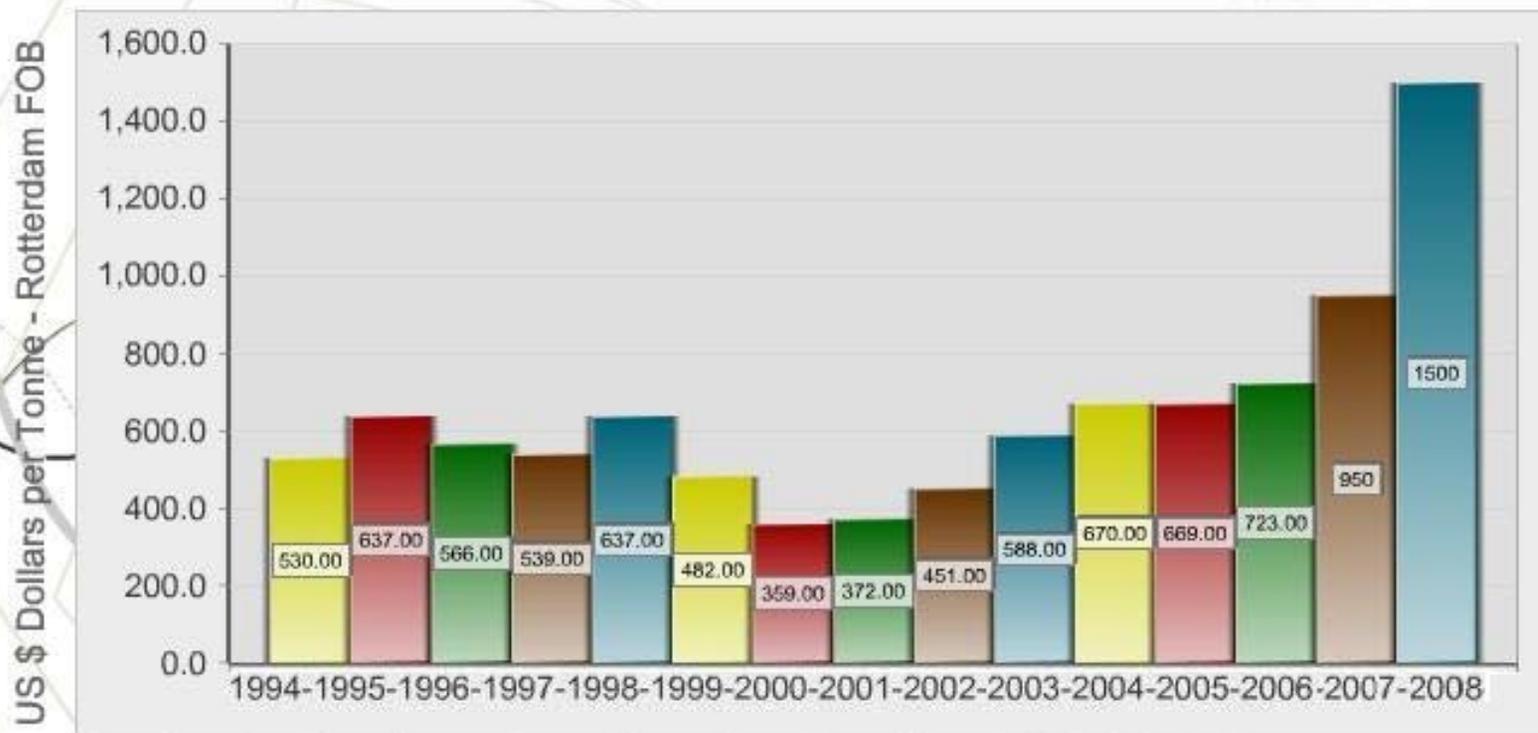
# INDIA'S BIODIESEL MARKET OVERVIEW



## **2. EMERGING FEEDSTOCK TRENDS**

# FEEDSTOCK TRENDS – RAPESEED OIL

## Europe Biodiesel Feedstock Prices Feedstock (Rapeseed Oil) Prices 1993 to 2008



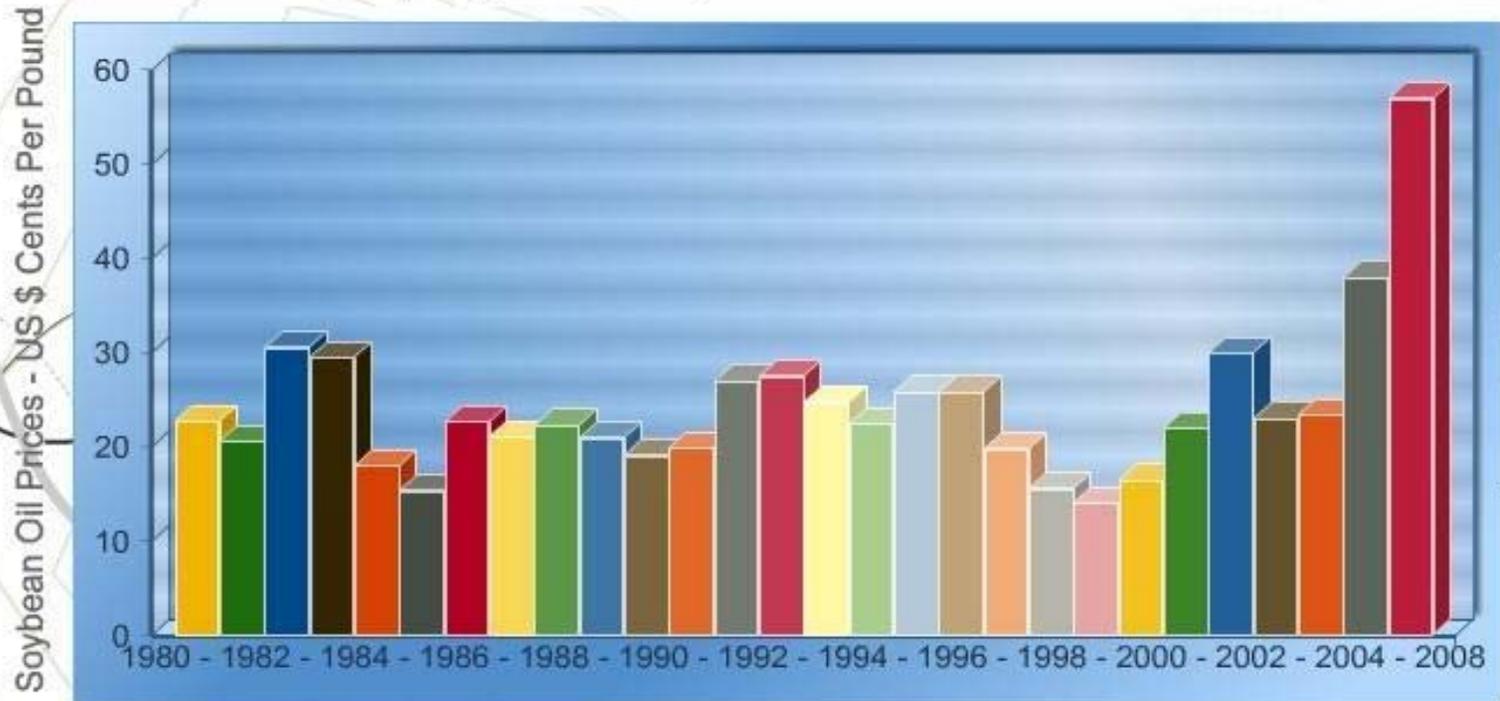
Source: Biodiesel 2020: A Global Market Survey. 2nd Edition. FAS

For 12+ years, rapeseed oil prices FOB in Rotterdam averaged \$615 USD/mt. The 1999-2008 trend demonstrates long term, sustained price increases.

# USA BIODIESEL FEEDSTOCK MARKET TRENDS

## U.S. Biodiesel Feedstock Prices

Feedstock (Soybean oil) Prices 1980 to 2008



Source: Biodiesel 2020: A Global Market Survey 2nd Edition, FAS, USDA, CBOT stats

The graph illustrates 27 years of US soybean oil prices. Historically, prices have varied from an annual change of 5% to over 40%. The trend from 2002-2008 illustrates soaring costs of soy.

