

# Biofuels

Wednesday, May 2, 2012; 8:00 AM – 9:15 AM

## Moderator:

**Joel Kurtzman**, Senior Fellow and Executive Director of the Center for Accelerating Energy Solutions, Milken Institute

## Speakers:

**Lynde Coit**, Senior Advisor to the President and CEO, Plasco Energy Group

**Chris Groobey**, Partner, Wilson Sonsini Goodrich & Rosati

**Richard Kauffman**, Senior Advisor to the U.S. Secretary of Energy

**Brian Chase**, Senior Consultant/Advisor, Chevron

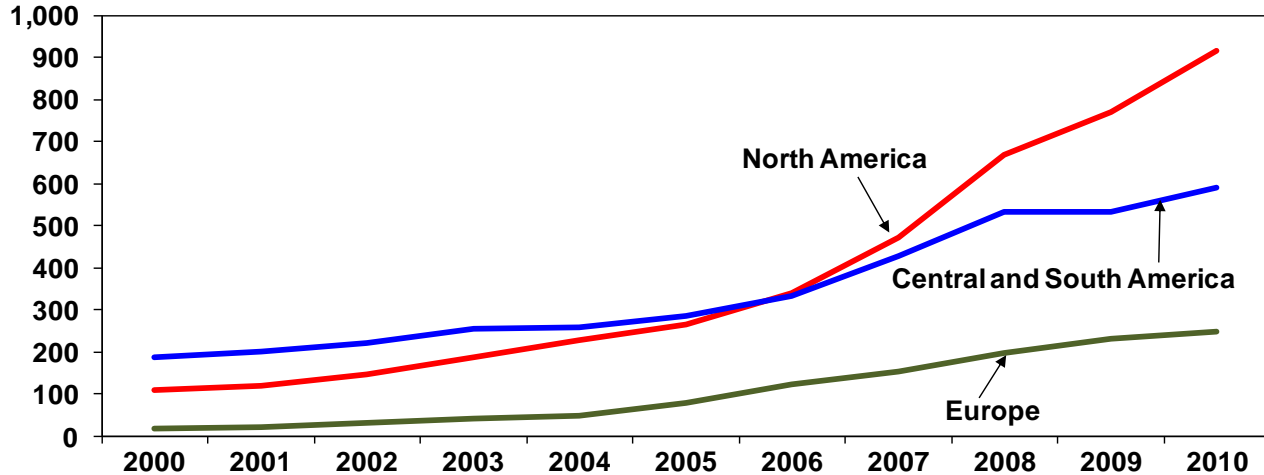
# Global biofuel production increased four-fold from 2000 to 2010



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## *Biofuel production by region*

Thousand barrels per day



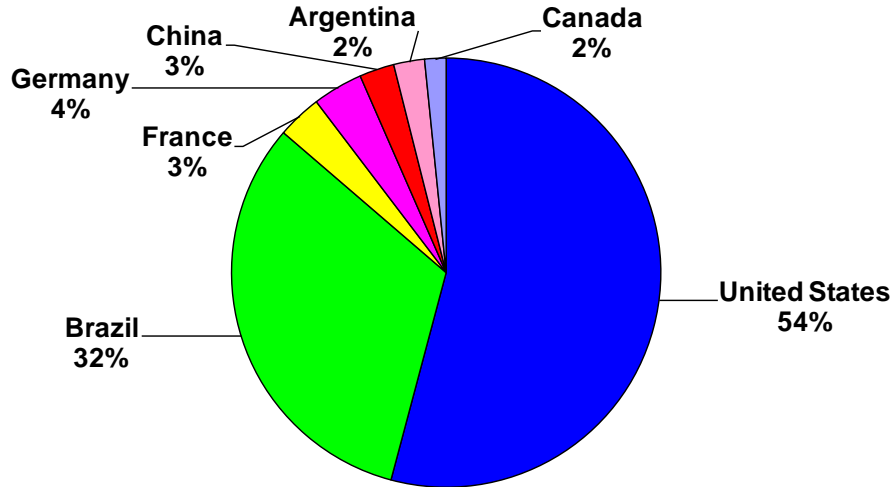
Source: U.S Energy Information Administration.

# U.S. accounts for more than half of global biofuel production

*Global biofuel production, 2010*



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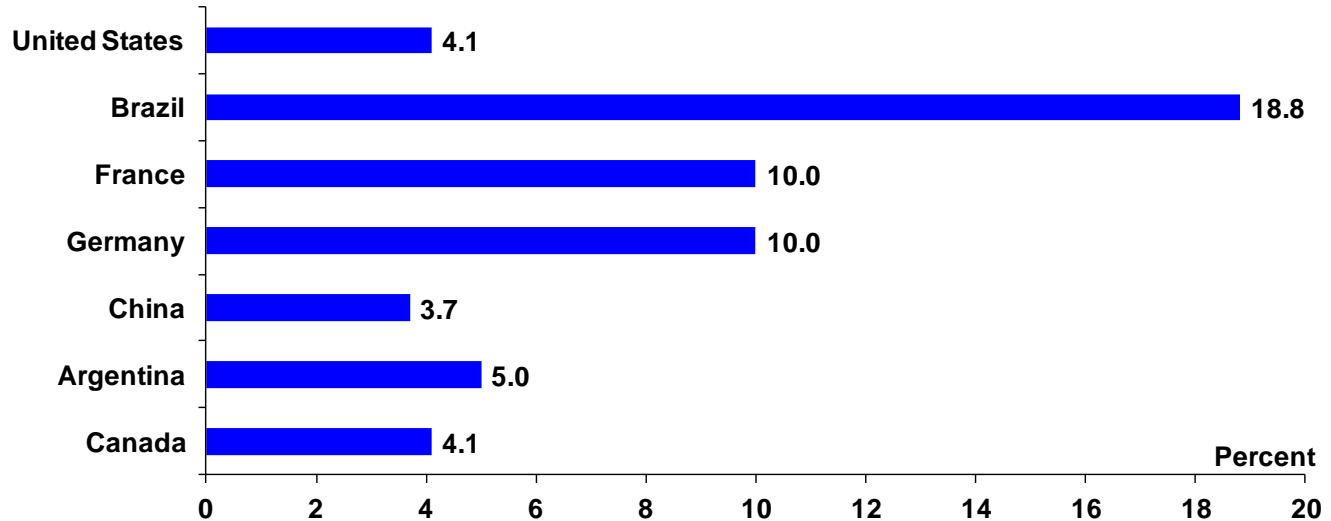
Source: U.S Energy Information Administration.

# U.S. biofuel represents a small share of its total liquid fuel market



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*Biofuel market share (liquid fuel) by leading global biofuel producers*



Source: The World Bank.

