

***Biofuels vs. food:  
Does biofuels increase food prices?***

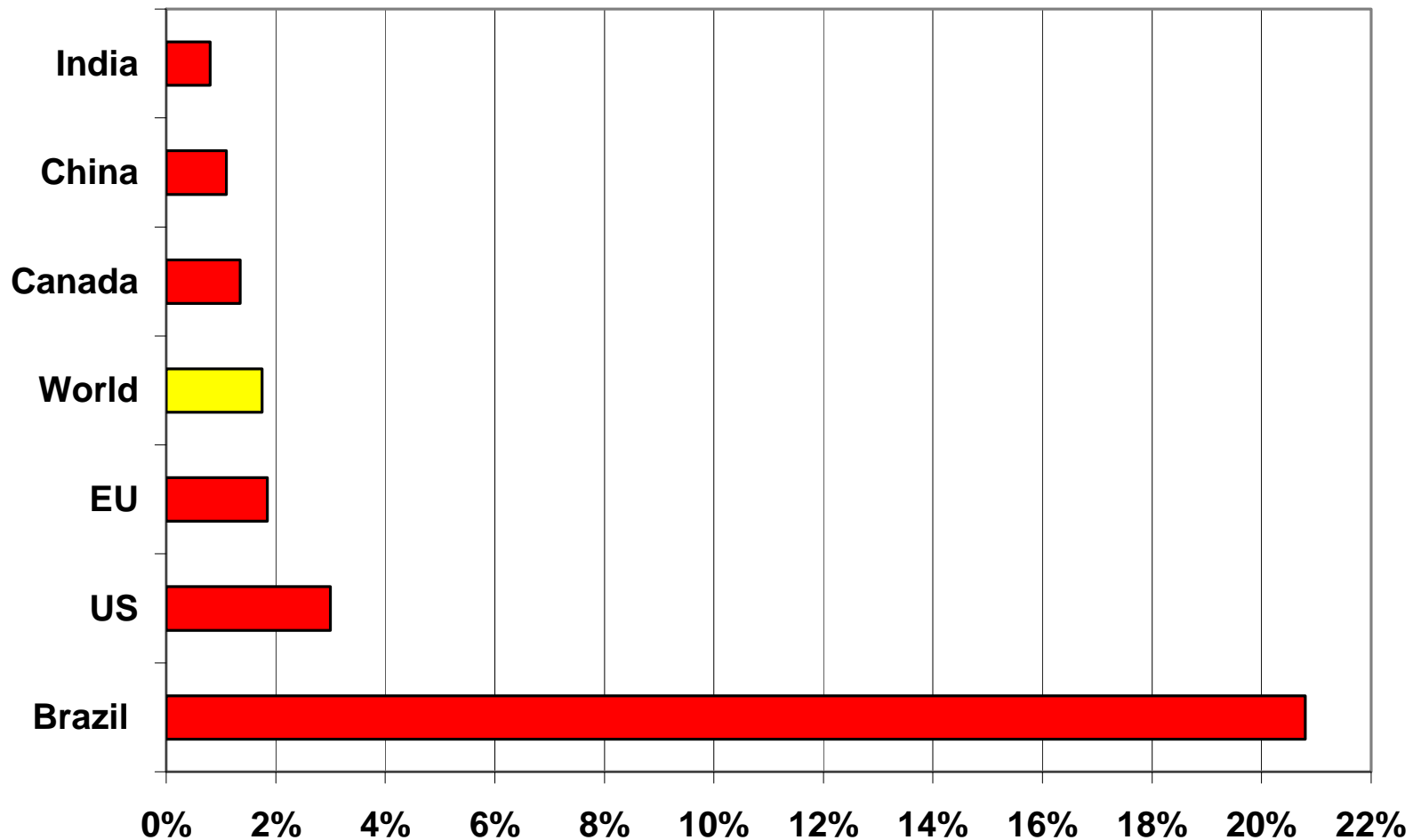
*Amela Ajanovic, Reinhard Haas  
Vienna University of Technology, Energy Economics Group*

*Salzburg, 31.08.2009*

1. Introduction
2. Biofuels production
3. Costs of biofuels
4. Biomass resources and land use
5. Feedstock prices
6. Conclusions

# 1. INTRODUCTION

# Share of biofuels



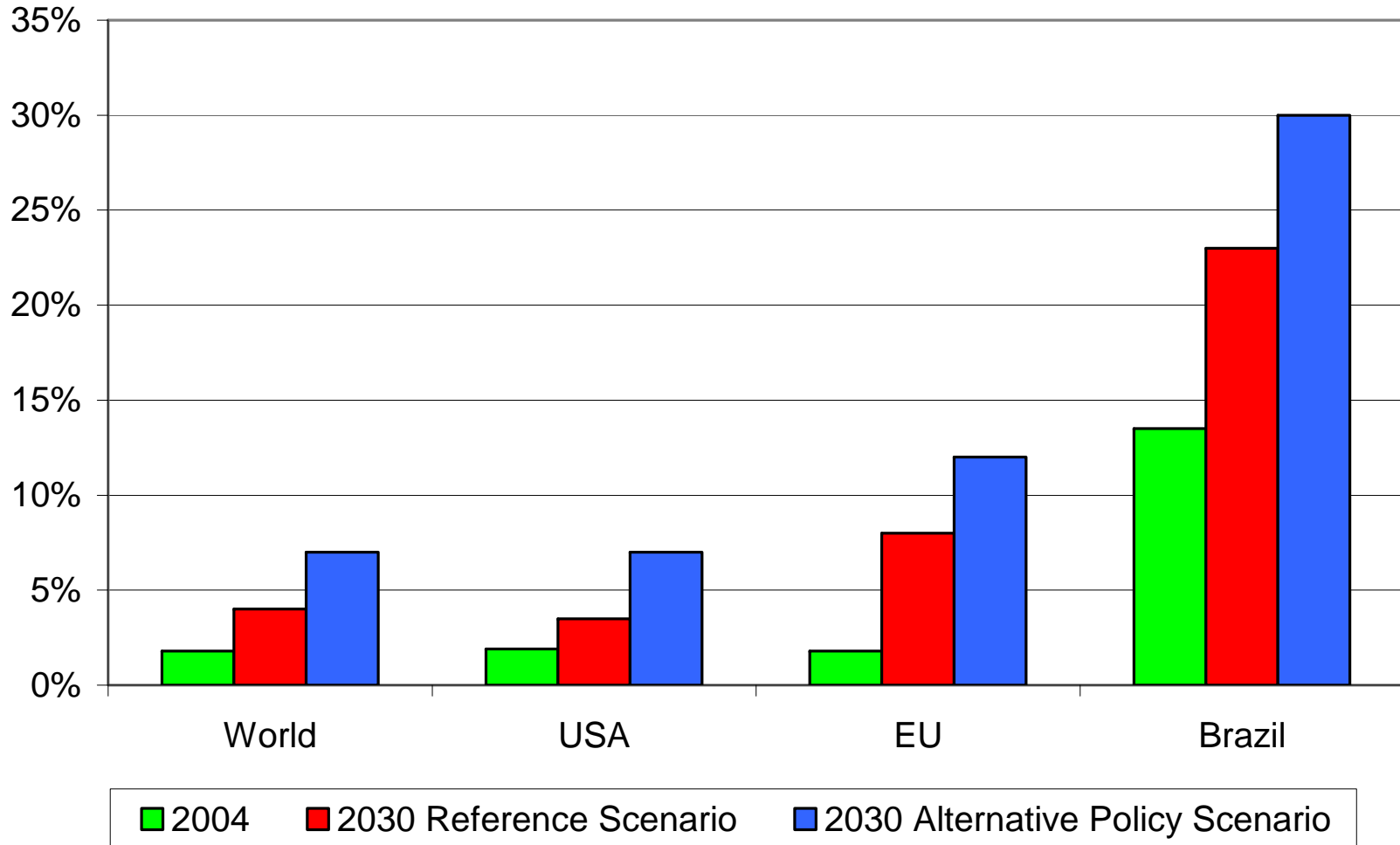
Share of biofuels in total road-fuel consumption in energy terms, 2007

(Source: F.O.Licht, IEA)

# Targets for biofuels

Country/Region	Mandatory, voluntary or indicative target
<b>Australia</b>	At least 350 million liters biofuels by 2010
<b>Canada</b>	5 percent renewable content in gasoline by 2010
<b>EU</b>	5.75 percent by 2010, 10 percent by 2020
<b>Germany</b>	6.25 percent by 2010, 10 percent by 2020
<b>France</b>	7 percent by 2010, 10 percent by 2015, 10 percent by 2020
<b>Japan</b>	0.6 percent of auto fuel by 2010; a goal to reduce fossil oil dependence of transport sector from 98% to 80% by 2030
<b>New Zealand</b>	3.4 percent target for both gasoline and diesel by 2012
<b>United States</b>	12 billion gallons by 2010, rising to 20.5 billion gallons by 2015 and to 36 billion gallons by 2022 (with 16 billion gallons from advanced cellulosic ethanol)
<b>Brazil</b>	Mandatory 25 percent ethanol blend with gasoline; 5 percent biodiesel blend by 2010.
<b>China</b>	2 million tons ethanol by 2010 increasing to 10 million tons by 2020; 0.2 million tons biodiesel by 2010 increasing to 2 million tons by 2020.
<b>India</b>	5 percent ethanol blending in gasoline in 2008, 10 percent as of 2009; indicative target of 20 percent ethanol blending in gasoline and 20 percent biodiesel blending by 2017.
<b>Indonesia</b>	2 percent biofuels in energy mix by 2010, 3 percent by 2015, and 5 percent by 2020.
<b>Thailand</b>	2 percent biodiesel blend by 2008, 10 percent biodiesel blend by 2012; 10 percent ethanol blend by 2012.
<b>South Africa</b>	2 percent of biofuels by 2013

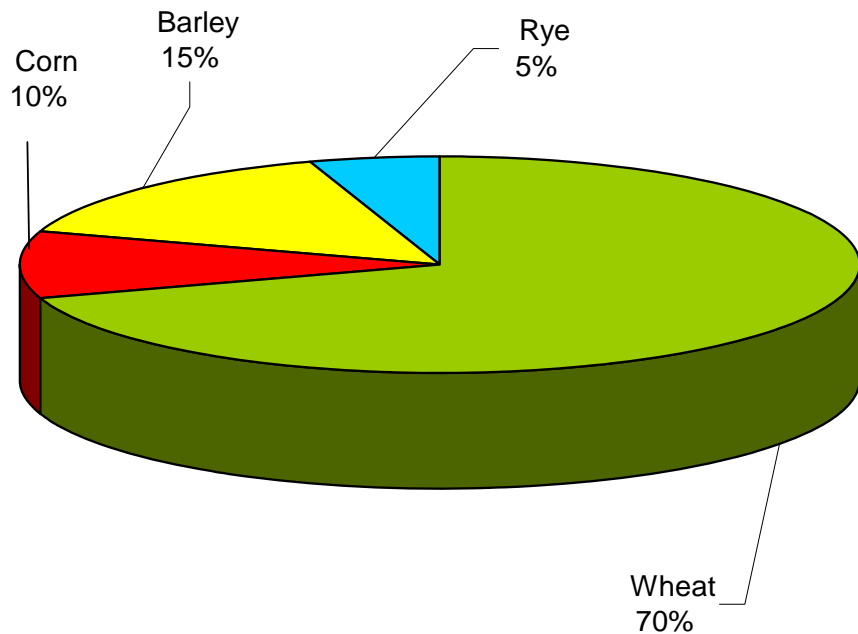
# Share of biofuels



Share of biofuels in road-transport fuel consumption in energy terms

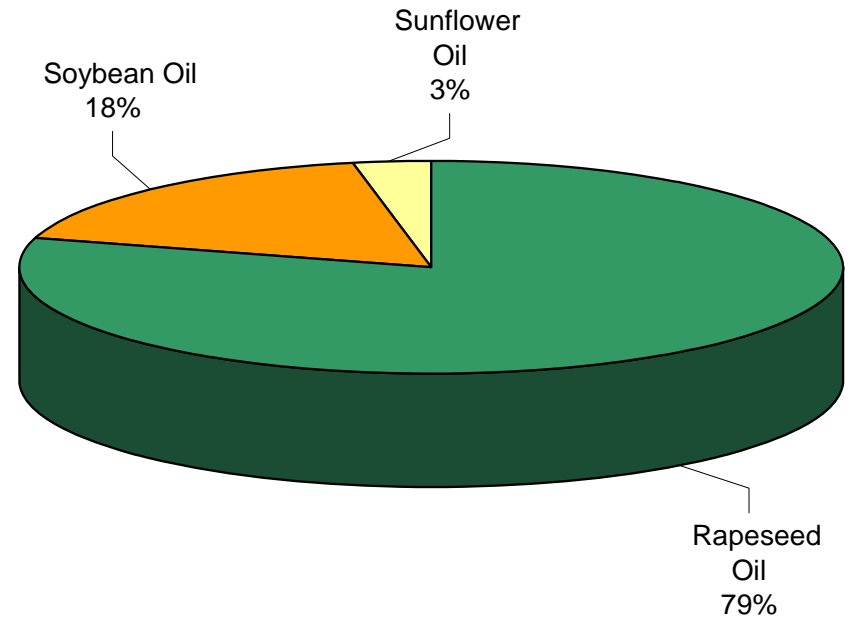
(Source: IEA,2006)

