

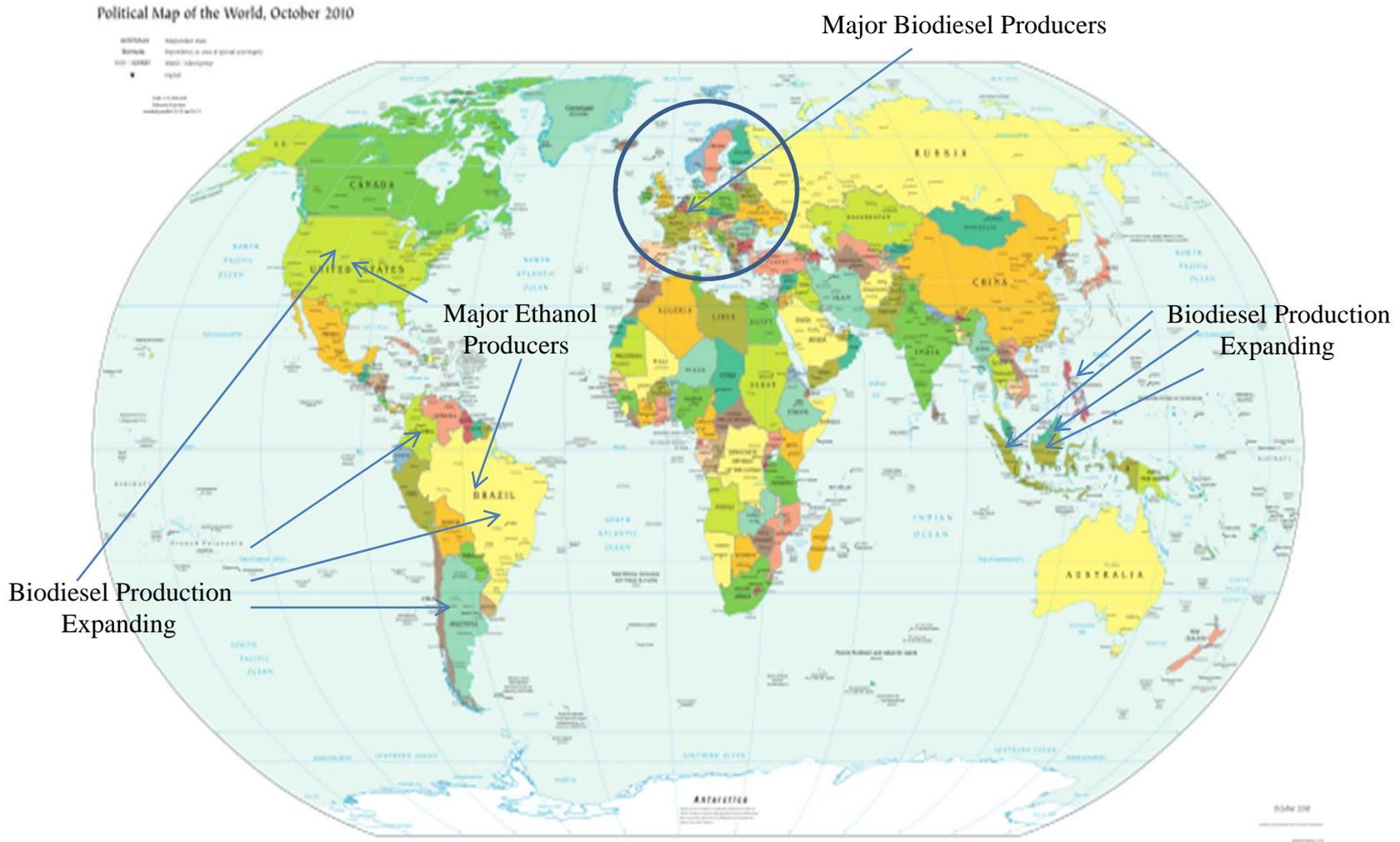


Global Supply and Demand of Biofuels

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