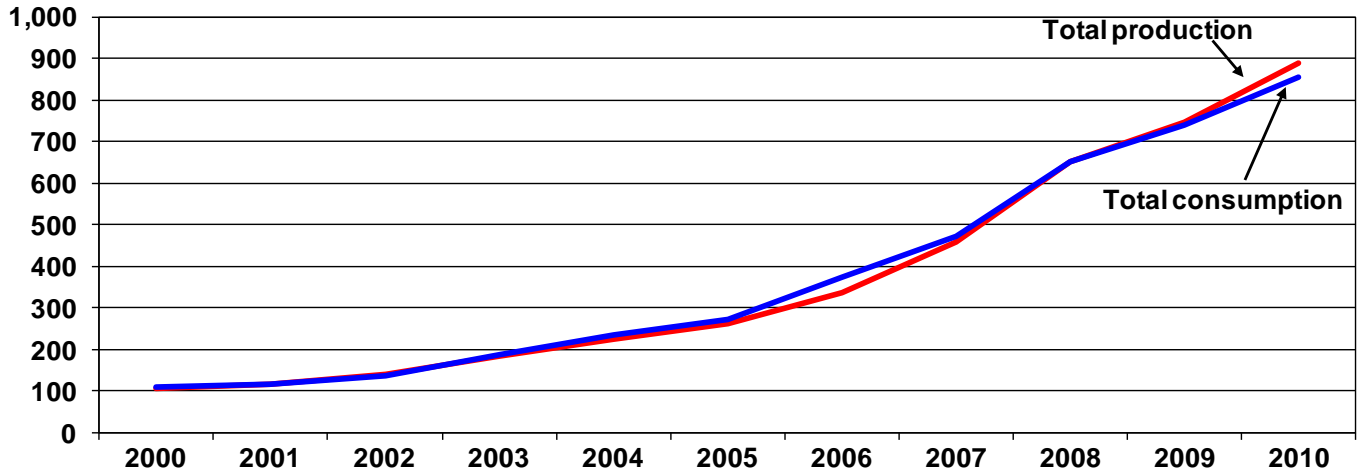
# U.S. biofuel production has increased more than seven-fold since 2000



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## *Domestic biofuel production*

Thousand barrels per day



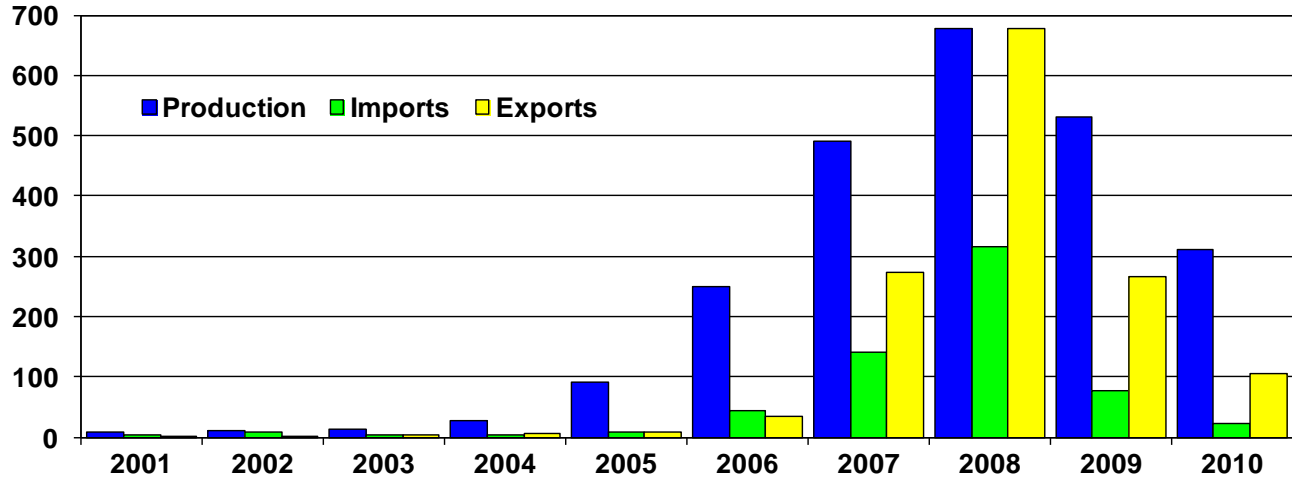
Source: U.S. Energy Information Administration.

# After peaking in 2008, U.S. biofuel exports have decreased



## *U.S. biofuel trade*

Million gallons



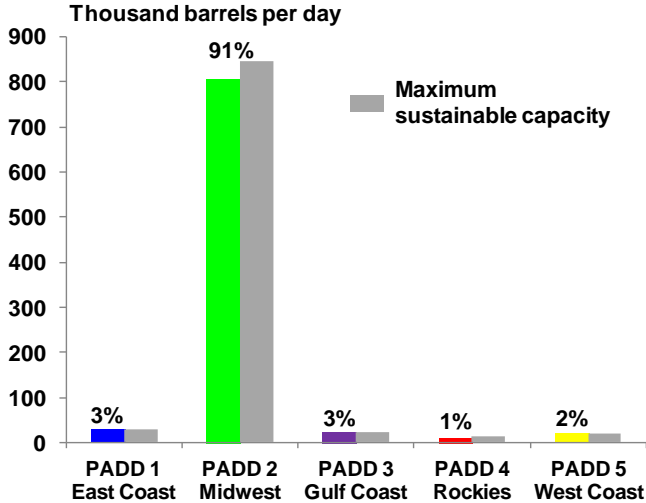
Source: U.S. Energy Information Administration.

# The Midwest produces the largest volume of ethanol

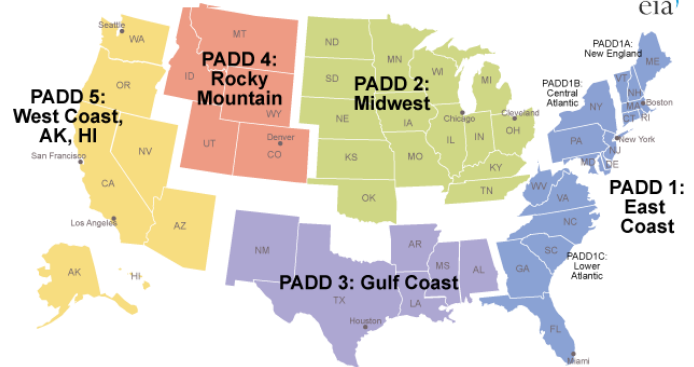
*U.S. ethanol plant production capacity, January 2011*



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Petroleum Administration for Defense Districts



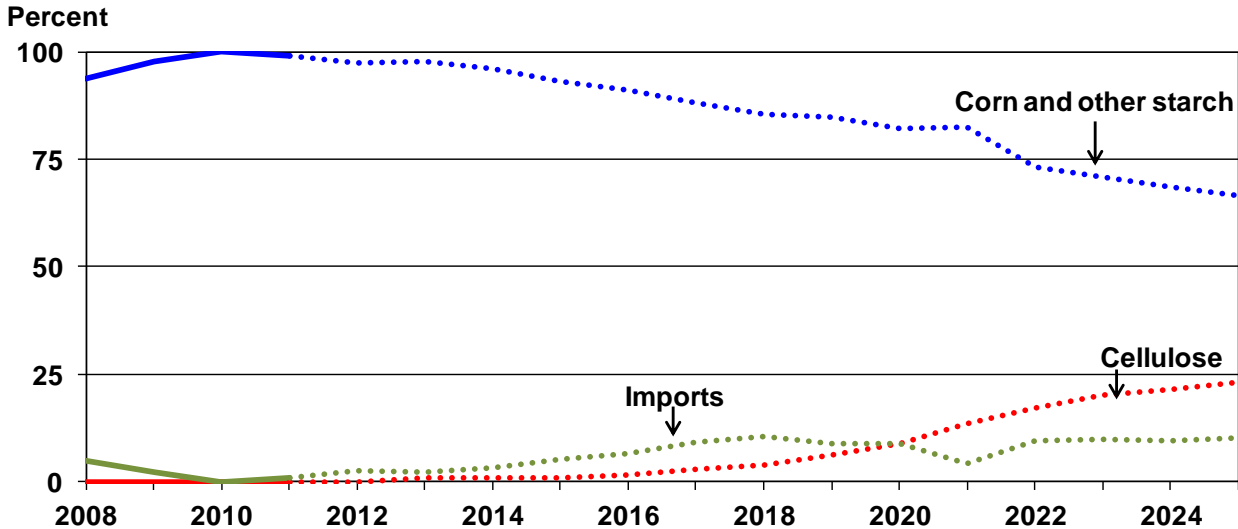
Source: U.S. Energy Information Administration.