Classification	Feedstock		Biodiesel	Ethanol	FT-Diesel	Bio-DME	Bio-SNG
1st	Oil crops	Rapeseed	X				
		Sunflower	X				
	Sugar crops	Sugar beet		X			
		Sugar cane		X			
	Starch crops	Wheat		X			
		Maize		X			
		Triticale		X			
		Sweet sorghum		X			
	Organic waste	Used oils/fats	X				
	Residues from agriculture	Digestible		X			X
2nd	Lignocellulosic crops	Woody plants		X	X	X	X
		Herbaceous plants		X	X	X	X
	Residues from agriculture	Non-digestible (straw)		X	X	X	X
	Residues from forestry			X	X	X	X
	Residues from wood industry			X	X	X	X



EU-25: Feedstock use in ethanol production in 2008

(Source: FAPRI,2008)

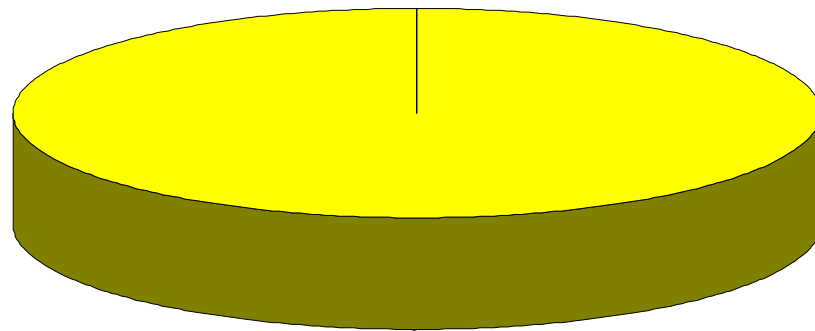


EU-25: Feedstock use in biodiesel production in 2008

(Source: FAPRI,2008)



# Biofuels - Brazil

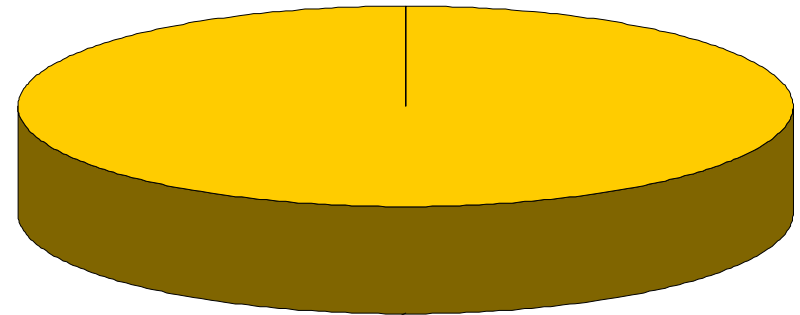


Sugarcane  
100%

293,259 T Tons

Brazil: Feedstock use in ethanol  
production in 2008

(Source: FAPRI,2008)



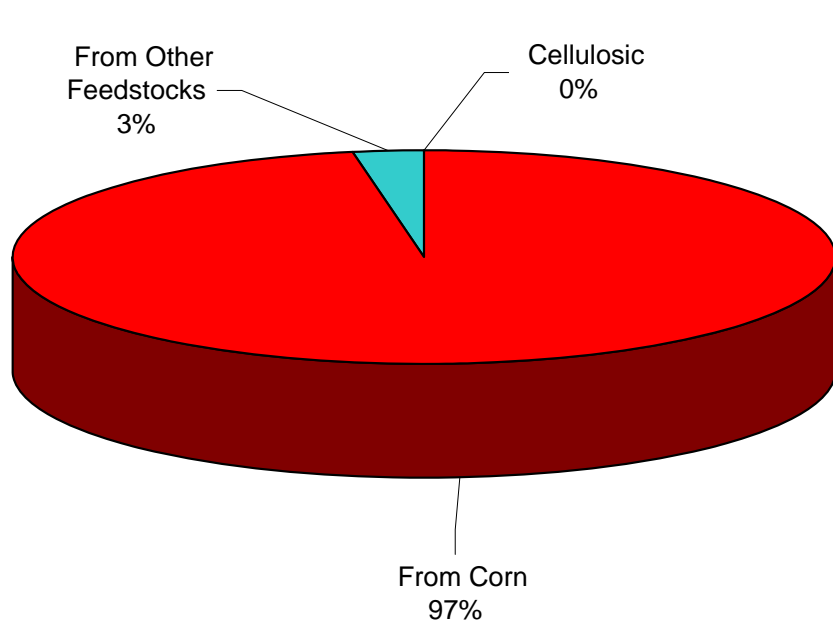
Soybean  
Oil; 100%

863 T Tons

Brazil: Feedstock use in biodiesel  
production in 2008

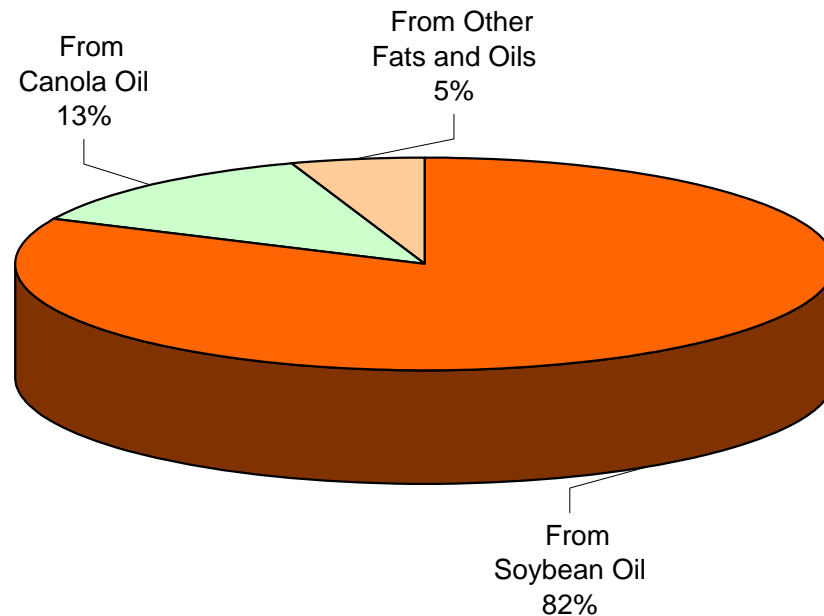
(Source: FAPRI,2008)

# Biofuels - USA



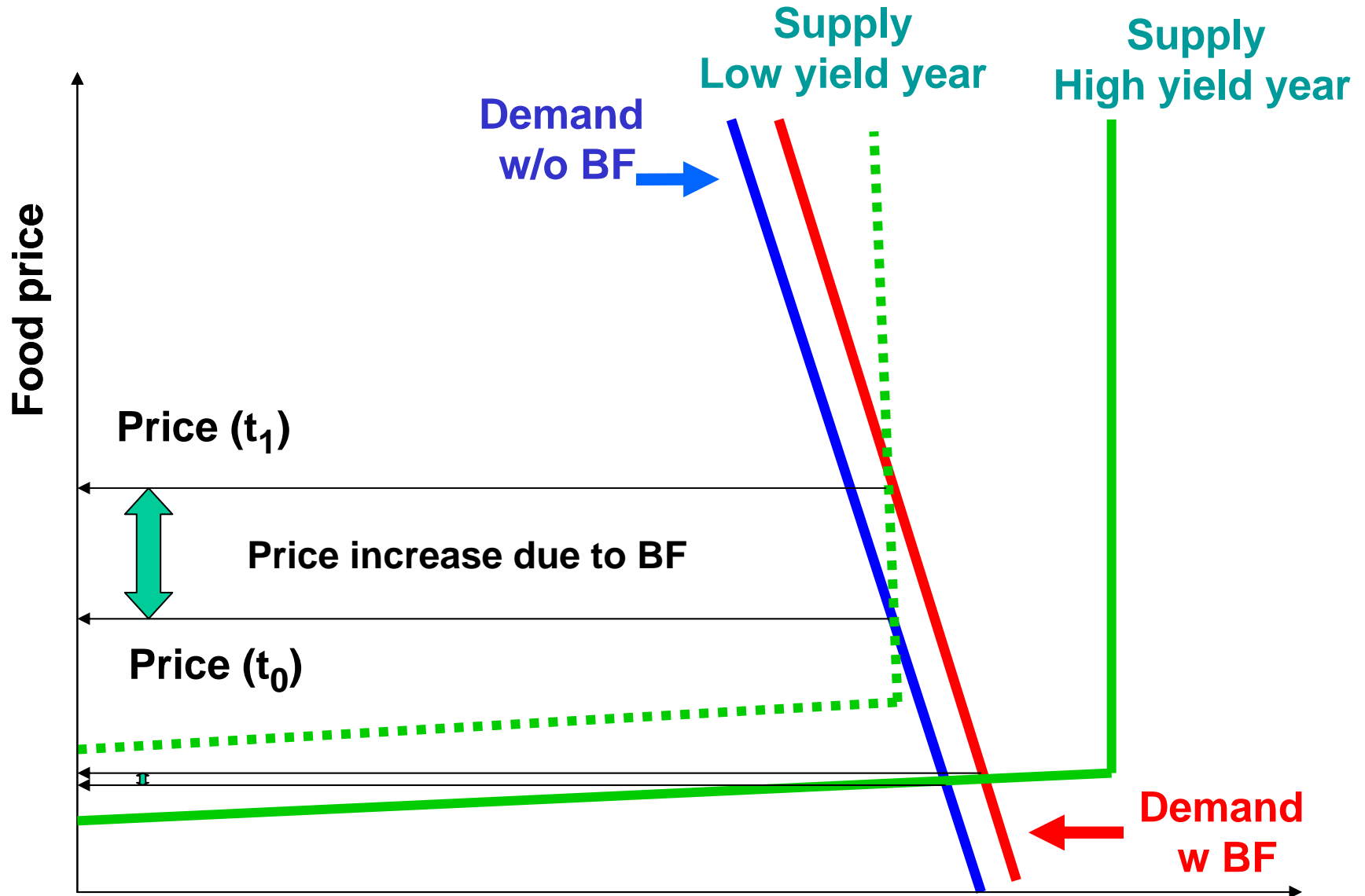
USA: Feedstock use in ethanol production in 2008

(Source: FAPRI,2008)