# FEEDSTOCK TRENDS

## National Feedstock Trends from Soybeans/Rapeseed to Multi-Feedstock

USA – 2005

majority of existing biodiesel plants  
64% use soybean SME exclusively



USA – 2006

only 42% of existing biodiesel  
plants use soybean SME exclusively

## Global Feedstock Trends Price Trends Driving Growth in *Lower Cost Feedstocks*

2006 – 2007: EU, USA

Higher feedstock prices for  
soy, rapeseed, and palm oil

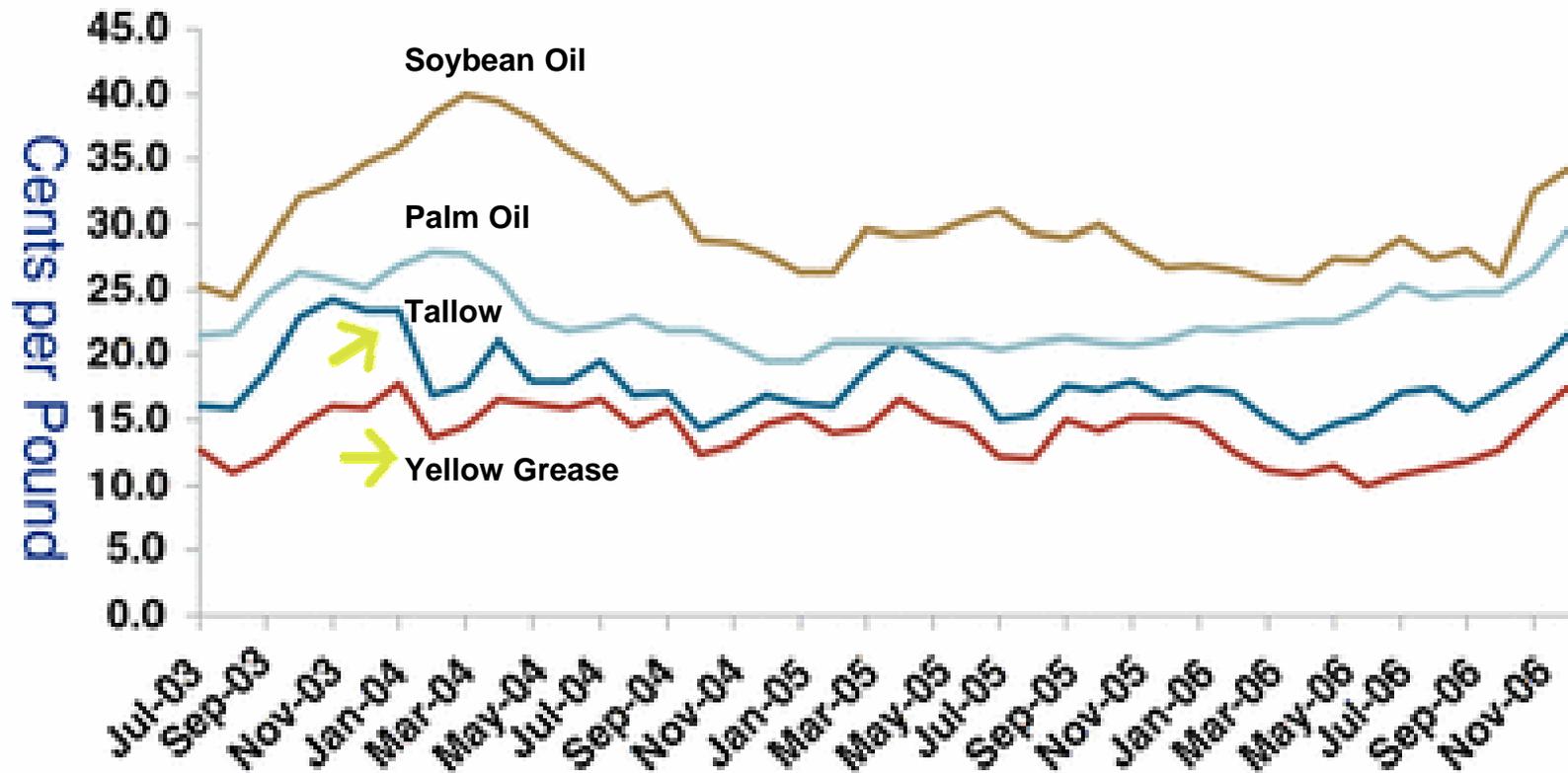


2008 + Future - Global

Demand for alternative feedstocks  
from Waste Grease, Jatropha, Algae

# Lower Cost Feedstocks for Biodiesel?

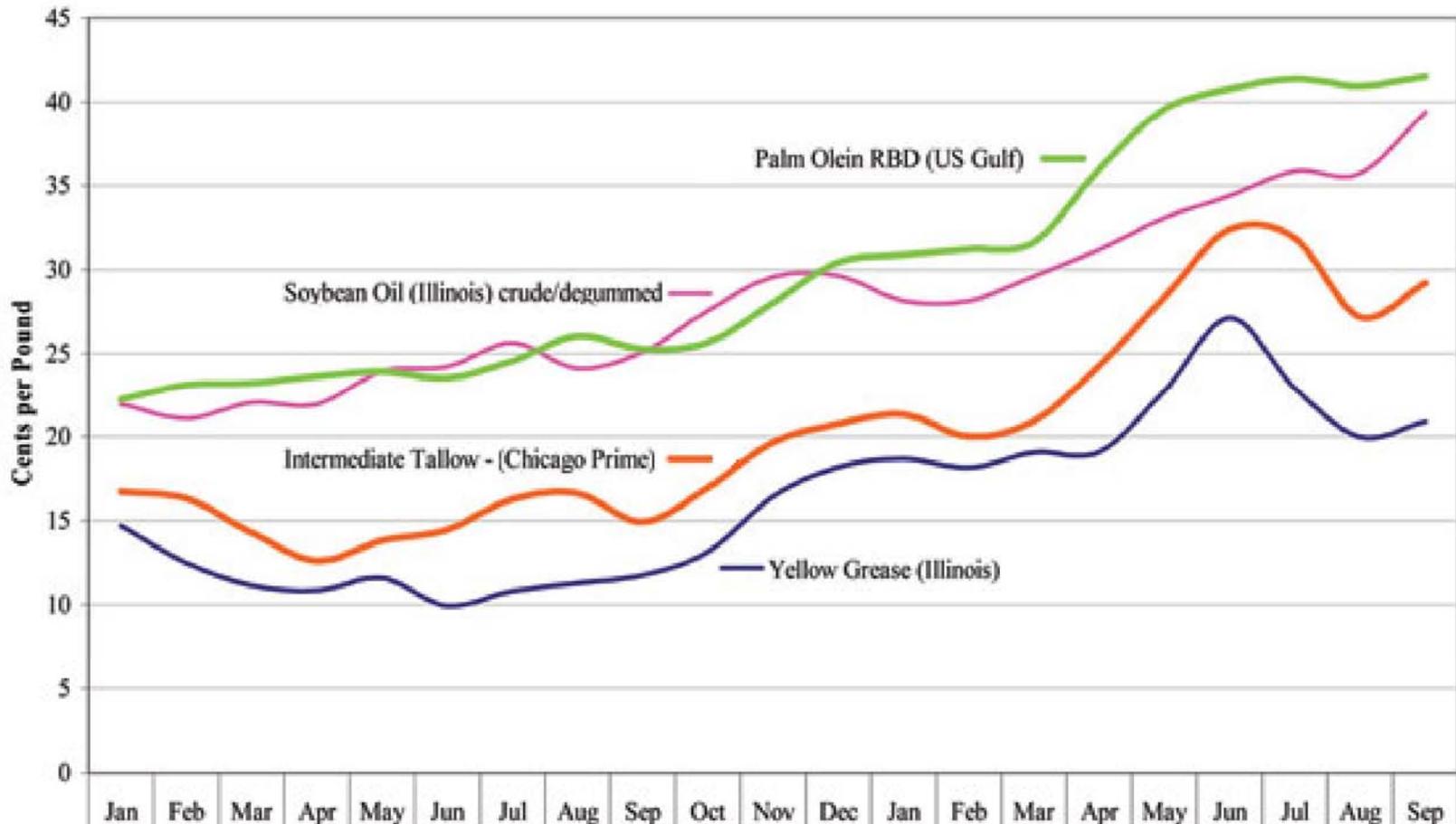
## Historical Prices



Source: SEC, Edgar Filings, Nova Source Biofuels, Jacobsen Commentary and Market News Bulletin