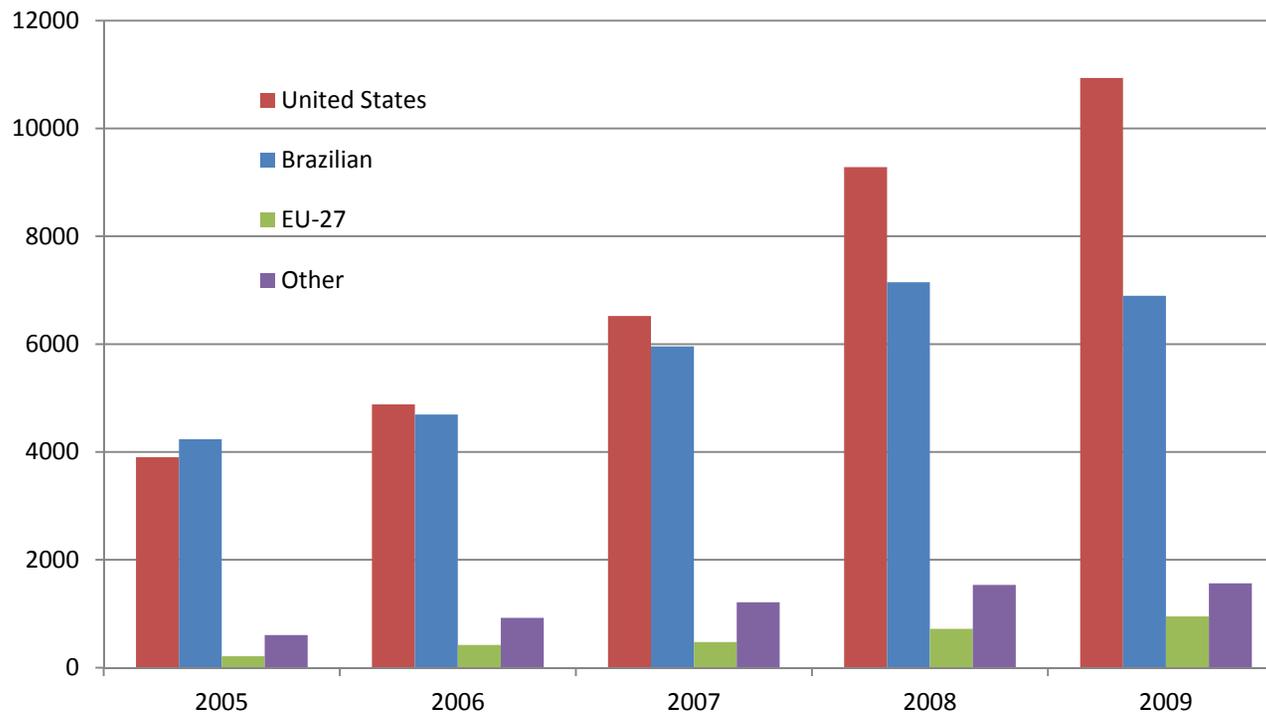
Transportation Research Board
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World Biofuels Production