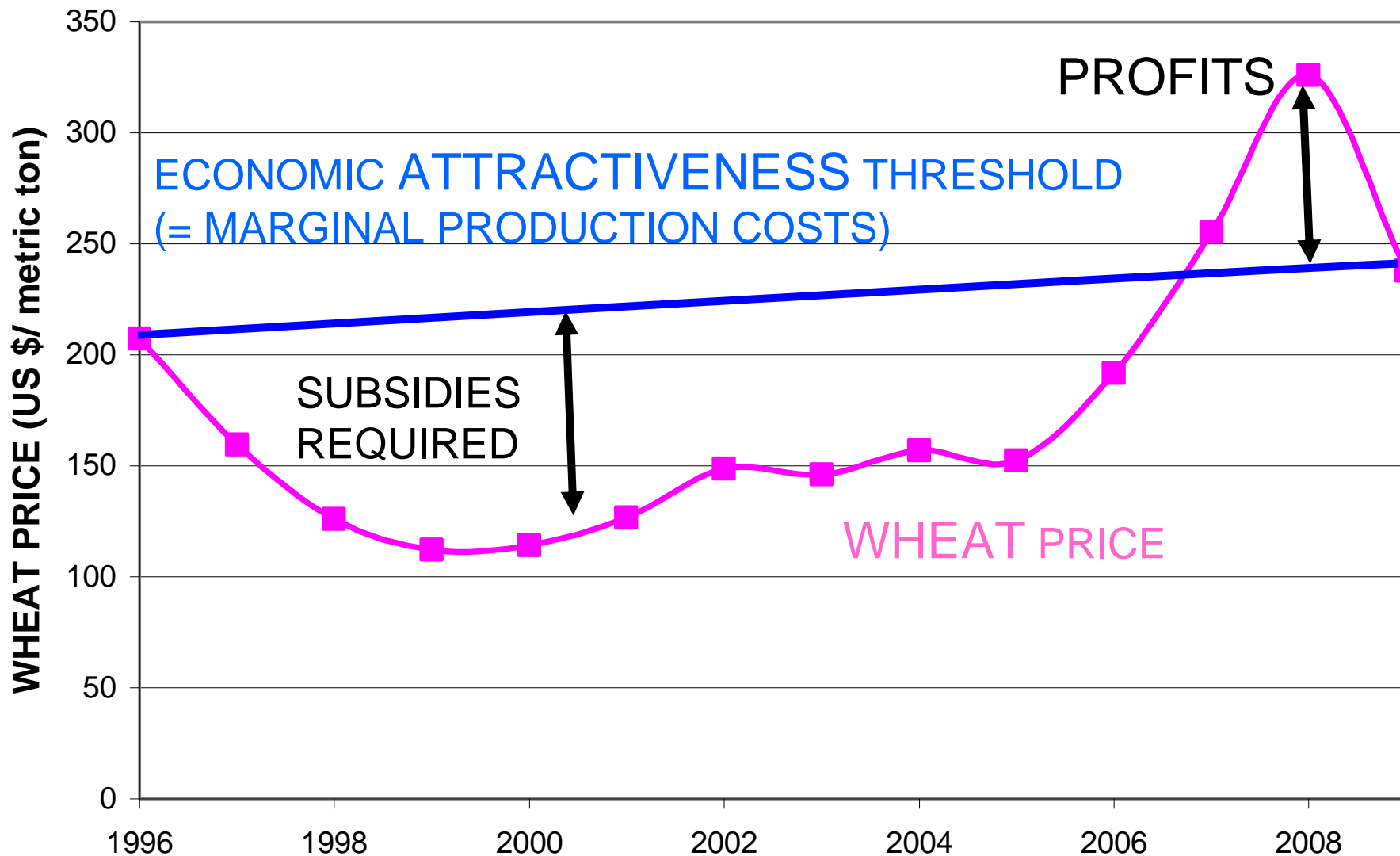


USA: Feedstock use in biodiesel production in 2008

(Source: FAPRI,2008)



# Which price is justified for feedstock price?



# *Food supply and malnourishment in the world*

- 3,7 billion – malnourished people
- Over consumption of food

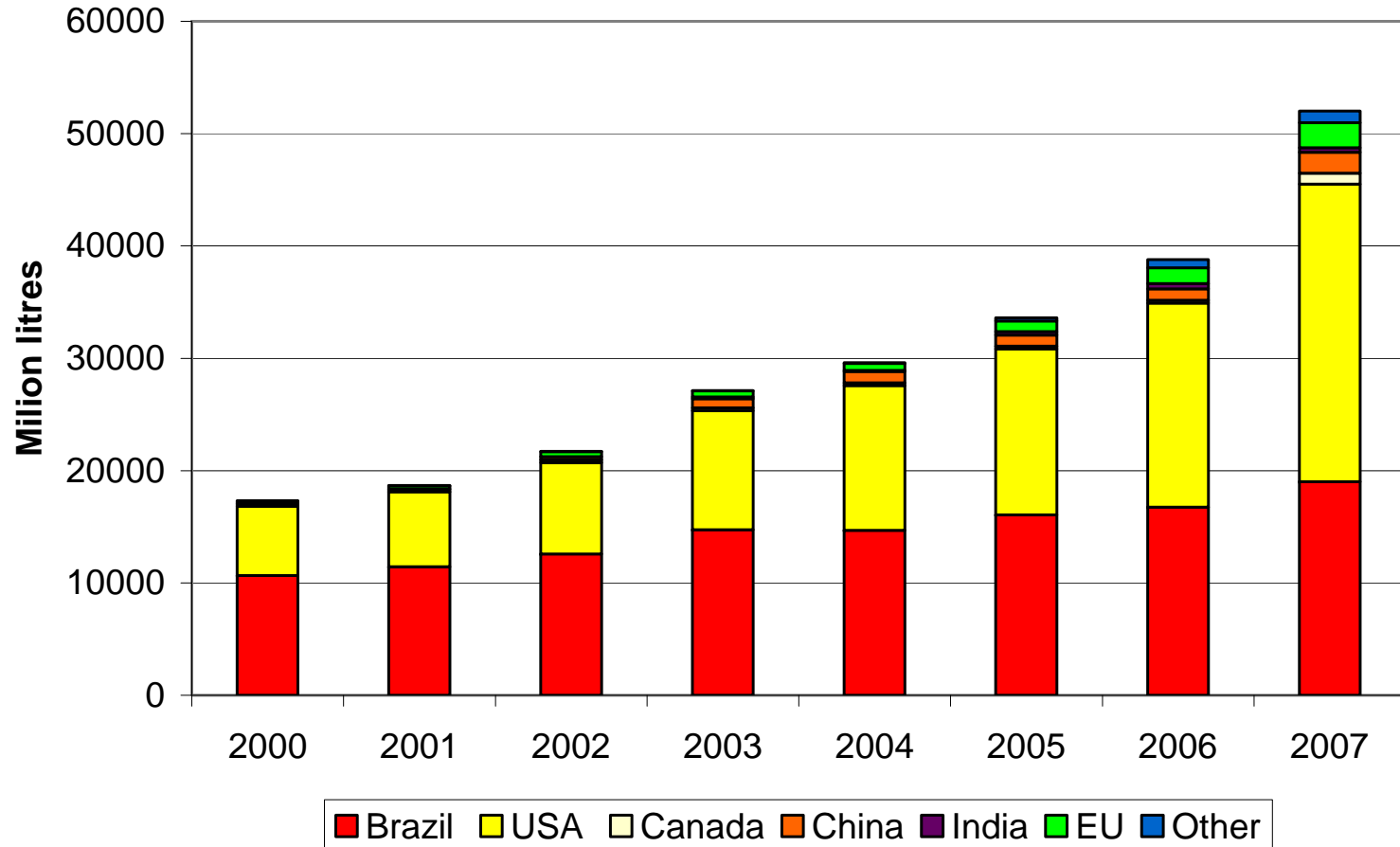
USA - 3800 kcal per day

Male 2400 kcal per day

Female 2000 kcal per day

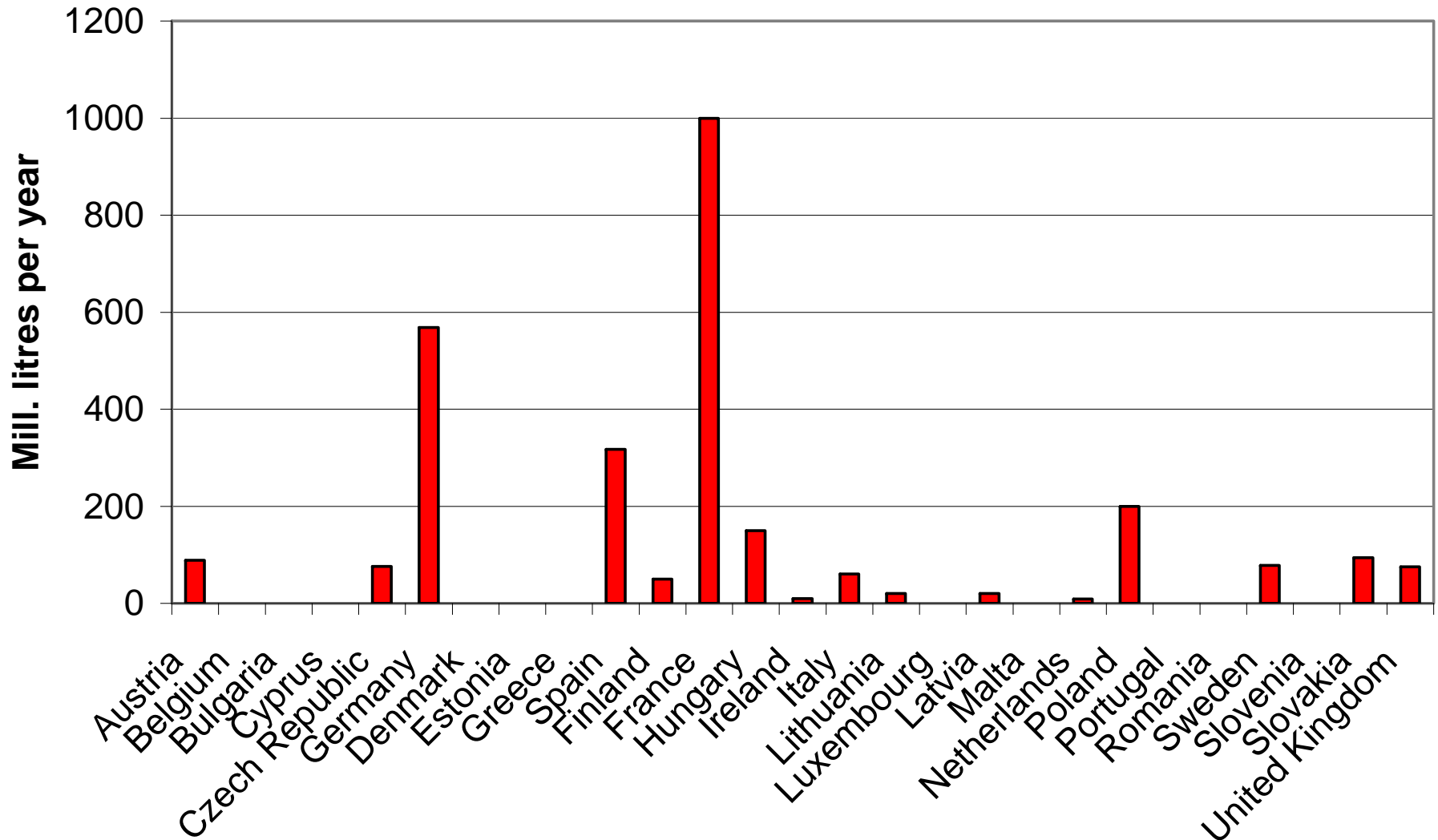
- Cropland:
  - USA - 0.48 ha per capita per year
  - China – 0.08 ha per capita per year
  - World – 0.22 ha per capita per year