# U.S. cellulosic ethanol market share is expected to increase in the next decade



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*Projected domestic market share from ethanol sources*



Source: U.S. Energy Information Administration.

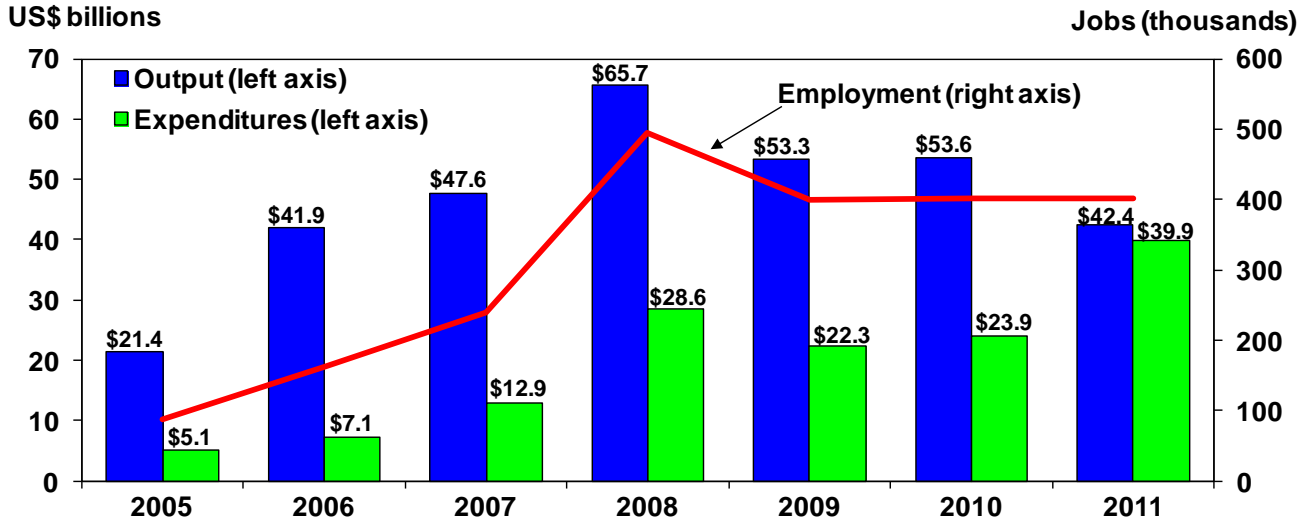


# U.S. ethanol industry is a significant contributor to GDP



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## *Economic impacts of the U.S. ethanol industry*



Source: Cardno ENTRIX, Renewable Fuels Association (RFA).

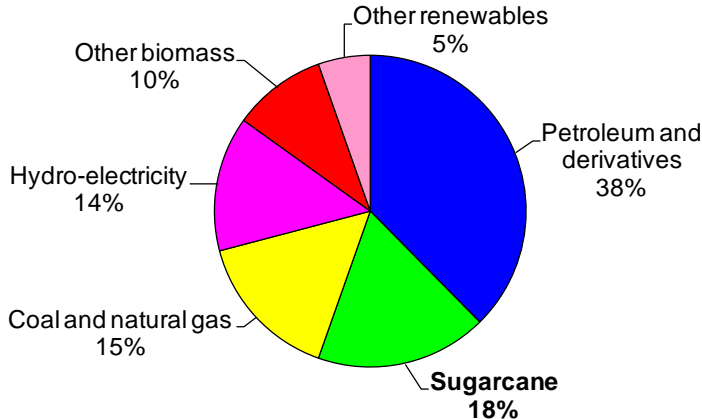
\*Includes direct, indirect, and induced impacts; includes construction, R&D, manufacturing, and agriculture industries.

# Sugarcane is top source of renewable energy in Brazil

*Brazilian energy production make-up, 2011*



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- **Sugarcane production: 620.1 million tons**
- **Ethanol production: 27.4 billion liters (domestic consumption and exports: 25.5 and 1.9 billion liters respectively)**
- **Revenue: US\$50+ billion**
- **Export earnings: US\$13.8 billion**
- **Direct employment: 1.3 million jobs**

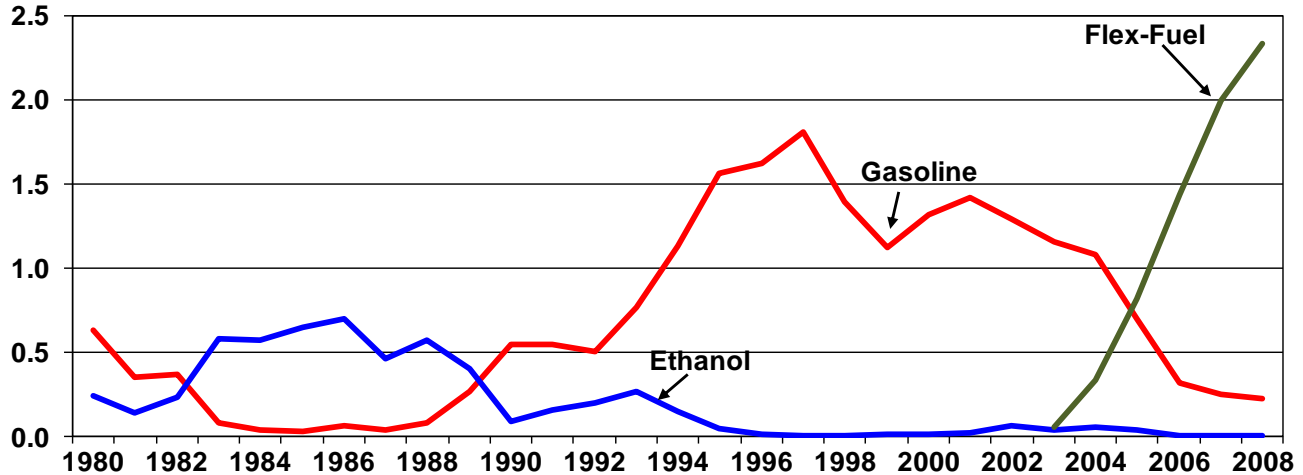
Source: The Brazilian Sugarcane Industry Association (UNICA) and sugarcane.org.

\*2010 data

# Flex-fuel vehicles in Brazil represent approximately 83 percent of the market

## *Types of vehicles sold in Brazil*

Millions of vehicles sold



Source: The Brazilian Sugarcane Industry Association (UNICA).