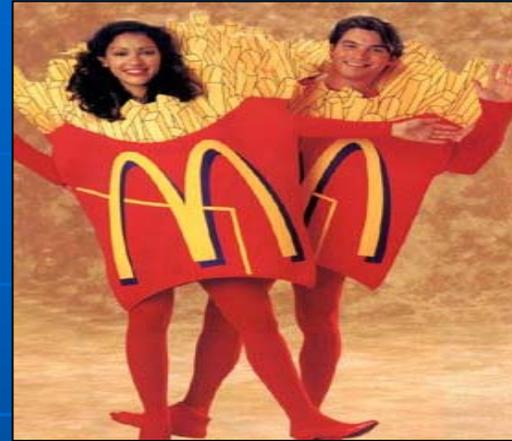
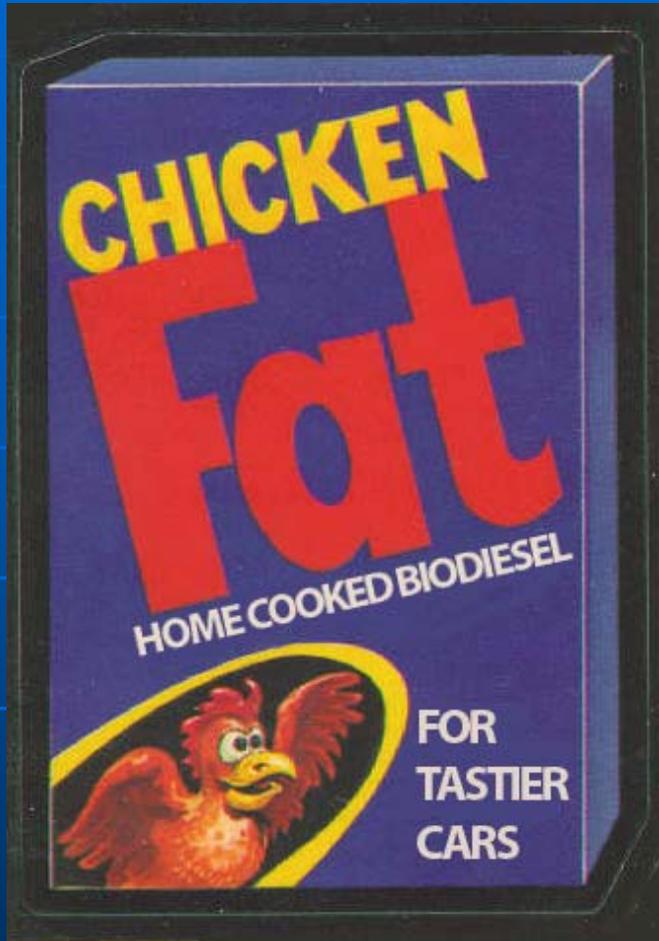
## Lower Cost Feedstocks for Biodiesel?

### Soybean Oil, Palm Oil, Tallow and Yellow Grease Prices 2006-2007



source: National Biodiesel Board, Jacobsen Publishing

## Lower Cost Feedstocks - “Renewable Diesel”



**Renewable Diesel:  
“Grease” is the word**

## Renewable Diesel Technologies – Waste and Grease to Diesel and Bio-Oil



# From Trash to Cash - Waste Feedstock Processing for “Renewable Fuels” Many Options – One is Thermal Depolymerization

The thermal depolymerization process can convert a wide range of waste materials into oil and other useful by-products, in proportions that vary according to the specific type of feedstock run through the works:

## 100 POUNDS OF:

**PLASTIC BOTTLES:** Clear (polyethylene terephthalate) and translucent (high-density polyethylene)

**MUNICIPAL LIQUID WASTE:** 75 percent sewage sludge, 25 percent grease-trap refuse

**TIRES:** All kinds, including standard rubber and steel-belted radials

**HEAVY OIL:** Refinery residues, heavy crudes, and tar sands

**MEDICAL WASTE:** Transfusion bags, needles and razor blades, and wet human waste

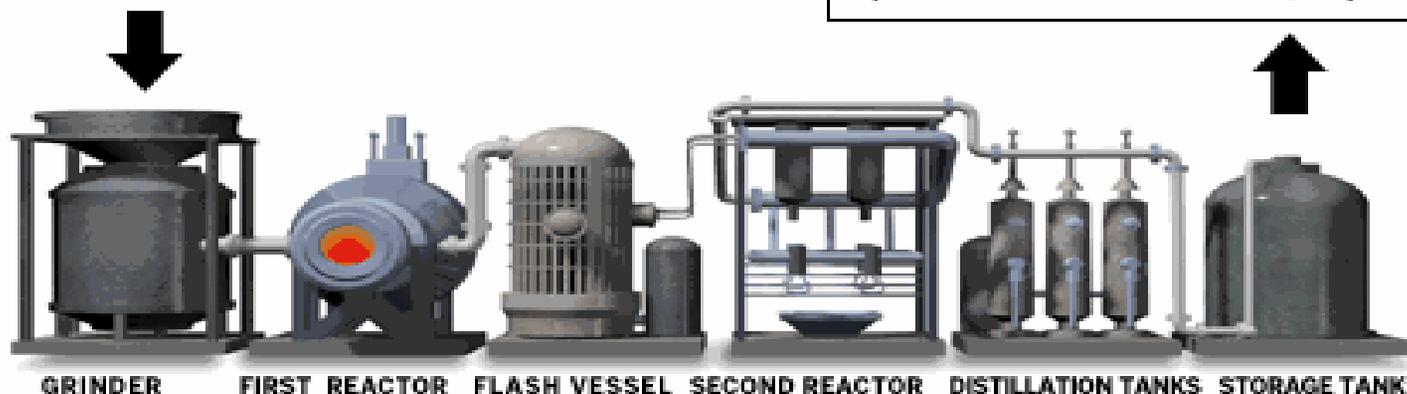
**PLASTIC BOTTLES:** 70 pounds oil, 16 pounds gas, 6 pounds carbon solids, 8 pounds water