## 2. BIOFUELS PRODUCTION



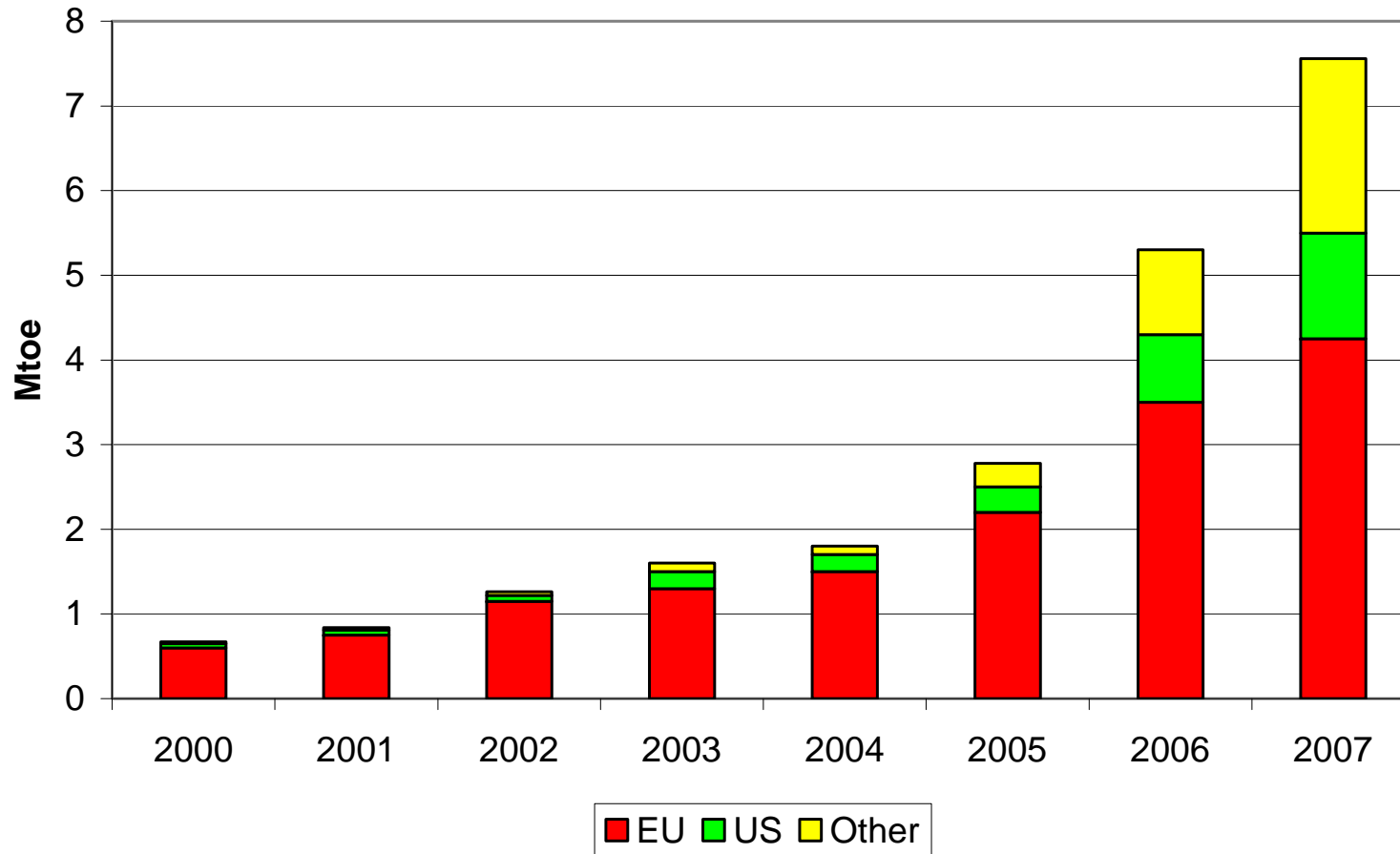
Recent trends in ethanol production (Source: F.O.Licht, IEA)

# Bioethanol EU



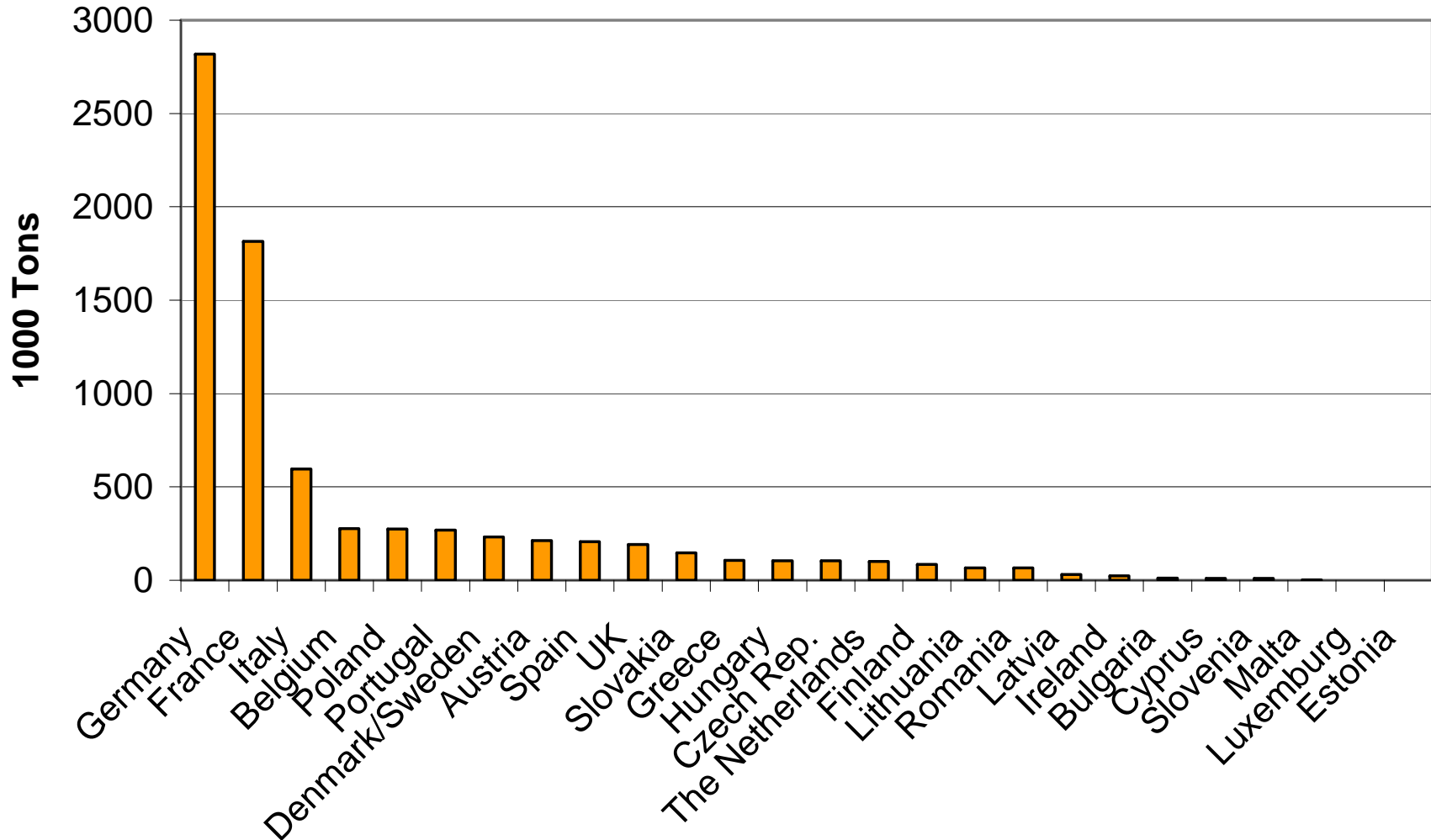
Bioethanol production in EU, 2008 (Source: Biofuels Platform)





Recent trends in biodiesel production (Source: F.O.Licht, IEA)

# Biodiesel EU



Biodiesel production in EU, 2008 (Source: EBB)

## 3. COST OF BIOFUELS

Biofuels costs (BFC)

$$BFC = FC + ACC - Sub$$

- Net feedstock costs (FC)
- Average gross conversion costs (ACC)
- Subsidy for biofuels (Sub)

Net feedstock costs are calculated as:

$$FC = FP - ASub - C_{by-product}$$

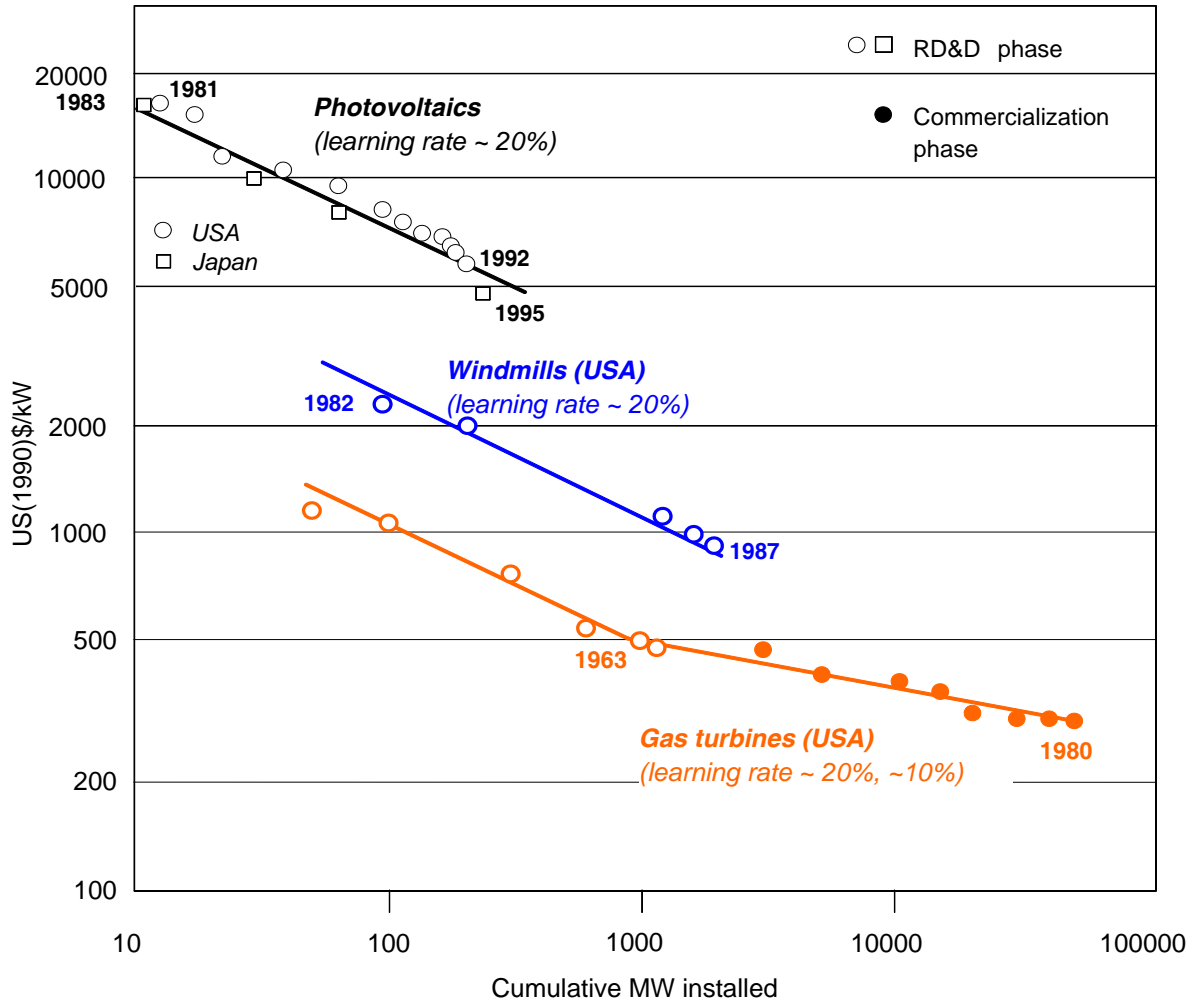
Where:

- FP.....Feedstock price
- ASub.....Agricultural subsidy
- Cby-product..... Credits for by-product