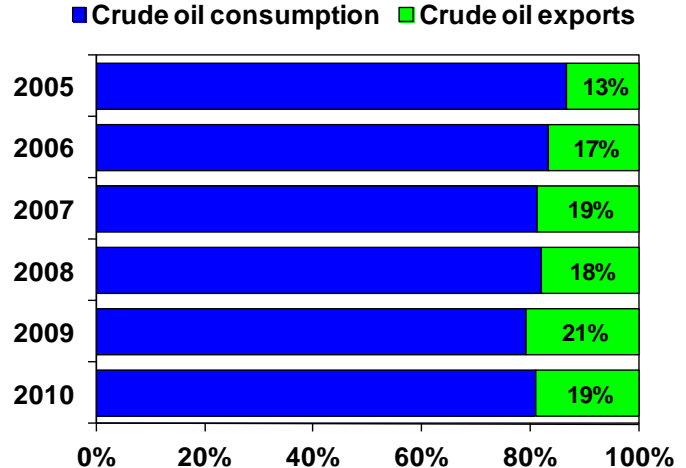
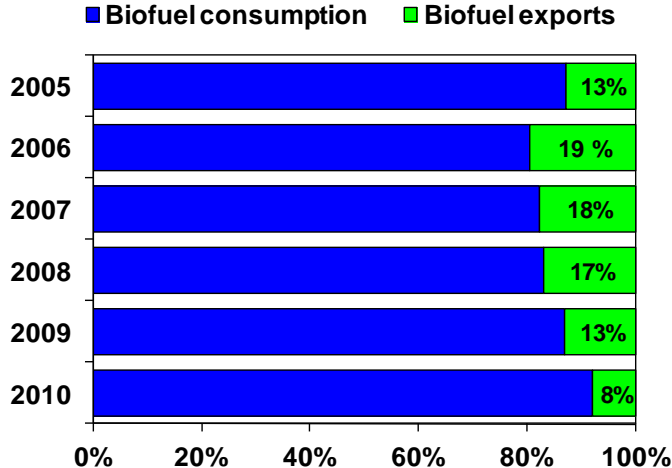
\*Flex-fuel production began in 2003

# How much of Brazil's biofuel and oil is consumed domestically vs. exported?



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## *Brazilian biofuel and crude oil production make-up*



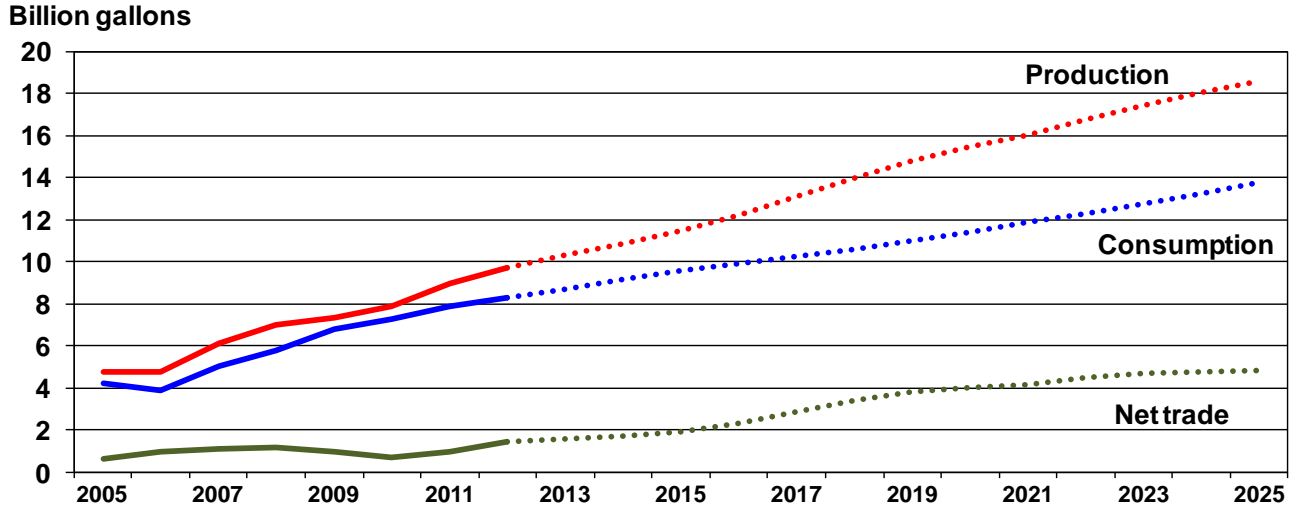
Source: U.S Energy Information Administration.

# U.S. decision not to extend tariffs on ethanol imports could impact Brazil's biofuel and ethanol market



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## *Current trends and projections of the Brazilian biofuel industry*



Source: Food and Agriculture Policy Research Institute.

\*Projections begin from 2012

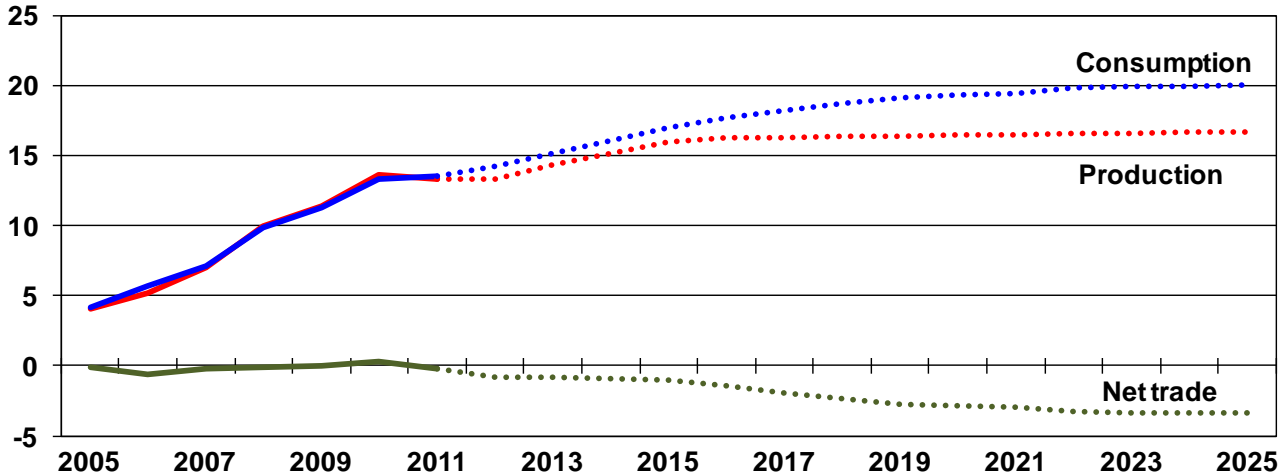
# The U.S. ethanol market will be impacted from opening the market to imports

*Current trends and projections of the U.S. biofuel industry*



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Billion gallons



Source: Food and Agriculture Policy Research Institute.

\*Projections begin from 2012

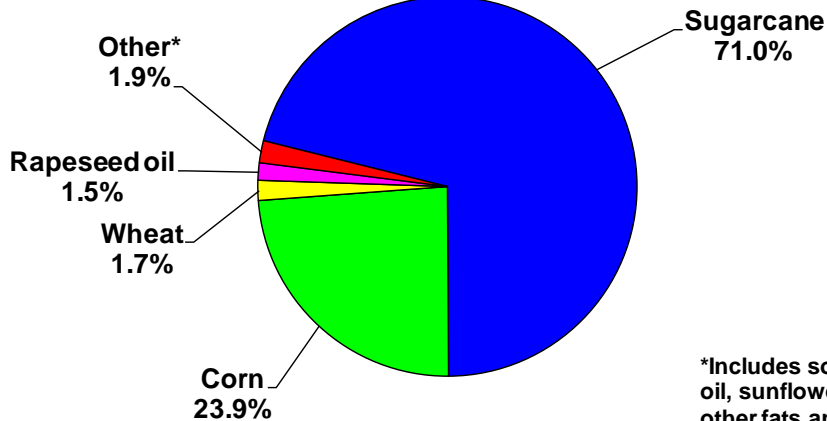
# How much feedstock is used in biofuel production?