**MUNICIPAL LIQUID WASTE:** 26 pounds oil, 9 pounds gas, 8 pounds carbon and mineral solids, 57 pounds water

**TIRES:** 44 pounds oil, 10 pounds gas, 42 pounds carbon and metal solids, 4 pounds water

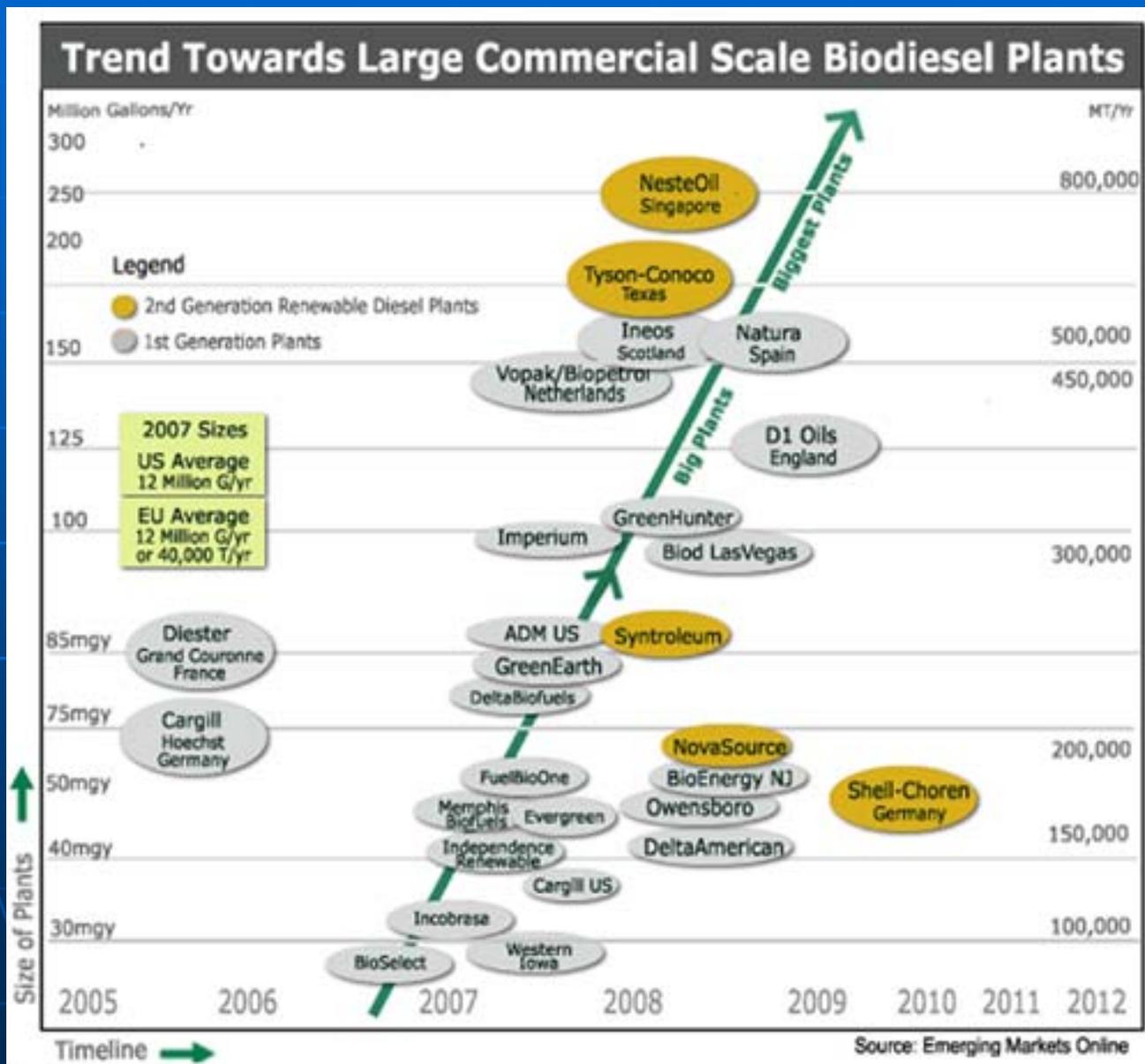
**HEAVY OIL:** 74 pounds oil, 17 pounds gas, 9 pounds carbon solids

**MEDICAL WASTE:** 65 pounds oil, 10 pounds gas, 5 pounds carbon and metal solids, 20 pounds water

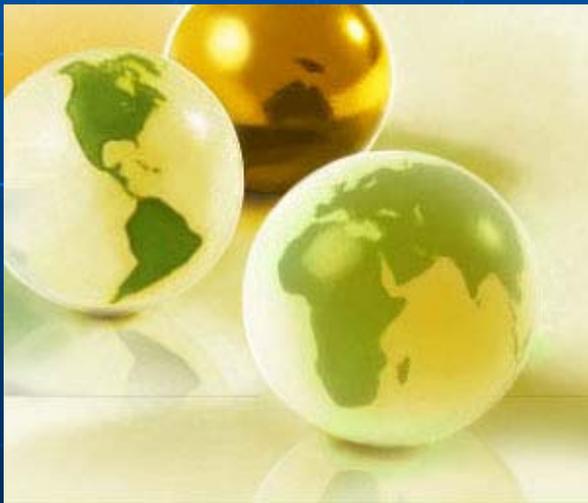


GRAPHIC BY DON FOLEY

# Renewable Diesel – Super Sized Projects Using Lower Cost Feedstocks



## GLOBAL BIODIESEL FEEDSTOCK TRADE TRENDS: Growth of The Emerging Markets



- 2007 - only 20 oil producers in the world supplying the demands of 200 nations
- 2010 – over 100 nations will produce biofuels and supply to more than 200 nations