- Average gross conversion costs are calculated as:

$$ACC = CC + LC + EC + MC$$

- Where:
- CC..... Capital costs
- LC..... Labour costs
- EC..... Chemicals, energy costs
- MC..... Costs for maintenance, insurance, taxes



$$C(x) = a \cdot x^{-b}$$

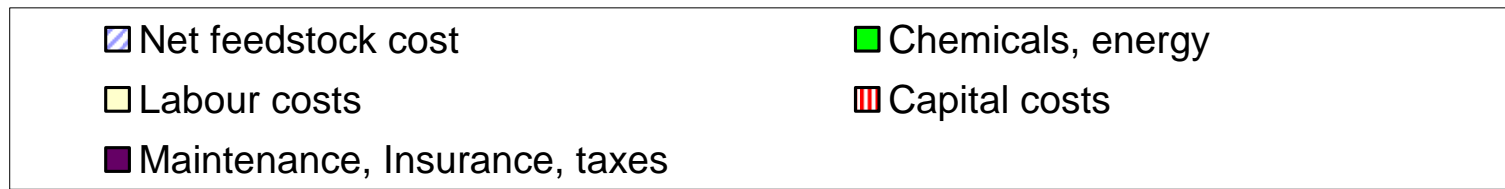
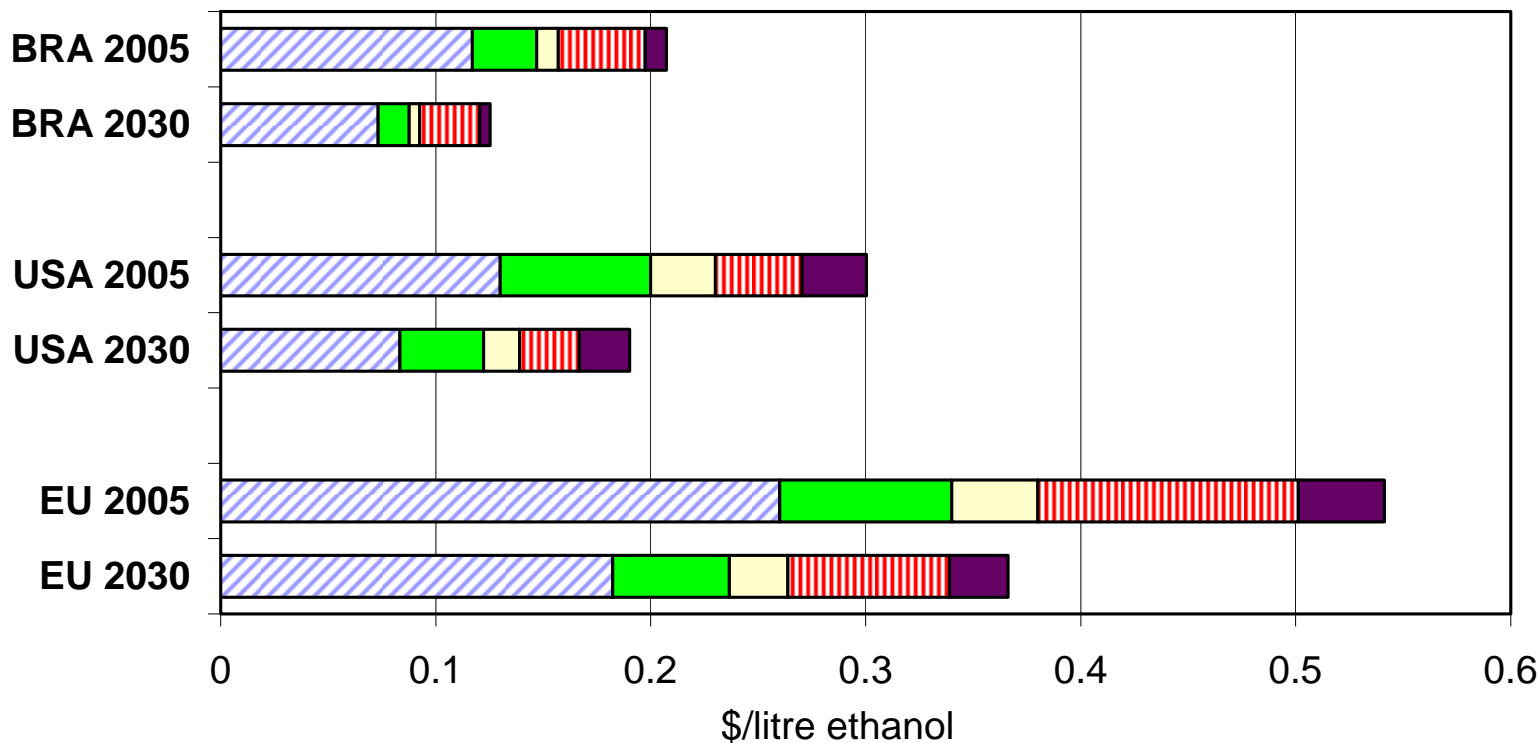
$C(x)$ : Specific cost  
 $x$ : Cumulative capacity  
 $b$ : Learning index  
 $a$ : Specific cost of the first unit