*Feedstock shares in global fuel production, 2011*



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Total feedstock: 540,459,000 metric tons



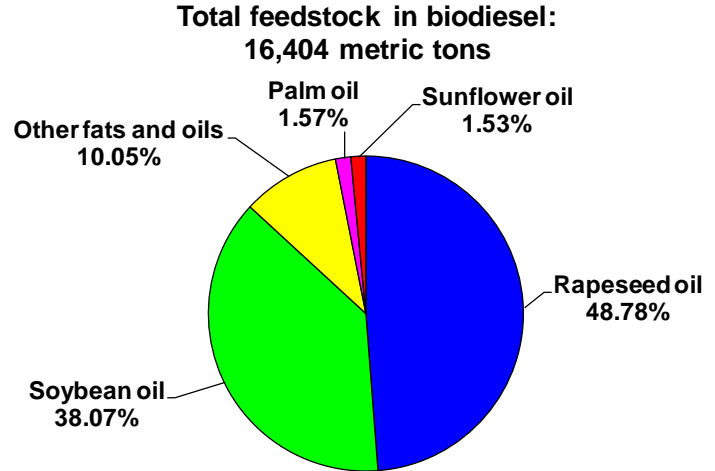
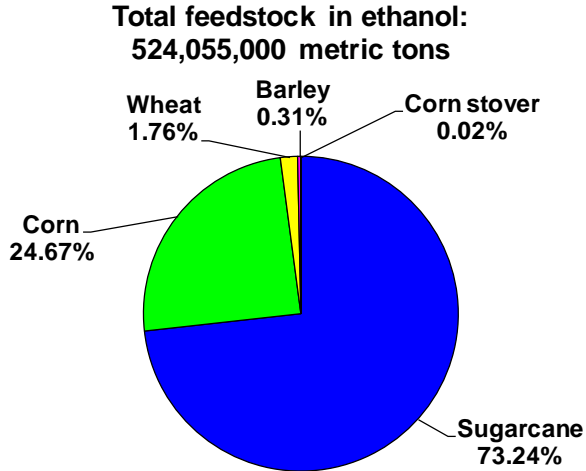
\*Includes soybean oil, barley, palm oil, sunflower oil, corn stover, and other fats and oils.

# 97 percent of feedstock is used to produce ethanol



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## Type of feedstock used in biofuel production, 2011



Source: Food and Agriculture Policy Research Institute.



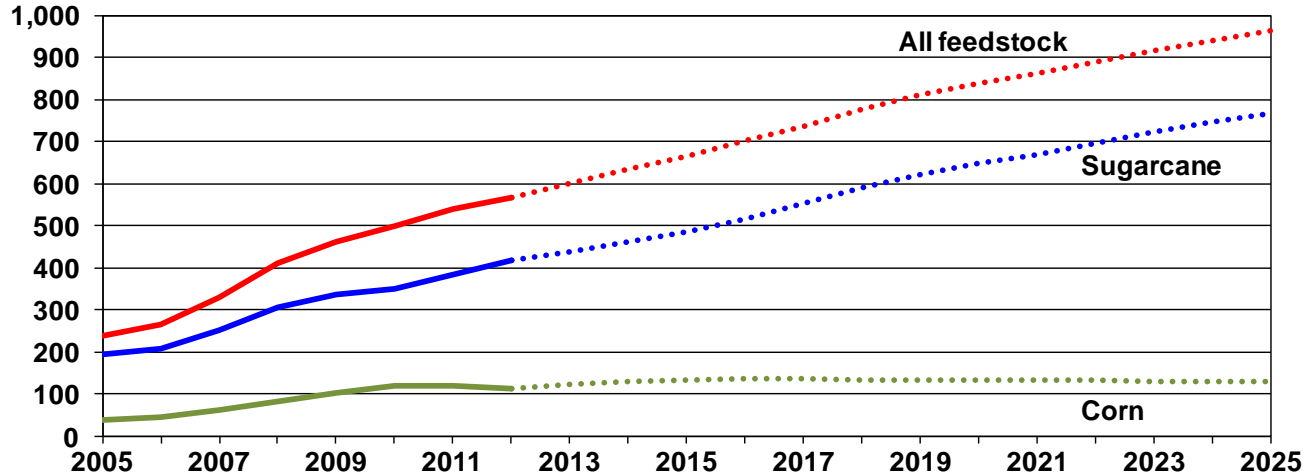
# Sugarcane will remain the dominant feedstock used in biofuel production

*Feedstock used in biofuel production trend and projection*



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Million metric tons



Source: Food and Agriculture Policy Research Institute.

\*Projections begin in 2012

# Costs associated with ethanol production in Brazil; feedstock production

*Dollars per liter*



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	1996	1998-2002	2005	2006	2007	2008
<b>Operating costs</b>	<b>0.372</b>	<b>0.160</b>	<b>0.188</b>	<b>0.216</b>	<b>0.234</b>	<b>0.384</b>
<b>Feedstock (cane)</b>	<b>0.193</b>	<b>0.084</b>	<b>0.091</b>	<b>0.113</b>	<b>0.109</b>	<b>0.150</b>
Labor	0.074	0.023	0.031	0.036	0.049	0.096
Maintenance	0.011	0.007	0.012	0.015	0.014	0.035
Chemicals	0.028	0.014	0.013	0.014	0.016	0.019
Energy	0.004	0.002	0.006	0.006	0.007	0.009
Interest payments on working capital	0.002	0.001	0.002	0.003	0.004	0.008
Rent	0.003	0.000	0.001	0.003	0.003	0.007
Other	0.058	0.030	0.032	0.028	0.031	0.061
<b>Fixed costs</b>	<b>0.093</b>	<b>0.045</b>	<b>0.033</b>	<b>0.037</b>	<b>0.066</b>	<b>0.096</b>
Depreciation	0.090	0.043	0.031	0.036	0.063	0.090
Other	0.003	0.002	0.001	0.001	0.003	0.007
<b>Total</b>	<b>0.465</b>	<b>0.205</b>	<b>0.221</b>	<b>0.253</b>	<b>0.300</b>	<b>0.480</b>

Source: U.S. Department of Agriculture.

# Forward markets for crude oil, natural gas, and refined gasoline are thin



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- **Crude oil**: Exchange traded crude has contracts listed for every month until 2017. However, the volumes on farther dated contracts (after 2015) are usually less than 1 percent of the volumes traded for front month contracts.
- **Natural gas**: The curve goes out to 2022. However, the trading volume of any contracts for delivery more than three years out is almost non-existent.
- **Refined gasoline**: Gasoline has contracts the next 3 years, but there is very little trading volume (less than 1 percent of front month volume) on contracts for delivery after December of this year.