**FORECAST: GROWTH IN GLOBAL BIODIESEL TRADE 2007-2020**  
Export-Import of Canola, Soy, Palm, Jatropha, Sunflower, Castor Oils



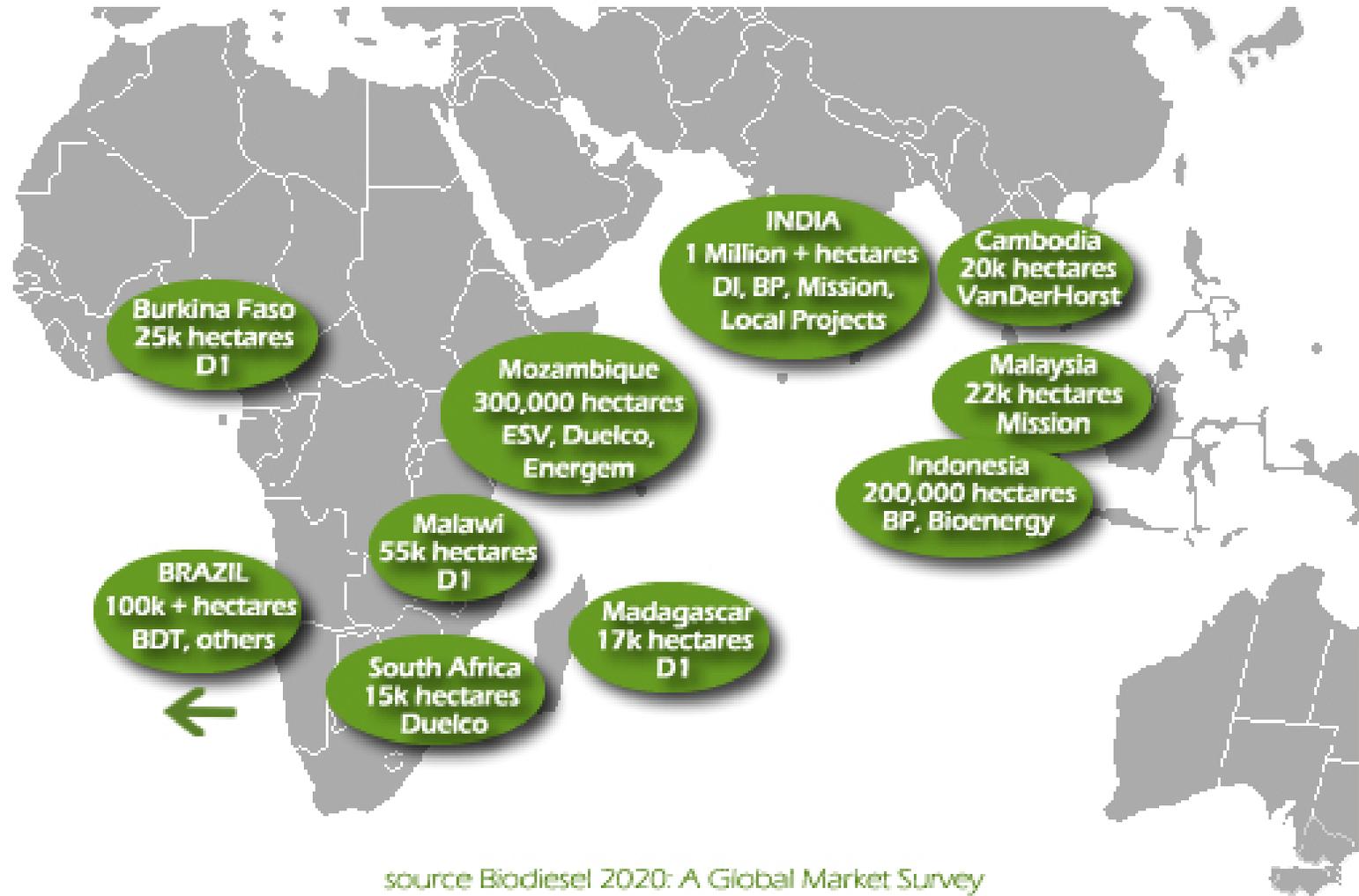
# **FUTURE FEEDSTOCKS FOR BIODIESEL**

## **JATROPHA FEEDSTOCK FOR BIODIESEL**

**High-Yield, Non-Food Oil, Non-Ag and Non-Rainforest areas, Low Water Use**



# Jatropha Curcas Commercial Projects



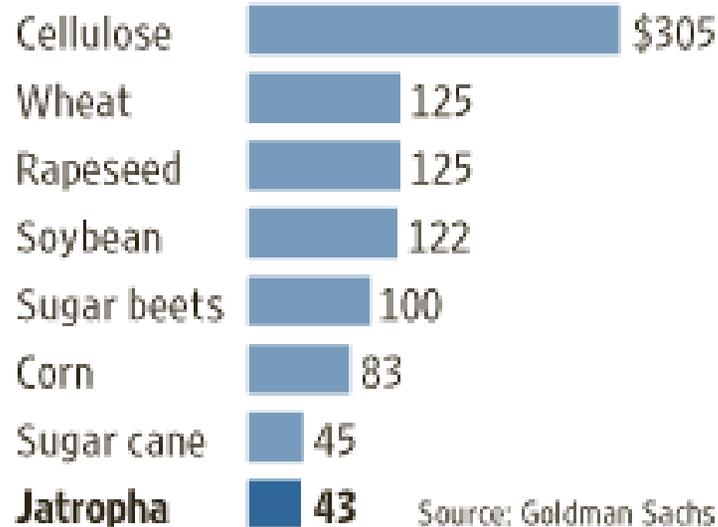
source Biodiesel 2020: A Global Market Survey