$$p = 2^{-b}$$

$P$ : progress ratio

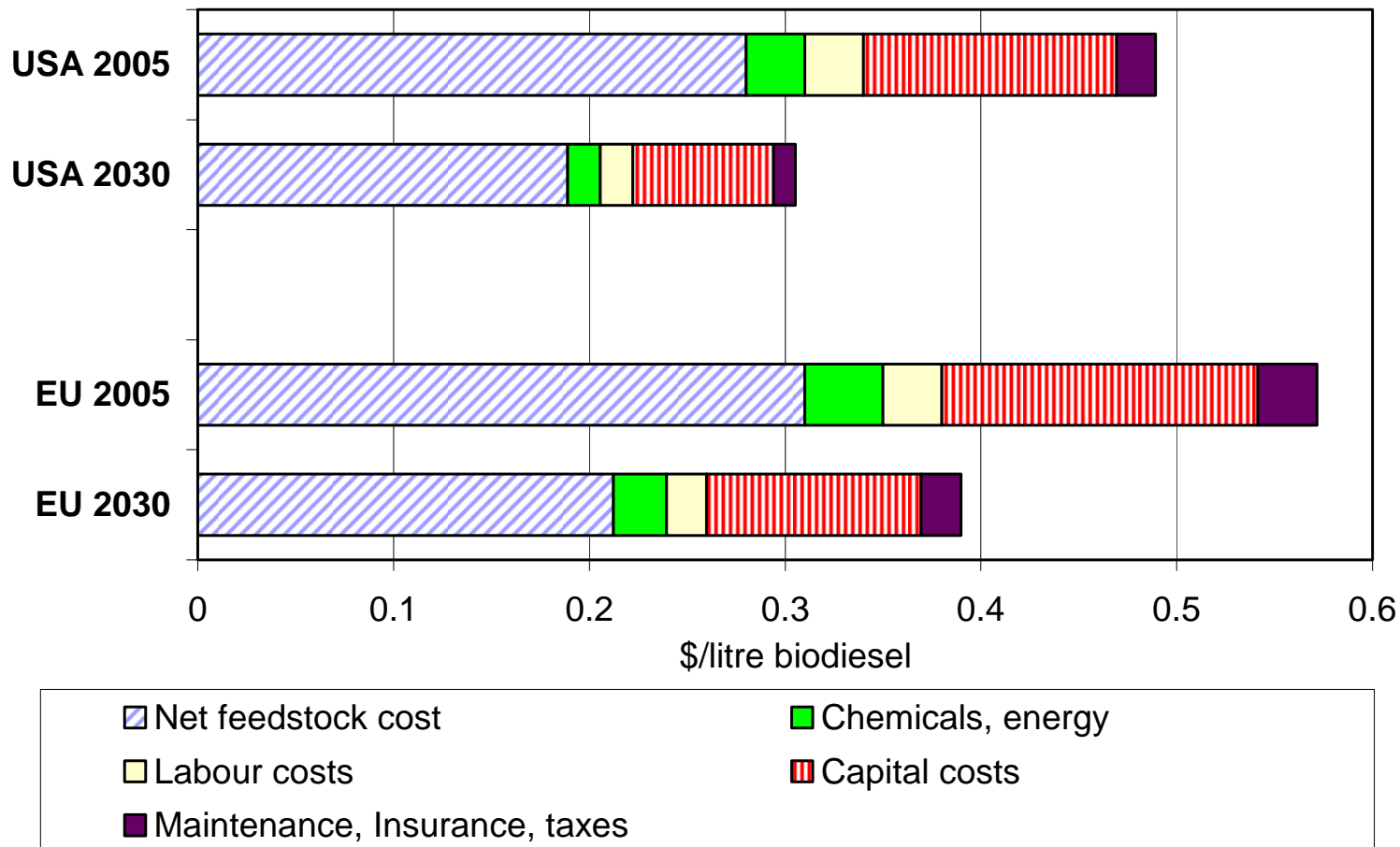
Technology learning curves

# Bioethanol production costs



Cost structure of bioethanol

# Biodiesel production costs

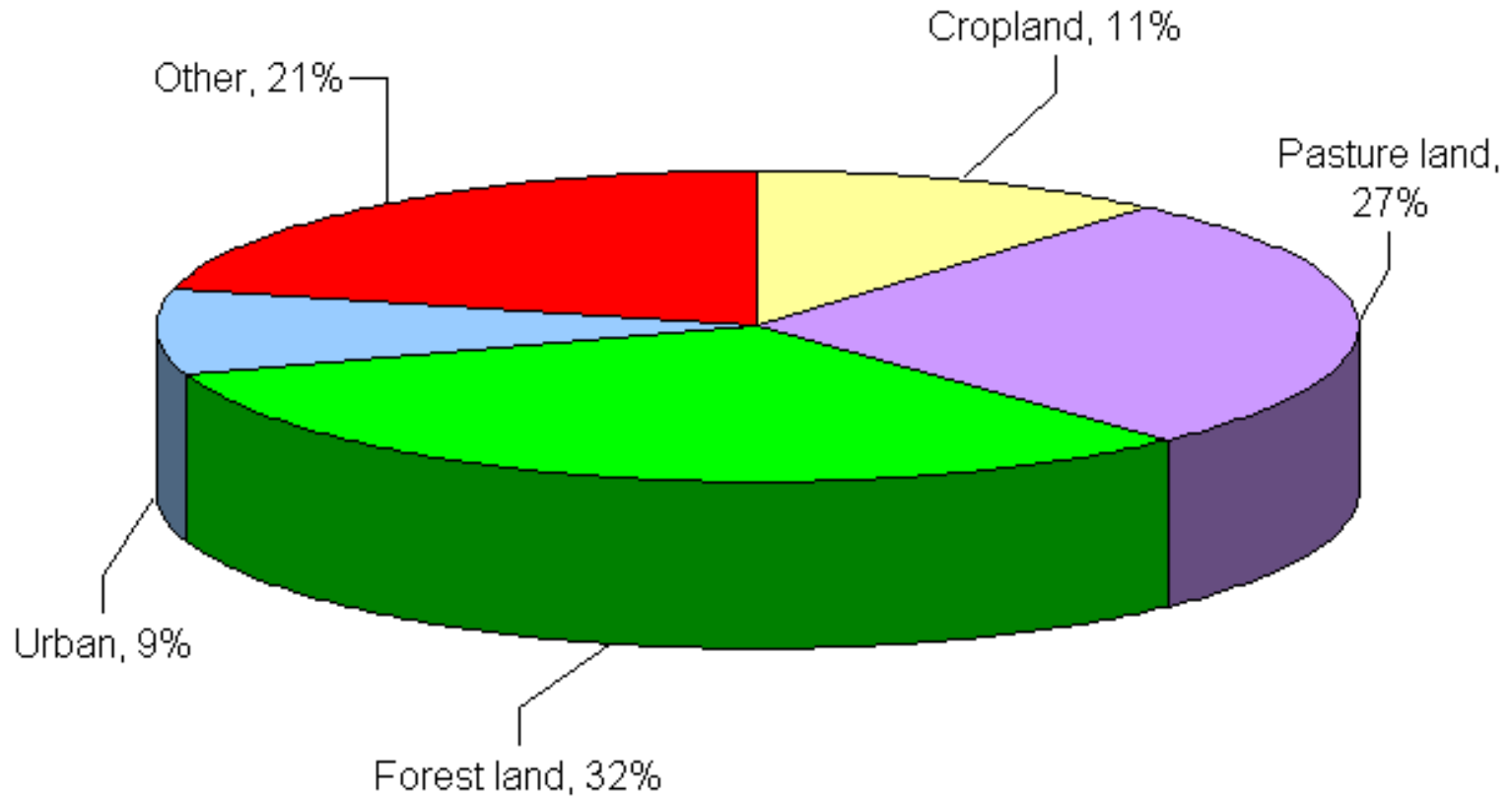


Cost structure of biodiesel



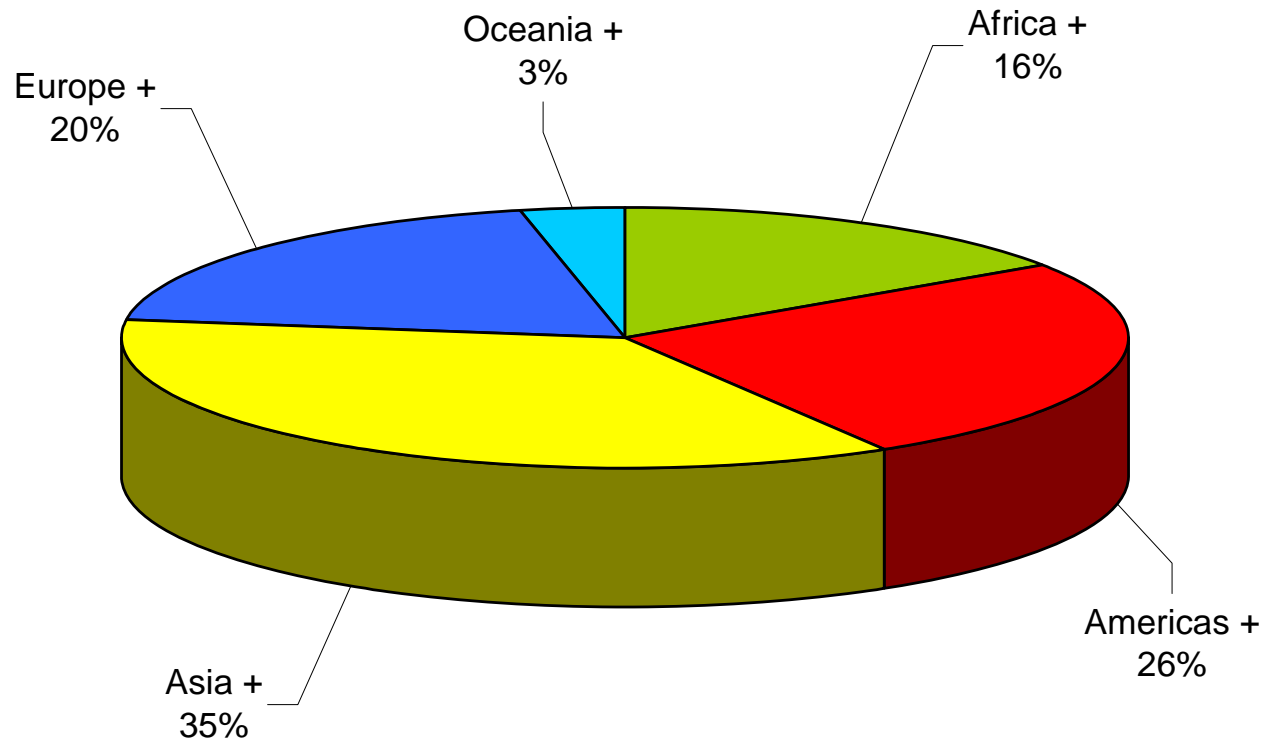
# 4. BIOMASS RESOURCES AND LAND USE

# Land area

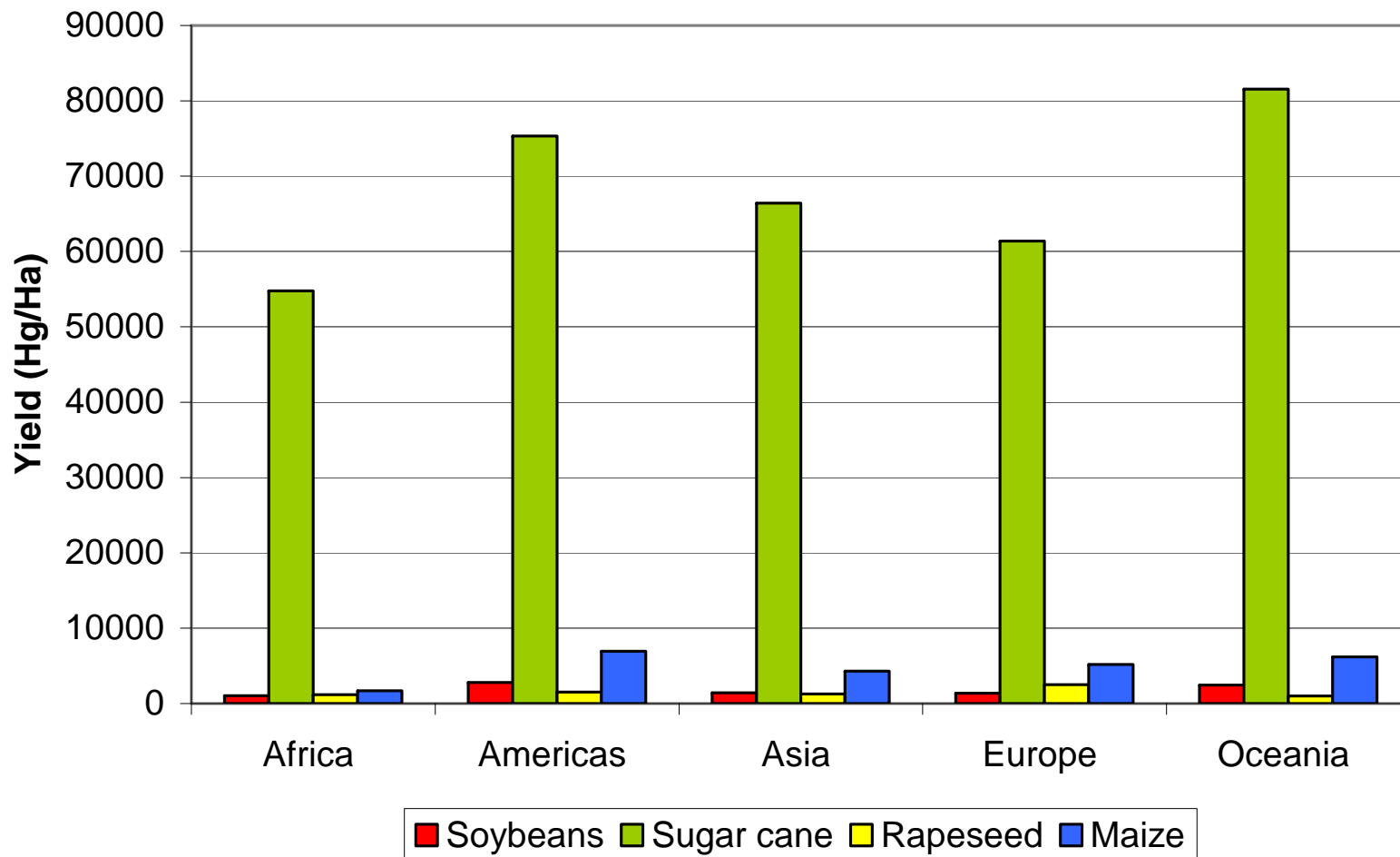


Land area (Source: FAOSTAT)

# Arable land

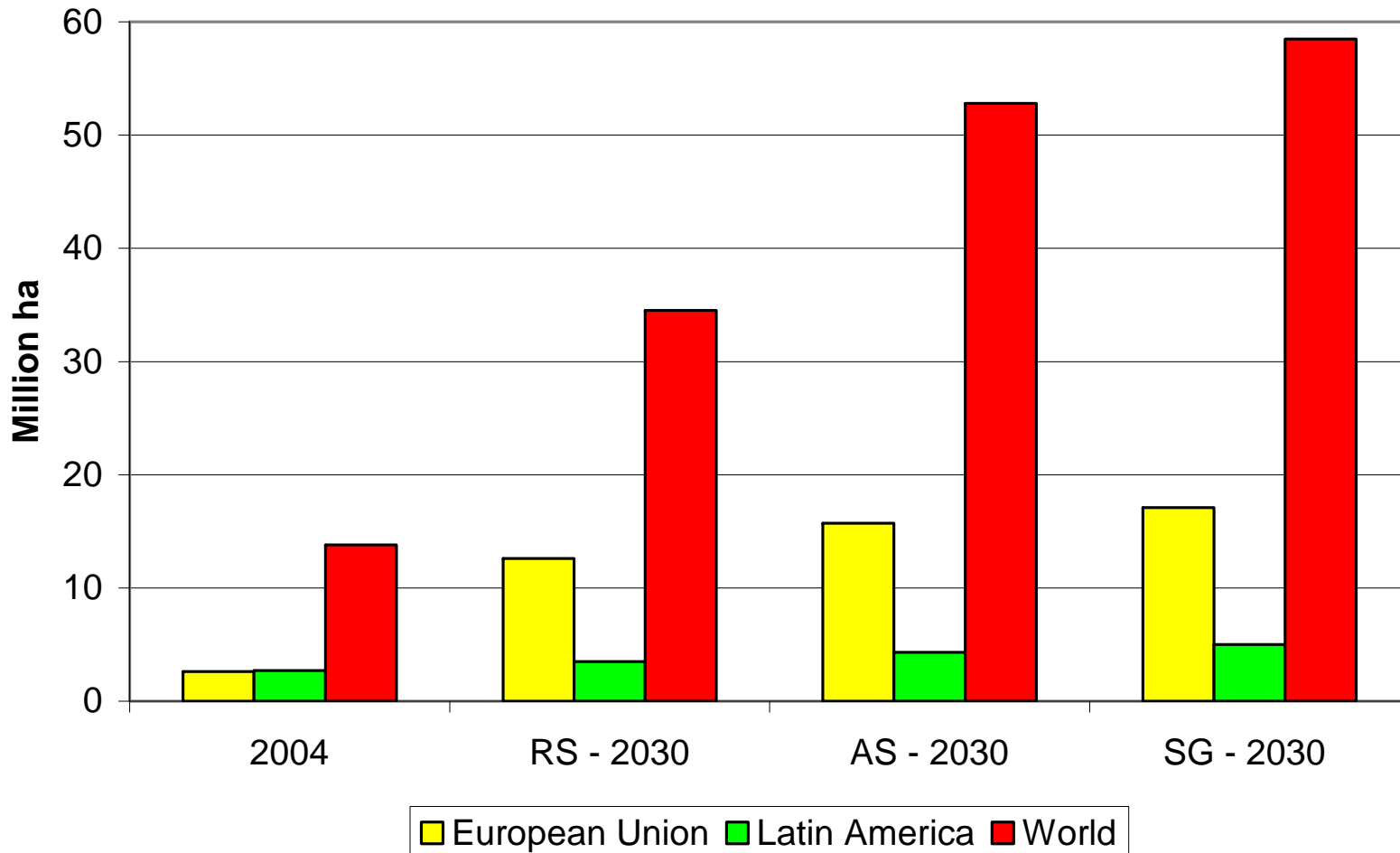


Arable land, (Source: FAO,2007)



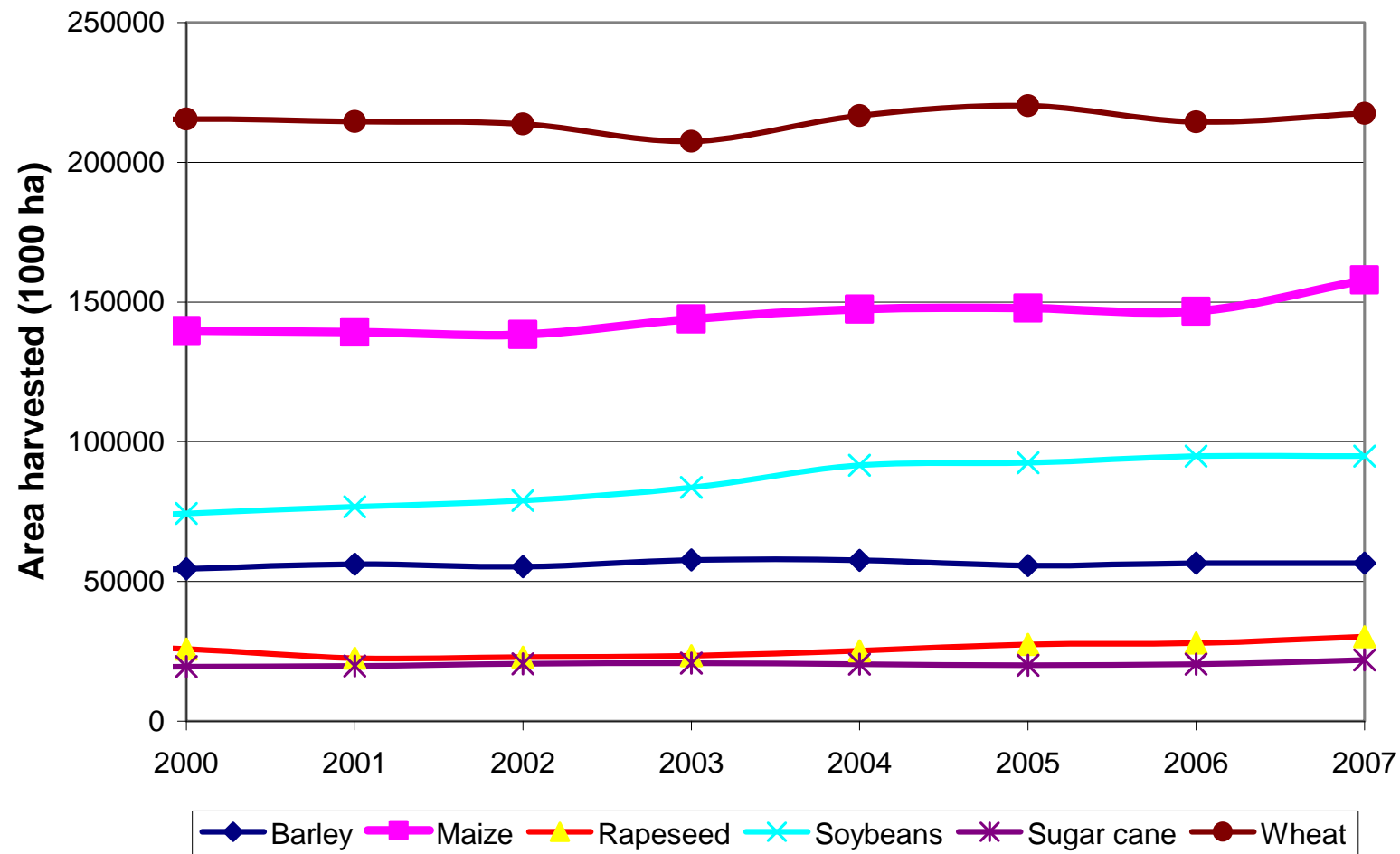
Yield 2007 (Source: FAO,2007)