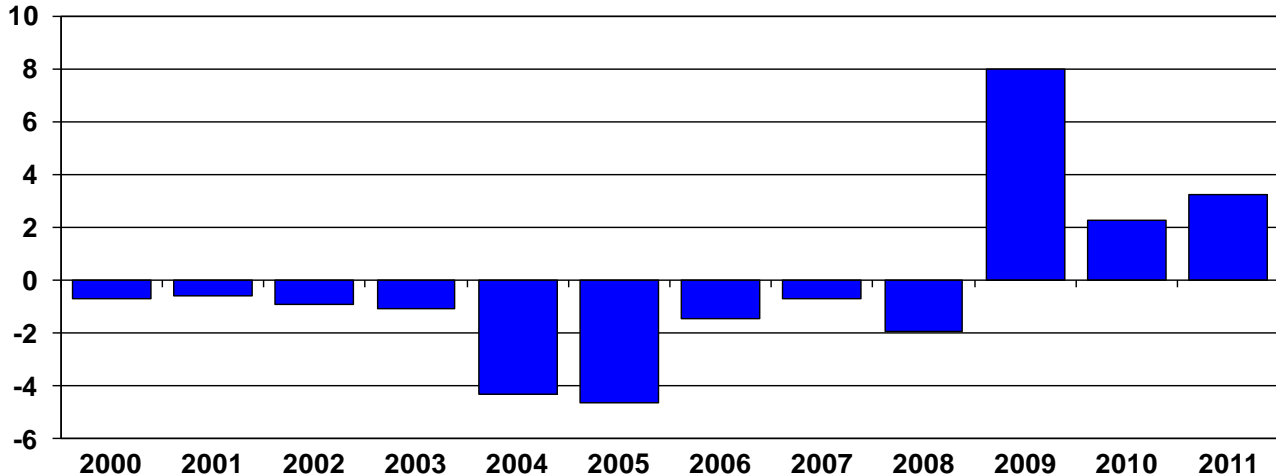
# U.S. crude oil production has increased by 12 percent since 2008



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*Annual percentage changes in U.S. crude oil production*

Annual percentage change



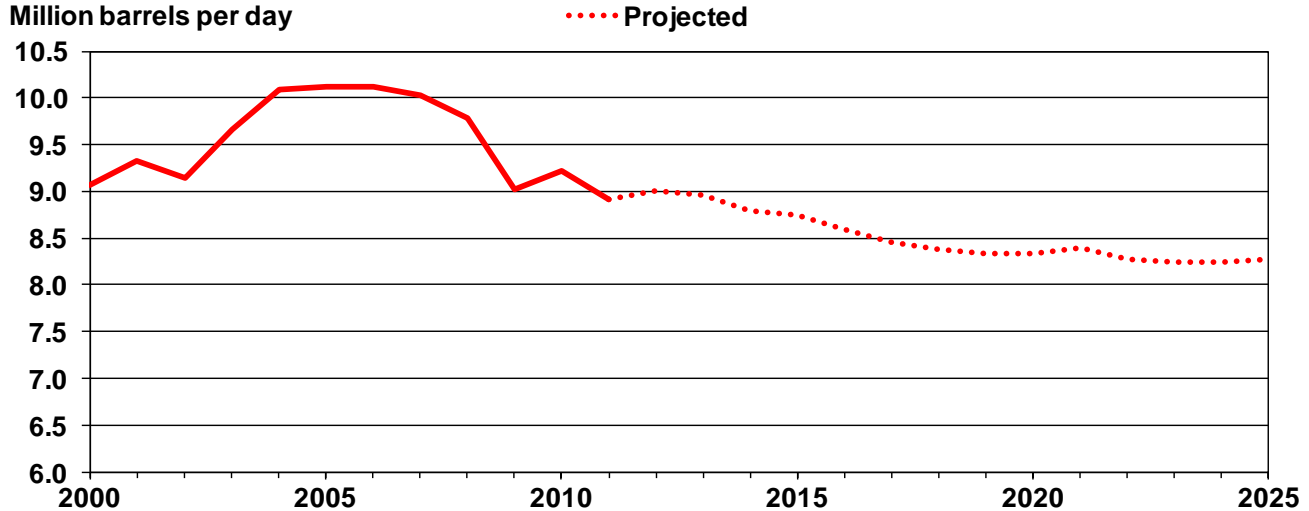
Source: U.S Energy Information Administration.

# U.S. crude oil imports have steadily declined since 2005



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*U.S. crude oil imports since 2000 and projections*



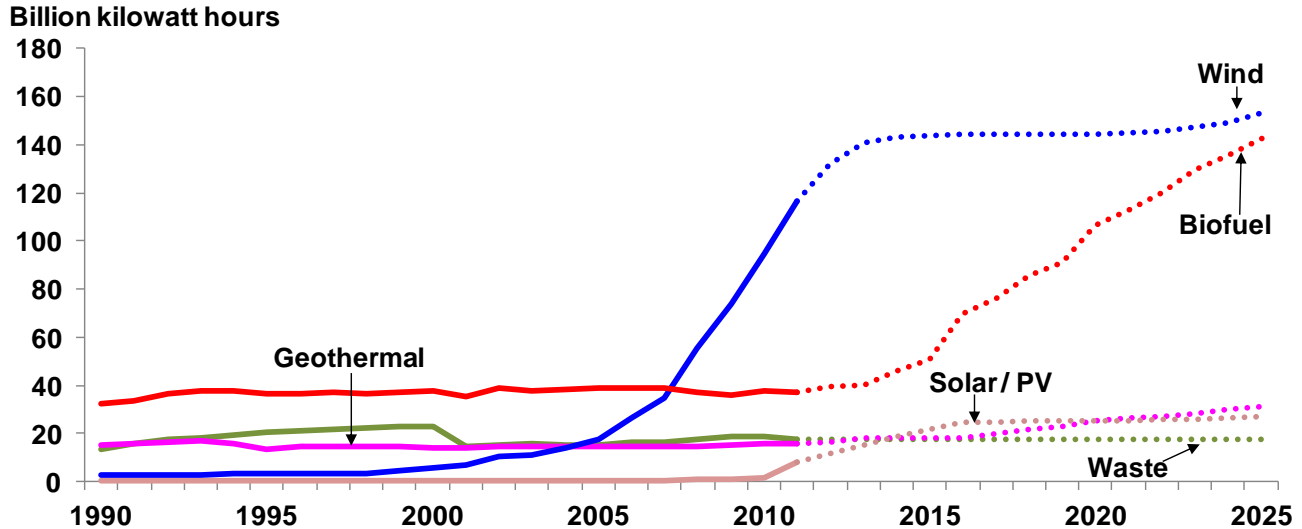
Source: U.S Energy Information Administration.

# Led by wind and biomass, the U.S. projects increases in renewable energy generation



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## *Domestic non-hydro renewable energy generation*



Source: U.S. Energy Information Administration.