## JATROPHA FEEDSTOCK FOR BIODIESEL

High-Yield, Non-Food Oil, Non-Ag and Non-Rainforest areas, Low Water Use

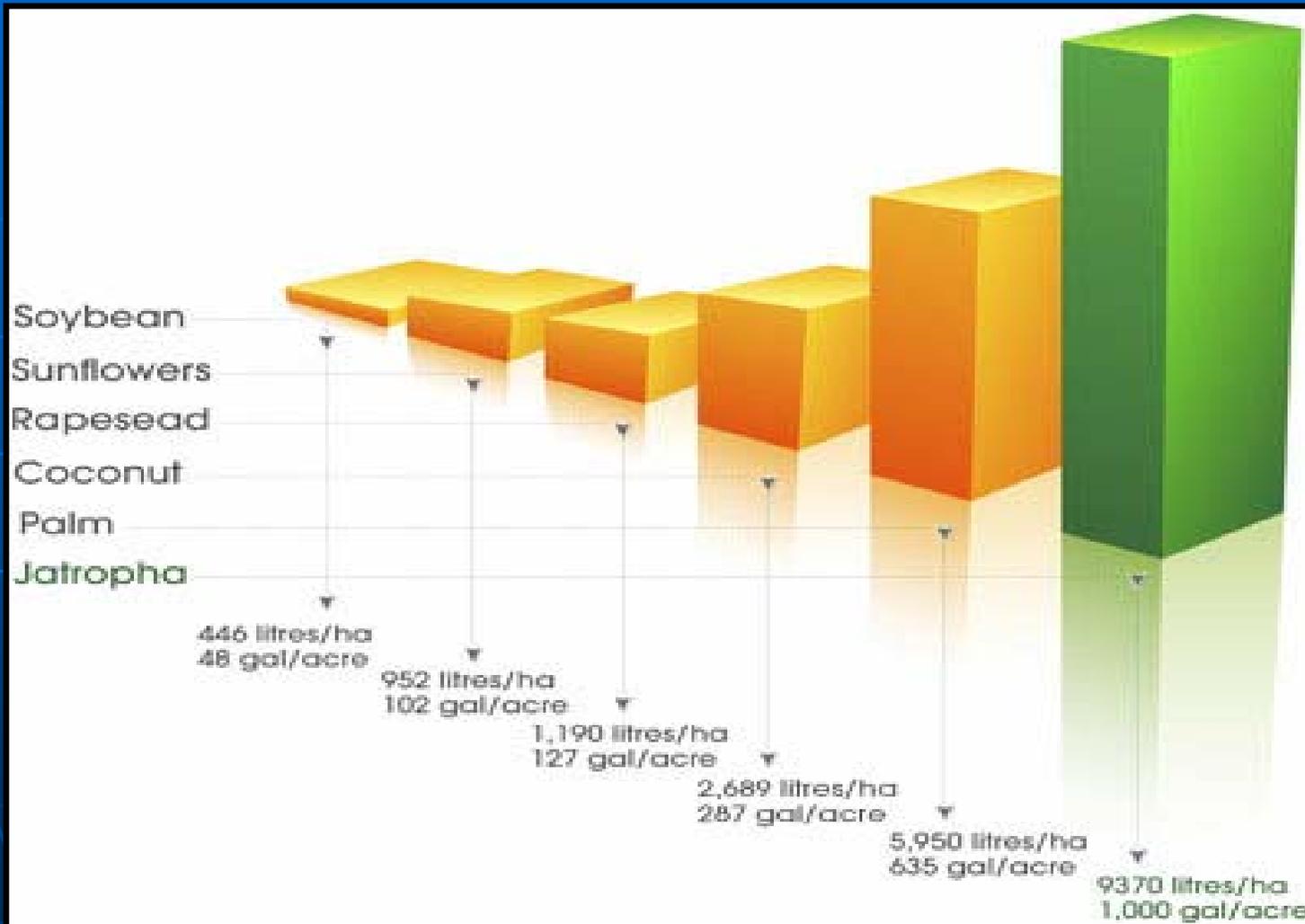
### Power Prices

Estimated cost per barrel of fuel produced by selected biofuel feedstocks



# JATROPHA FEEDSTOCK FOR BIODIESEL

High-Yield, Non-Food Oil, Non-Ag and Non-Rainforest areas, Low Water Use



Source: Xenerga estimates, high-yield Jatropha seeds

## **ALGAE - BASED BIODIESEL**

**Offers The Promise of High-Yield, Commercial-Grade, Non- Food Based Fuel**



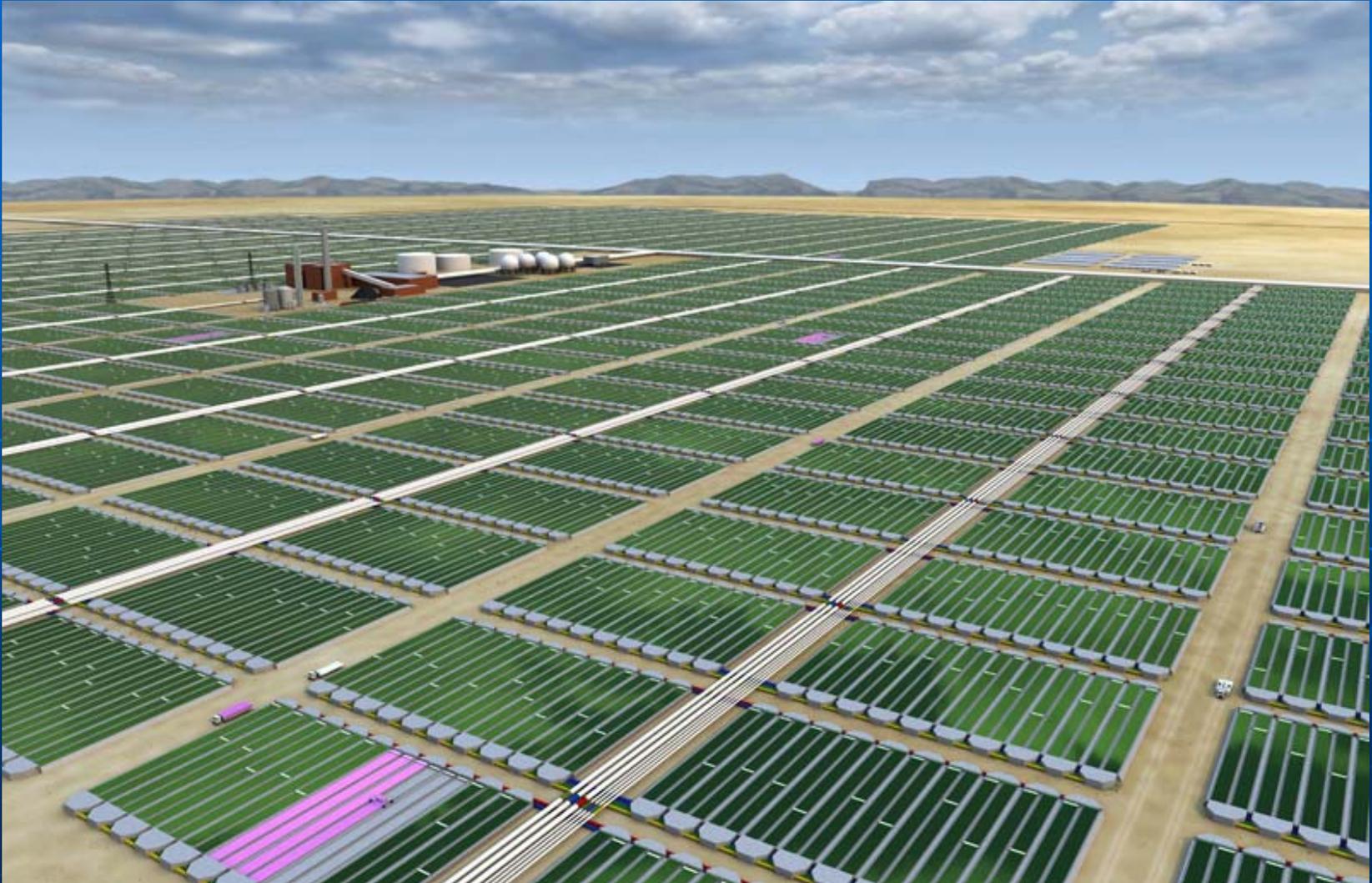
## Algae Projects Reported Under Development

High-Yield, Non-Food Oil, Non-Ag and Non-Rainforest areas, Low Water Use

Solix	Solazyme
Green Star Products, Inc.	PetroAlgae
Algae BioFuels	Seambiotic
Icon Energy	LiveFuels Inc
Inventure	GreenFuel Technologies Corporation
Aquaflow Bionic Corporation	Infinifuel Biodiesel
Valcent / Vertigro Joint Venture	Algoil
Enhanced Biofuels & Technologies	OriginOil
Kwikpower International	Alga Technologies
Bio Fuel Systems	SQC

## A Look at The Future - Algae Farms

High-Yield, Non-Food Oil, Non-Ag and Non-Rainforest areas, Low Water Use