# Land requirements

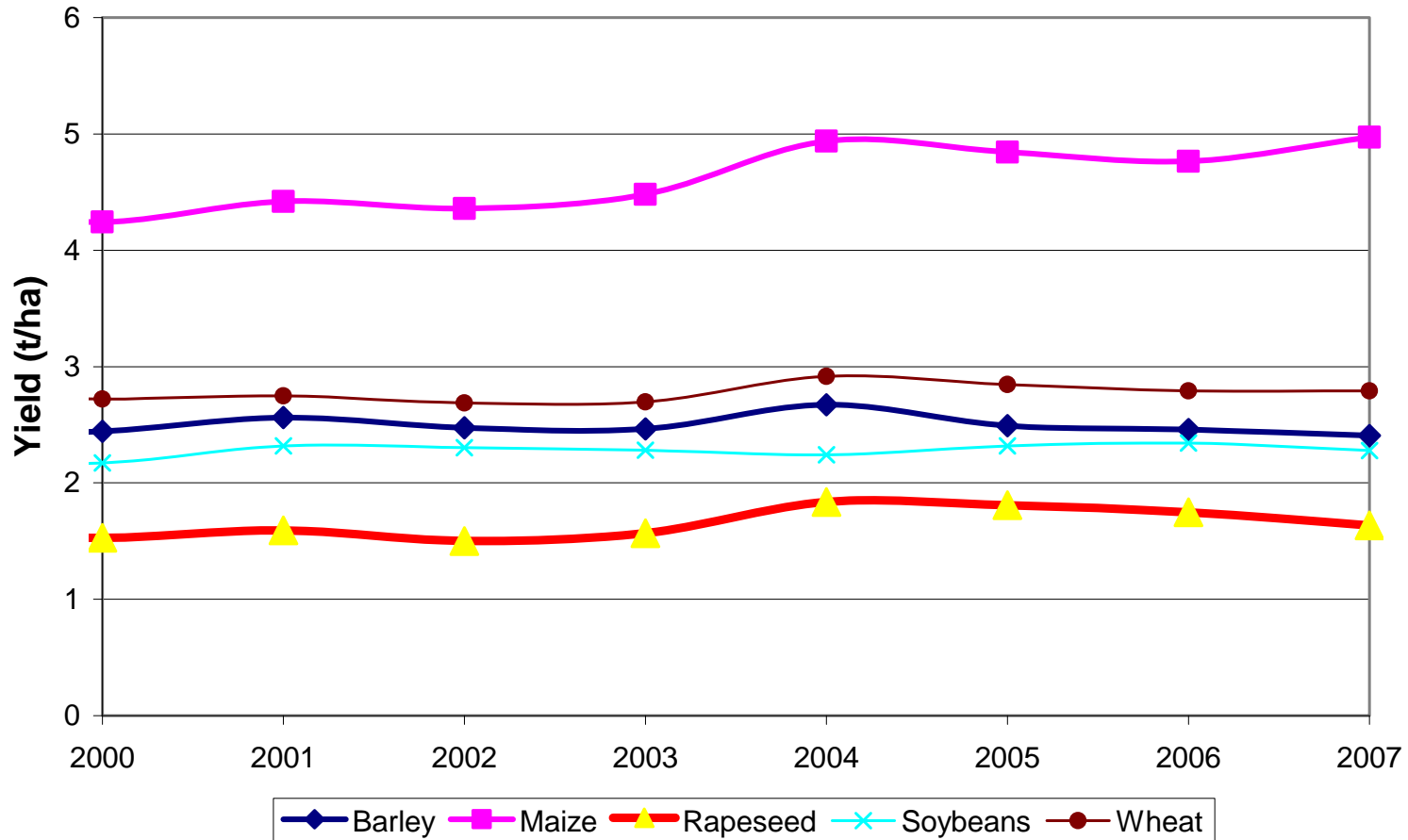


Land requirements for biofuels production (Source: WEO,2006)

# Area harvested

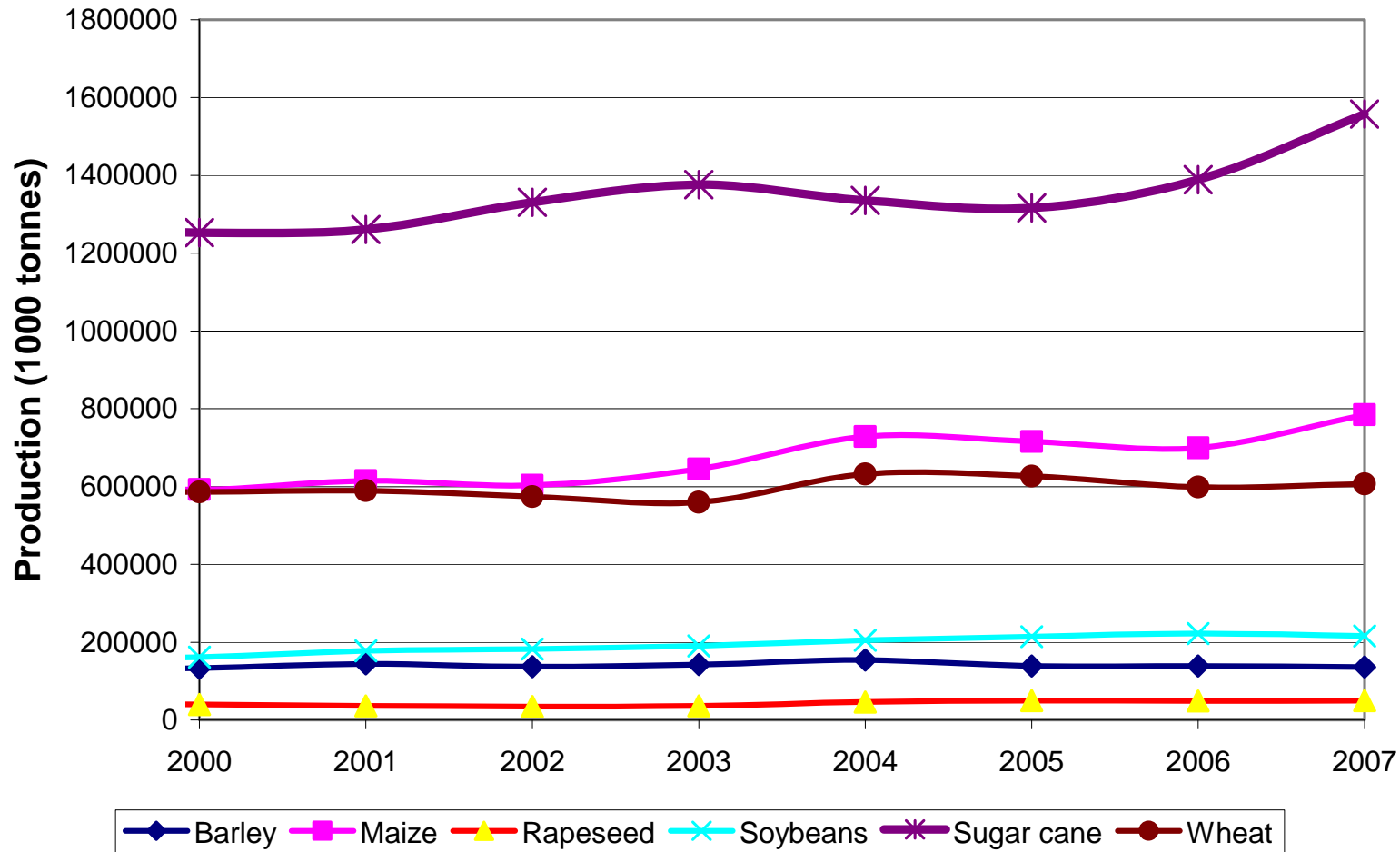


World-wide: Area harvested (Source: FAOSTAT)



Yield (Source: FAOSTAT)

# Production of feedstock

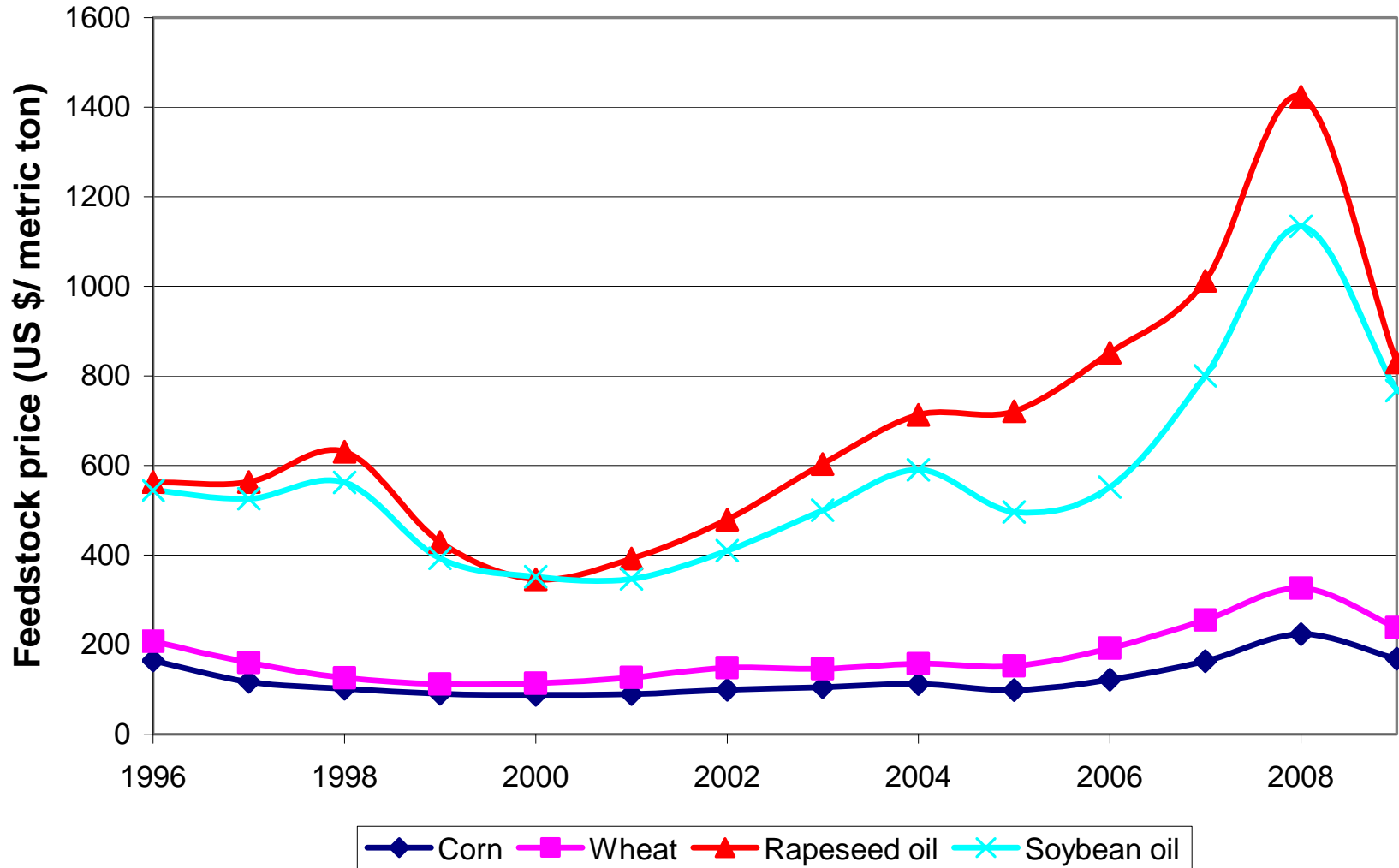


World-wide production of major feedstock (Source: FAOSTAT)