# Increase in supply, shale gas production, and a mild winter have contributed to current low prices

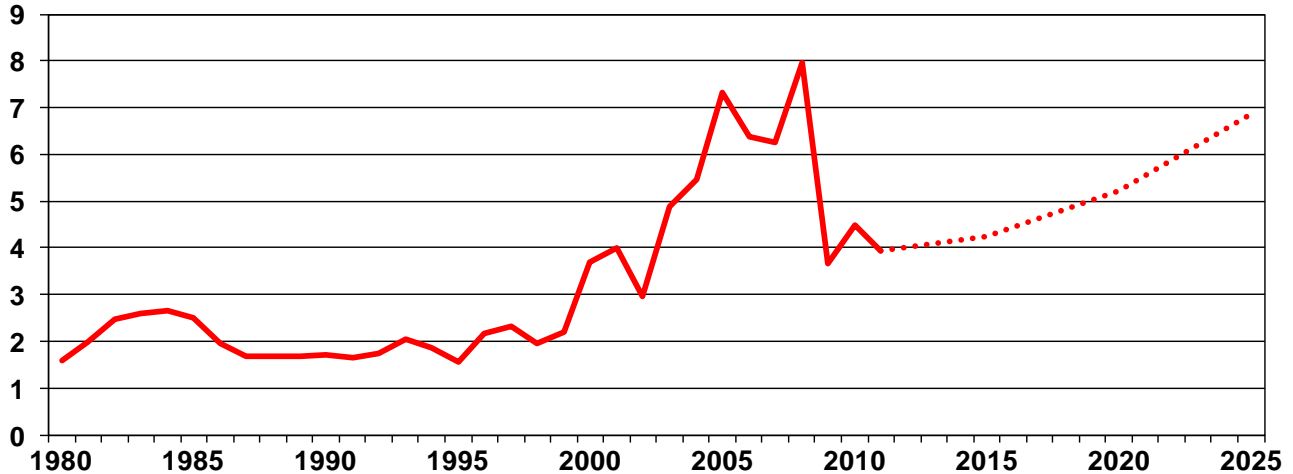


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## *U.S. natural gas wellhead prices*

US\$ per thousand cubic feet

.....Projected



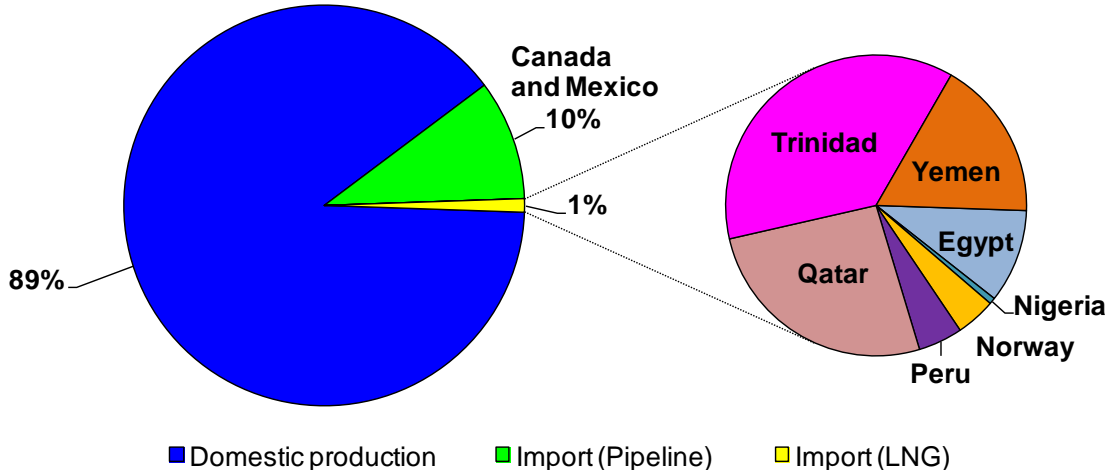
Source: U.S Energy Information Administration.

# Natural gas production is supplied mostly by domestic reserves



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*U.S. natural gas sources, 2011*



Source: U.S Energy Information Administration.



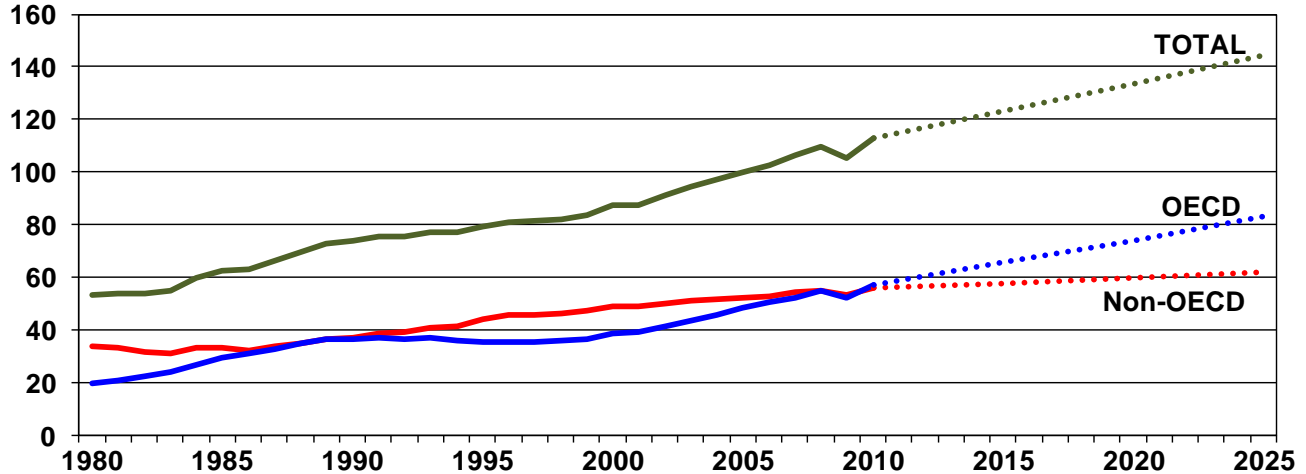
# Global natural gas consumption on the rise

*Non-OECD nations will lead the way*



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Trillion Cubic Feet



Source: U.S Energy Information Administration.

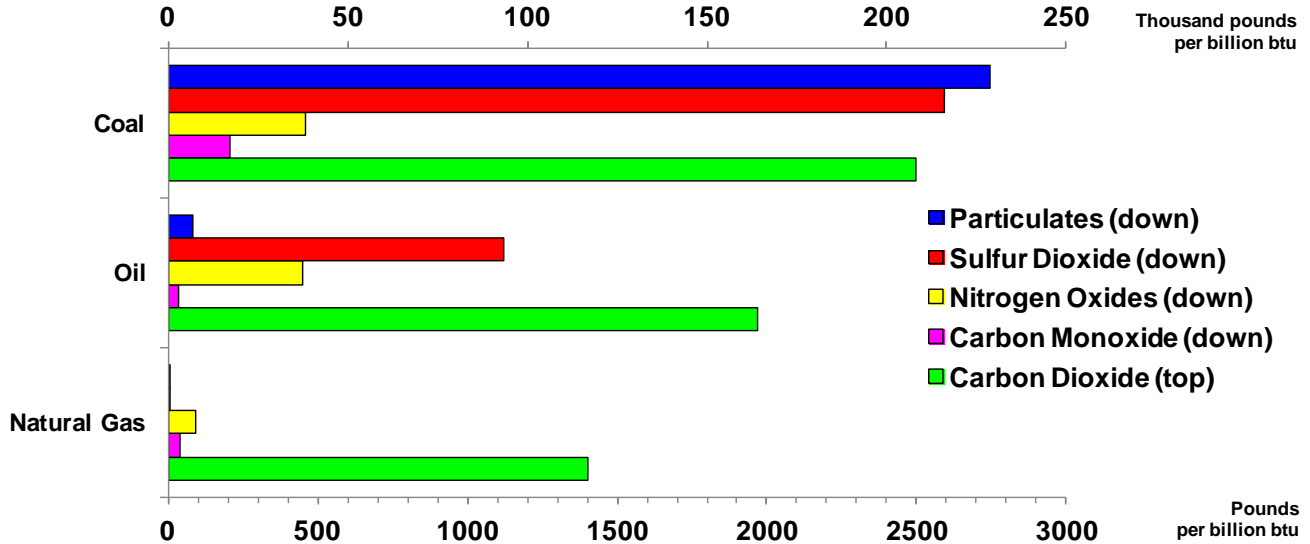
\*Projection begins from 2010.