### **3. BIODIESEL OUTLOOK AND OPPORTUNITIES**

# GLOBAL BIODIESEL OUTLOOK AND OPPORTUNITIES

## Short-Term Outlook, Opportunities to 2010



↑ Growth in Multiple Feedstocks



↑ Export Growth From Alternative Feedstocks



↑ Big Plants Open Near Ports, Refineries



↑ Renewable Diesel Growth - Recycled Waste

# GLOBAL BIODIESEL OUTLOOK AND OPPORTUNITIES

## Medium Term Outlook, Opportunities to 2015



↑ Emergence of Commercial Scale Jatropha



↑ Export Growth from Latin America, Africa, Asia



↑ Algae Commercial Scale Production Increases



↑ Growth in Renewable Diesel Projects for Commercial and Community/Muni Projects

# GLOBAL BIODIESEL OUTLOOK AND OPPORTUNITIES

## Long-Term Outlook, Opportunities to 2020



↑ **Algae Becomes Mainstream Commodity**



→ **Global Supply Balance Shifts North to South**



→ **Global Demand Balance Increase From Asia**

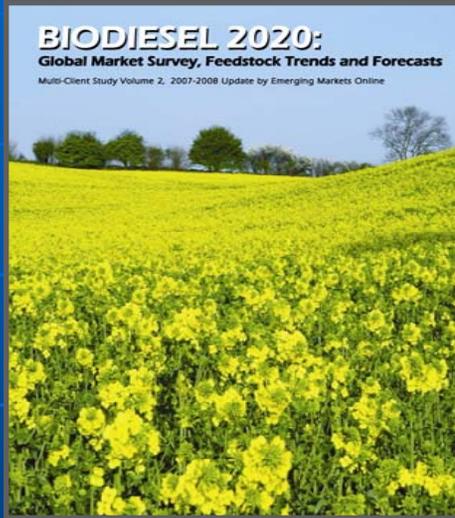


↑ **Community Projects Increase Significantly**

**For more information**

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