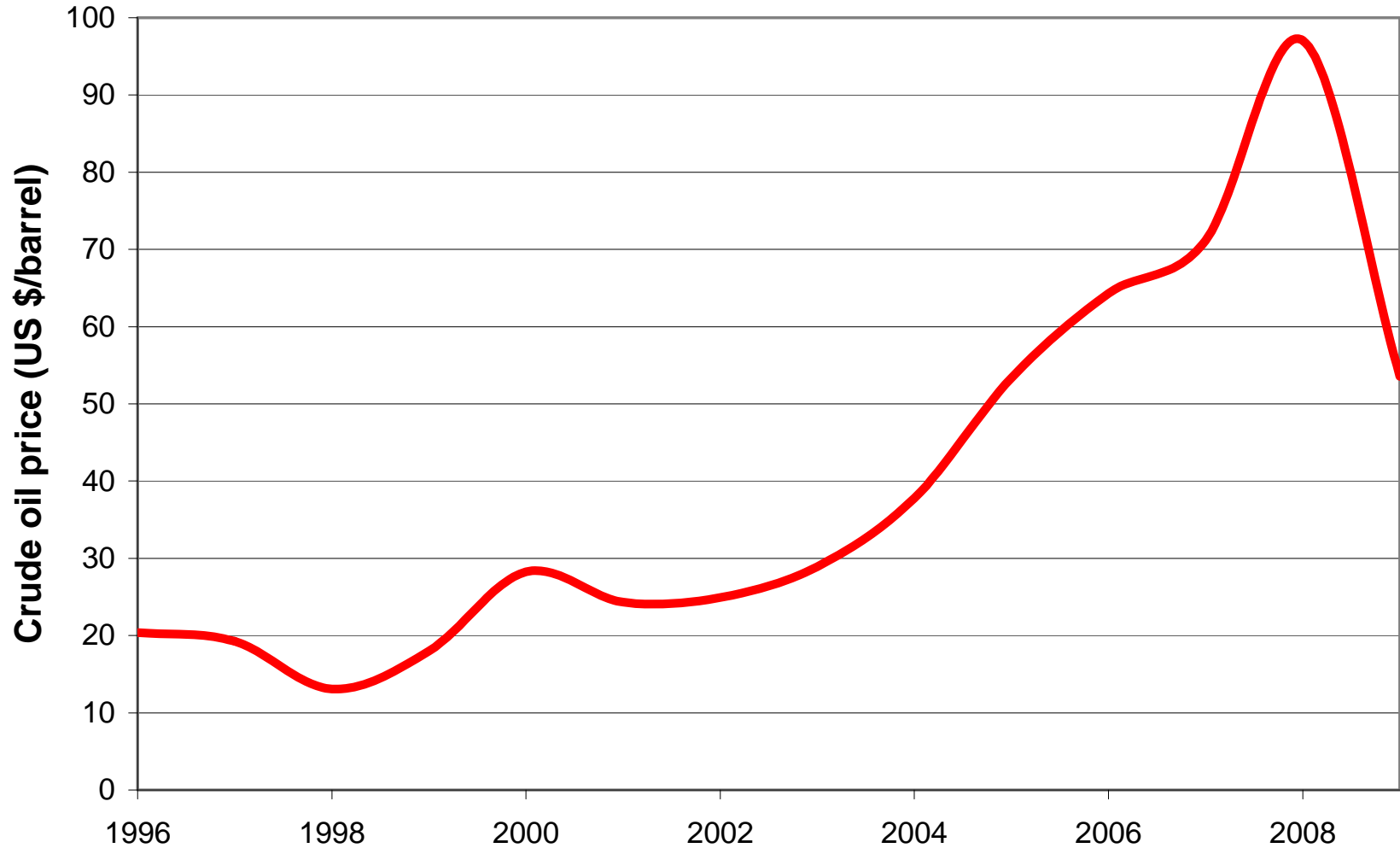
# 5. FEEDSTOCK PRICES

# Feedstock prices



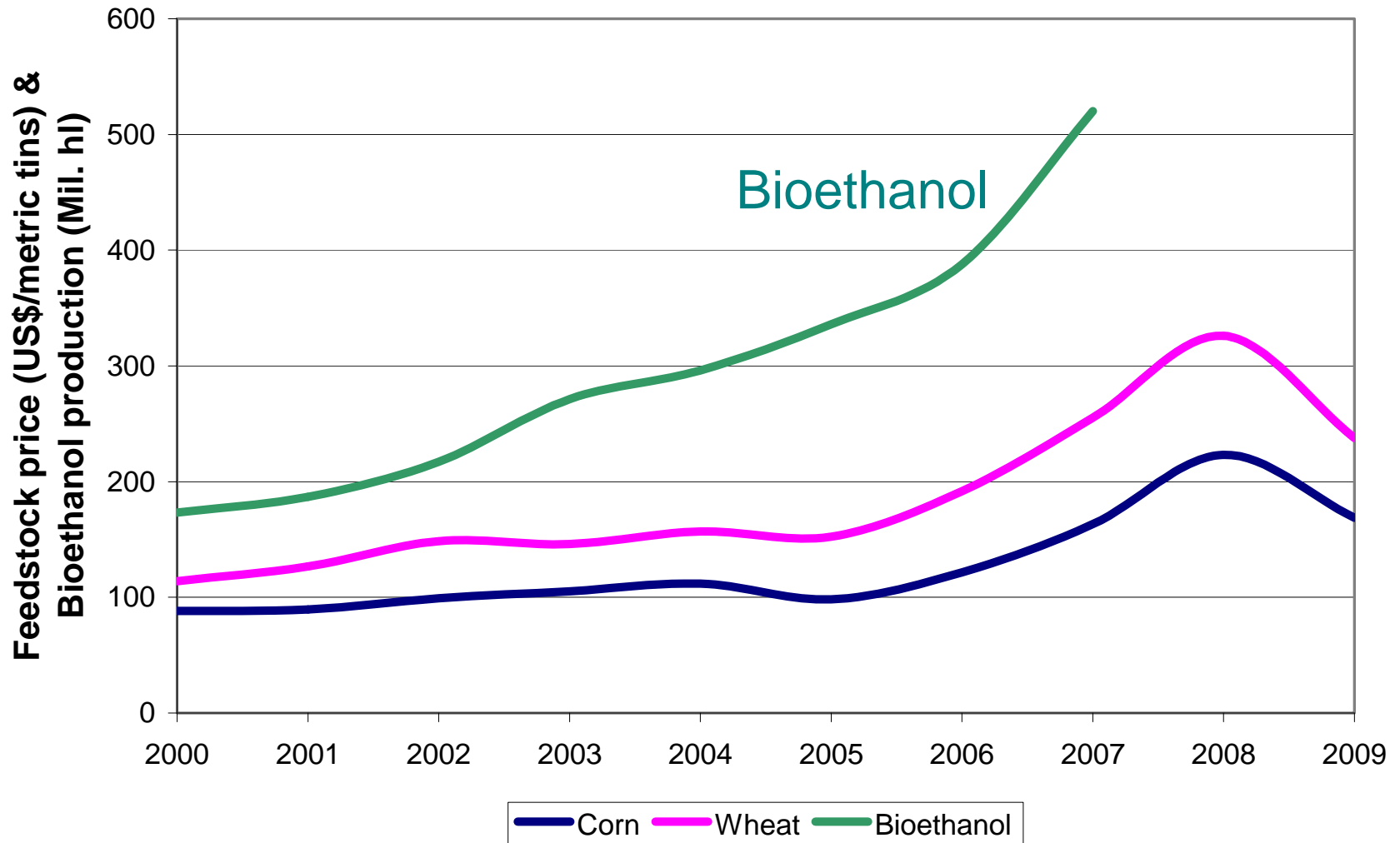
Feedstock prices for period 1996-2009 (Source: International Monetary Fund)

# Crude oil price

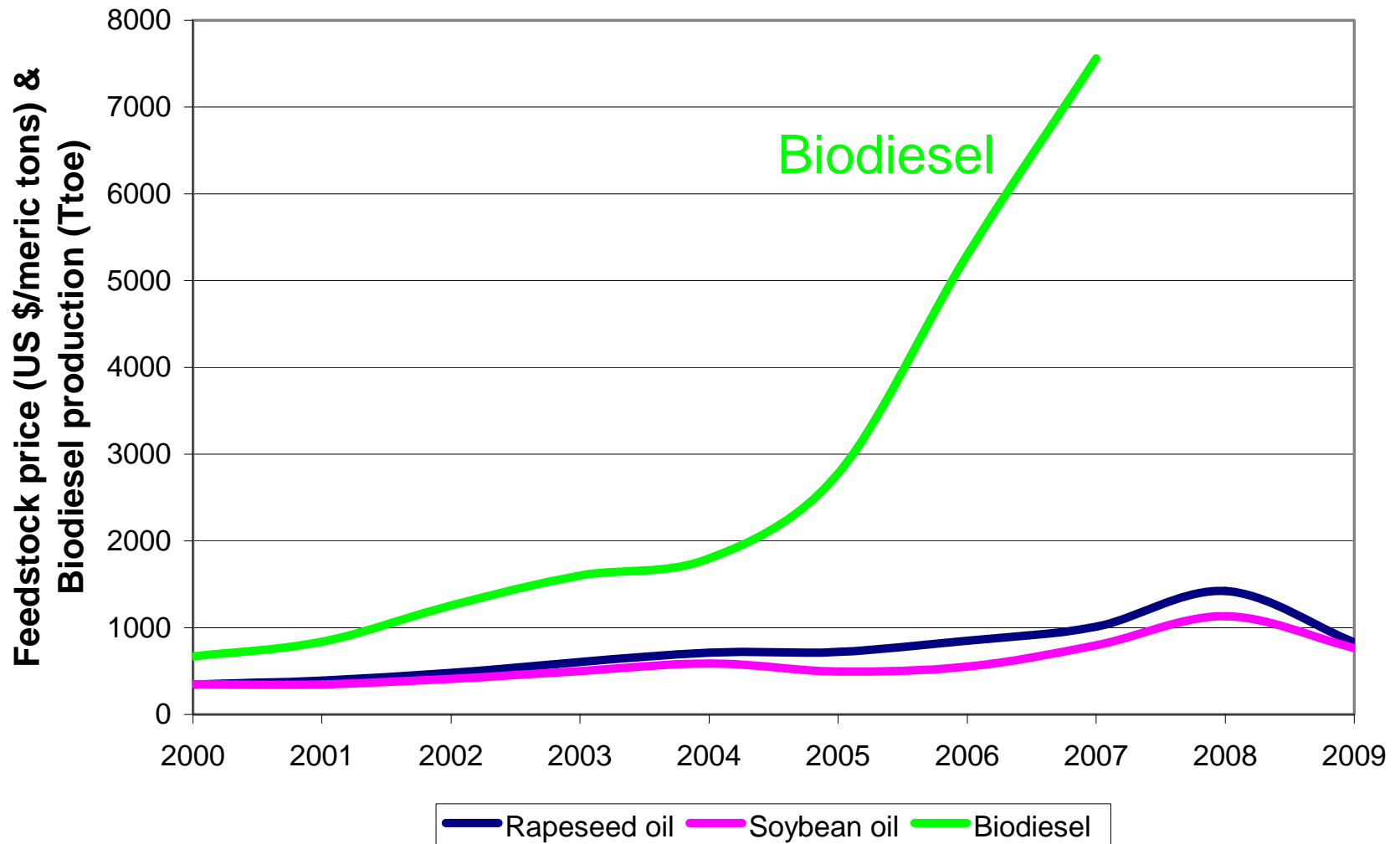


Crude oil price for period 1996-2009 (Source: International Monetary Fund)

# *Feedstock prices vs bioethanol production*



# *Feedstock prices vs biodiesel production*



## 6. CONCLUSIONS

# Conclusions

- The use of feedstocks – also used for food production- may increase feedstocks prices at some points-of-time – mainly due to increases in feedstocks demands and corresponding higher marginal costs.
- Within the period 2000-2009 the increase in feedstocks prices cannot be only consequence of increasing biofuels production. There were considerable volatilities in feedstocks prices. Yet, the by far largest part of these volatilities was caused by other impact parameters as there are oil price and speculation.
- That leads to the ultimate conclusion that the argument, that biofuels production has a significant impact on rising feedstocks prices, does not hold.

**Thank you for attention!**