# Natural gas is the least polluting fossil fuel



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## *Pollutant breakdown of the top fossil fuels*



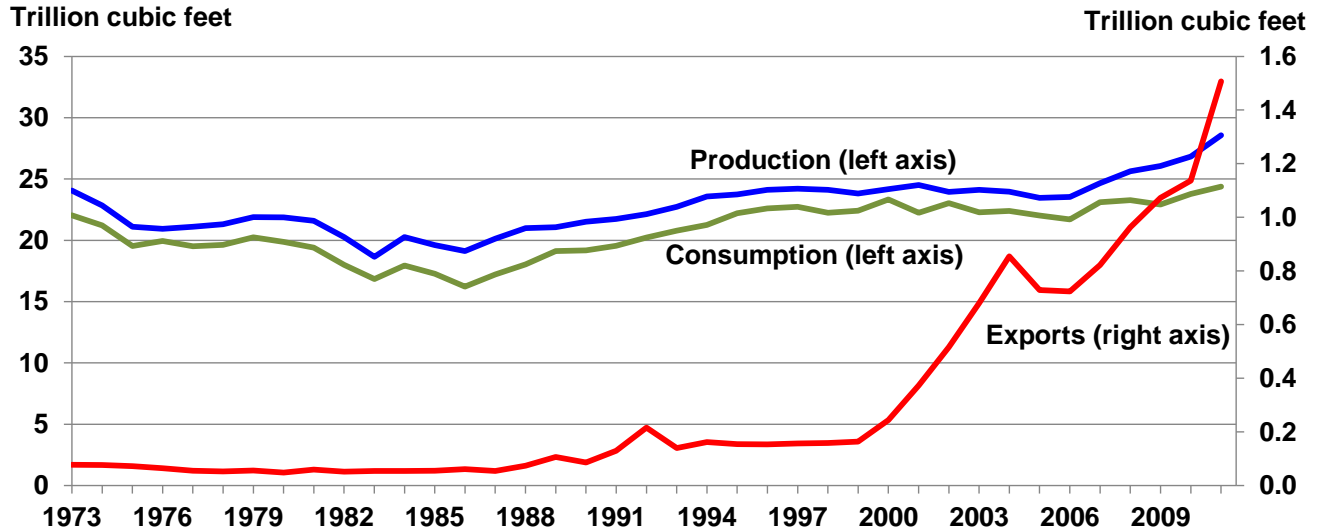
Source: U.S Energy Information Administration.

# U.S. natural gas exports have increased significantly since 2000



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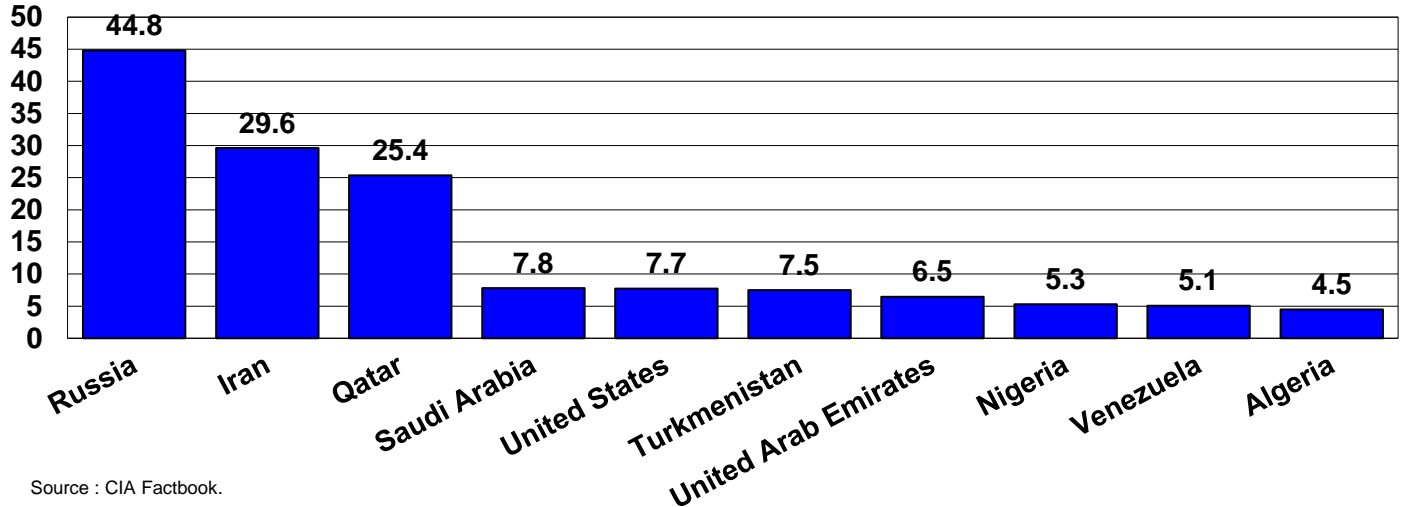
## U.S. natural gas consumption vs. exports



Source: U.S. Energy Information Administration.

# Top ten natural gas reserves countries

Trillion cubic meters



Source : CIA Factbook.

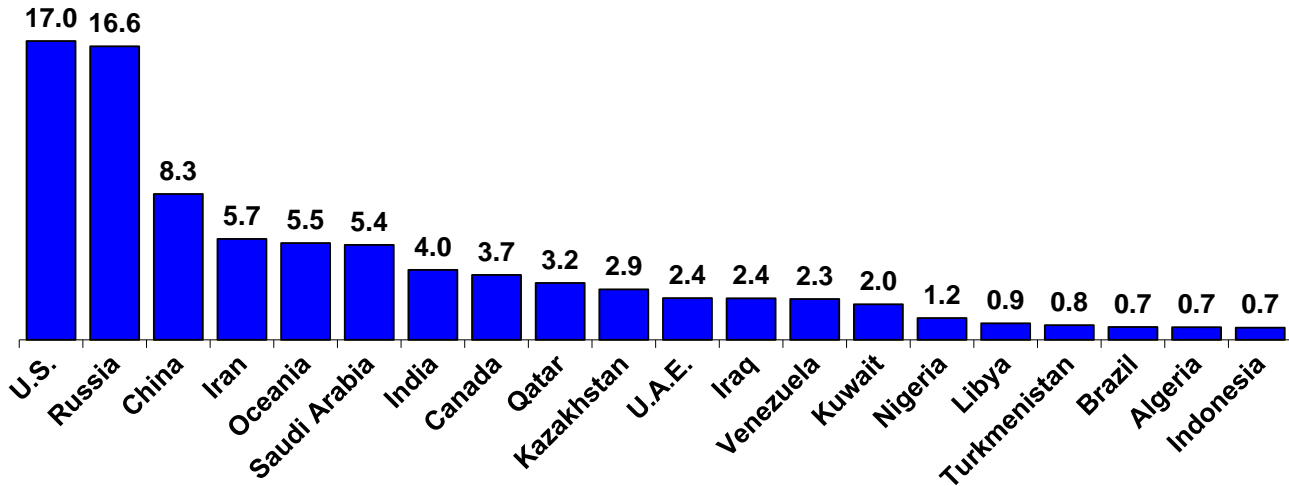
# Technology game changer

*U.S. now has the largest energy reserves in the world*



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Total fossil fuel reserves, % of world total



Note: Fossil fuels include oil, natural gas and coal.

Source: U.S. Congressional Budget Office