World Ethanol Production

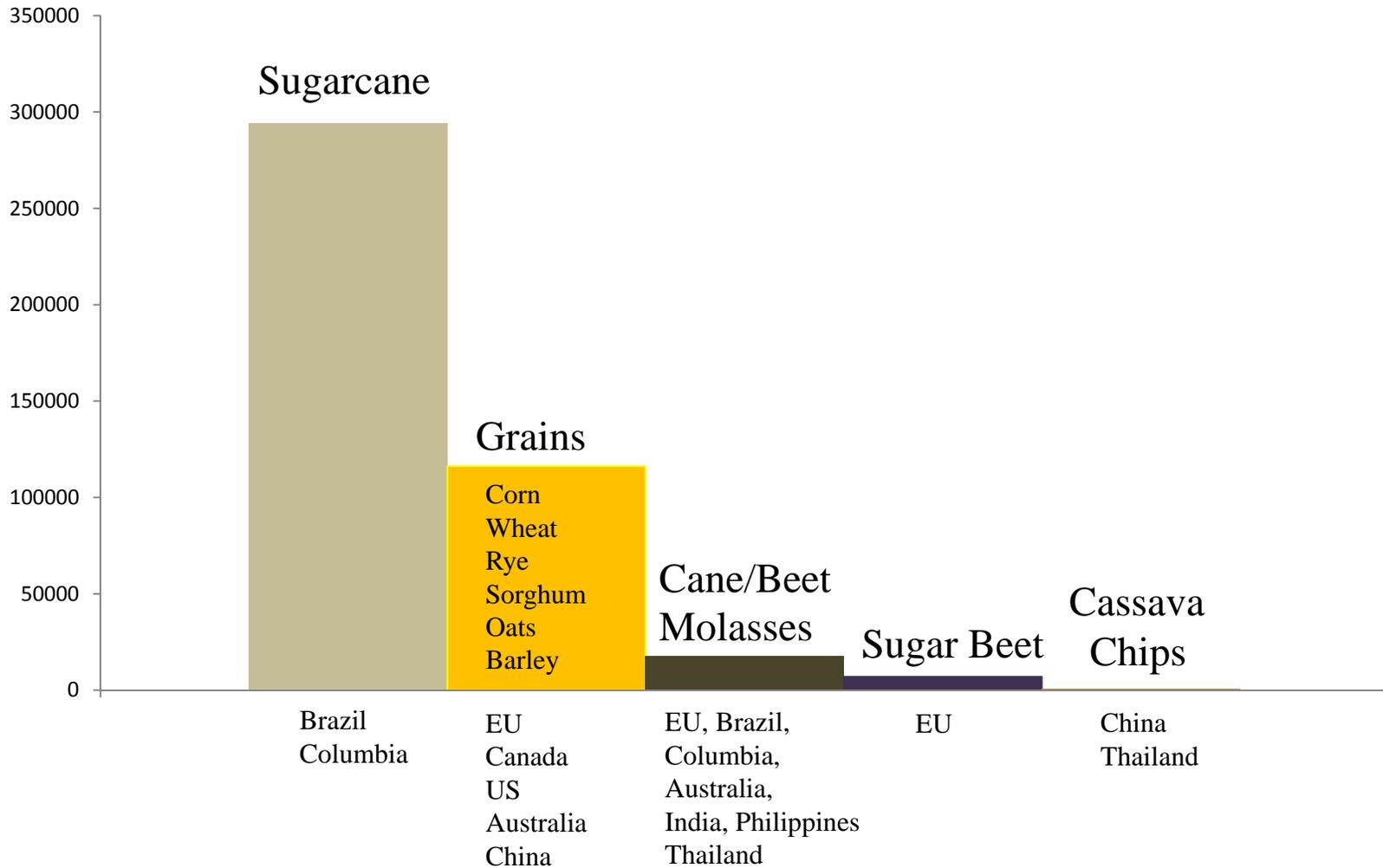
Million gallons



Source: U.S. Energy Information Administration, International Energy Statistics

Ethanol Feedstock Production

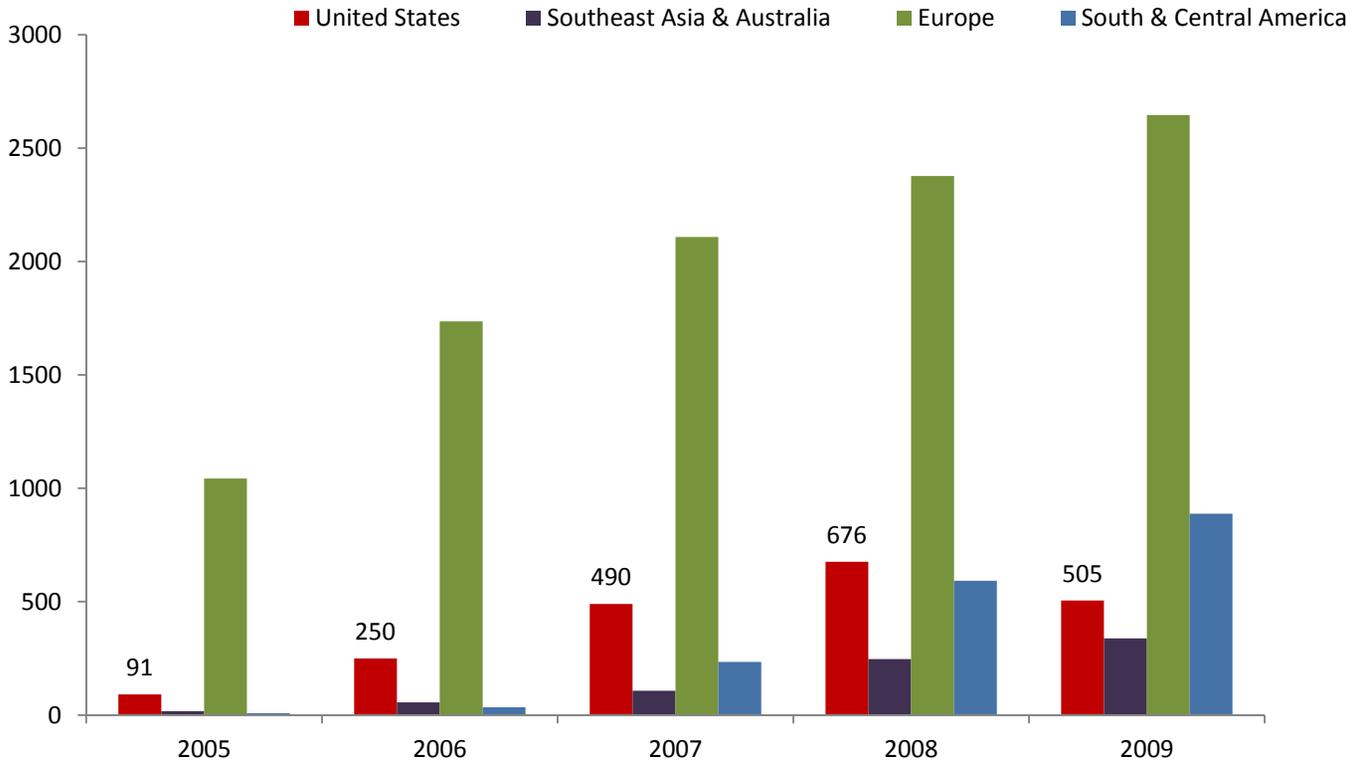
Thousand Metric Tons



Source: F.O. Licht

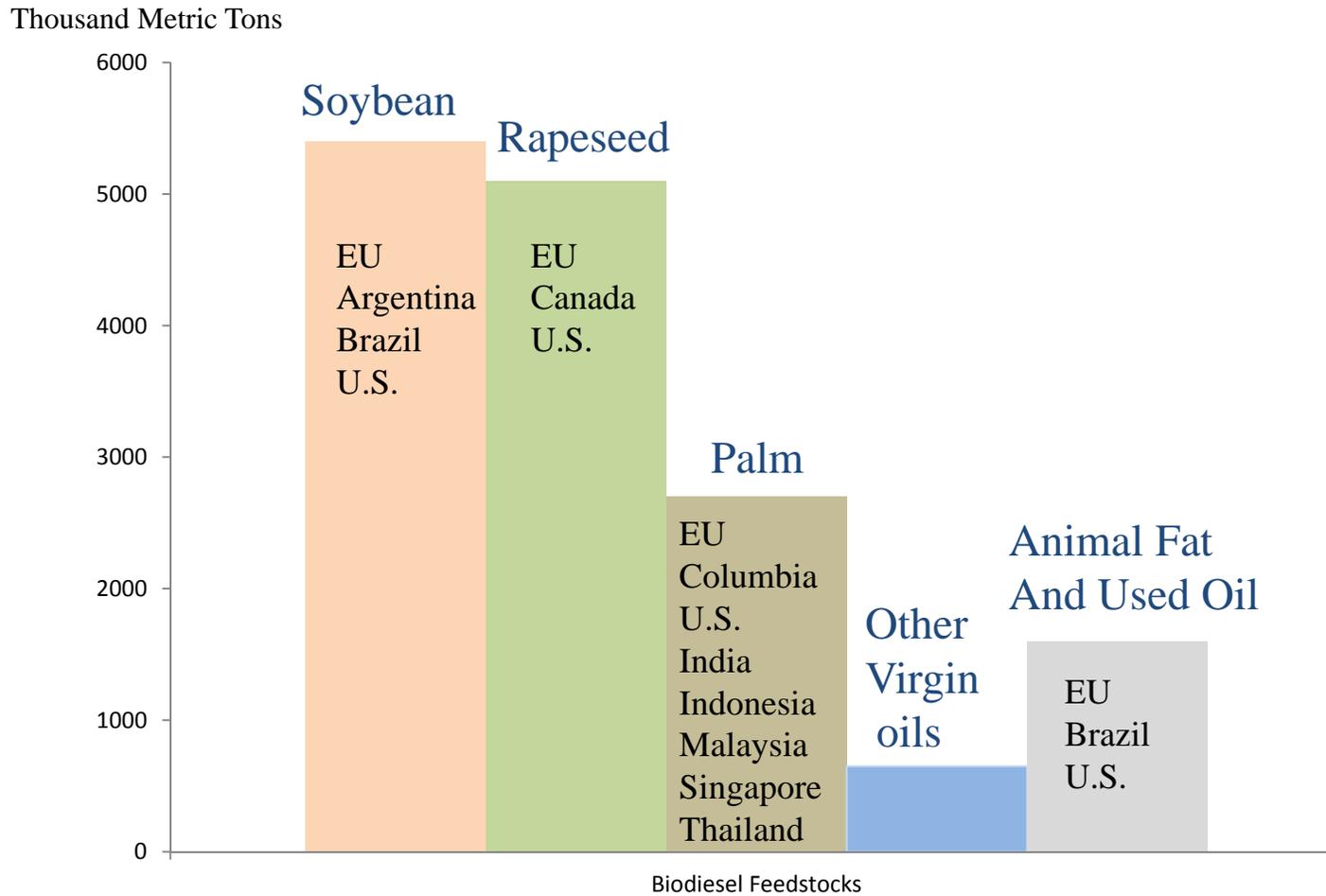
World Biodiesel Production

Million Gallons



Source: U.S. Energy Information Administration, International Energy Statistics

Biodiesel Feedstock Production



Source: F.O. Licht

Relative Size of Biofuels

- About 25 billion gallons of global biofuels production in 2009
- Most of which is ethanol at about 20 billion gallons
- Ethanol makes up about 8 % of U.S. gasoline
- Biodiesel makes up less than 1 % of U.S. diesel fuel
- About 7 % of global cereal consumption is in transport fuel
- About 38 % of the 2010/11 US corn crop will be used for ethanol
- About 15 % of 2010/11 soyoil production will be used for biodiesel
- About 8 % of 2010/11 soybean production will be used for biodiesel
- Last week's spot price for ethanol was 2.45 \$/gal compared to unleaded gasoline at 2.40 \$/gal
- Last week's spot price for biodiesel was 4.53 \$/gal compared to ULSD at 2.58 \$/gal

Government Policies Drive Biofuel Demand

- The EU-27 has a minimum target of 5.75 % biofuel in 2010 and increase to 10% by 2020
- Canada passed a 5 % RFS for gasoline in September 2010
- Brazil requires 20-25 % ethanol blending in all gasoline and a 5 % B5 mandate began on January 1, 2010
- Argentina established B7 and E5 mandates in 2010
- Columbia started E8-E10 and B7-B10 mandates depending on feedstock availability

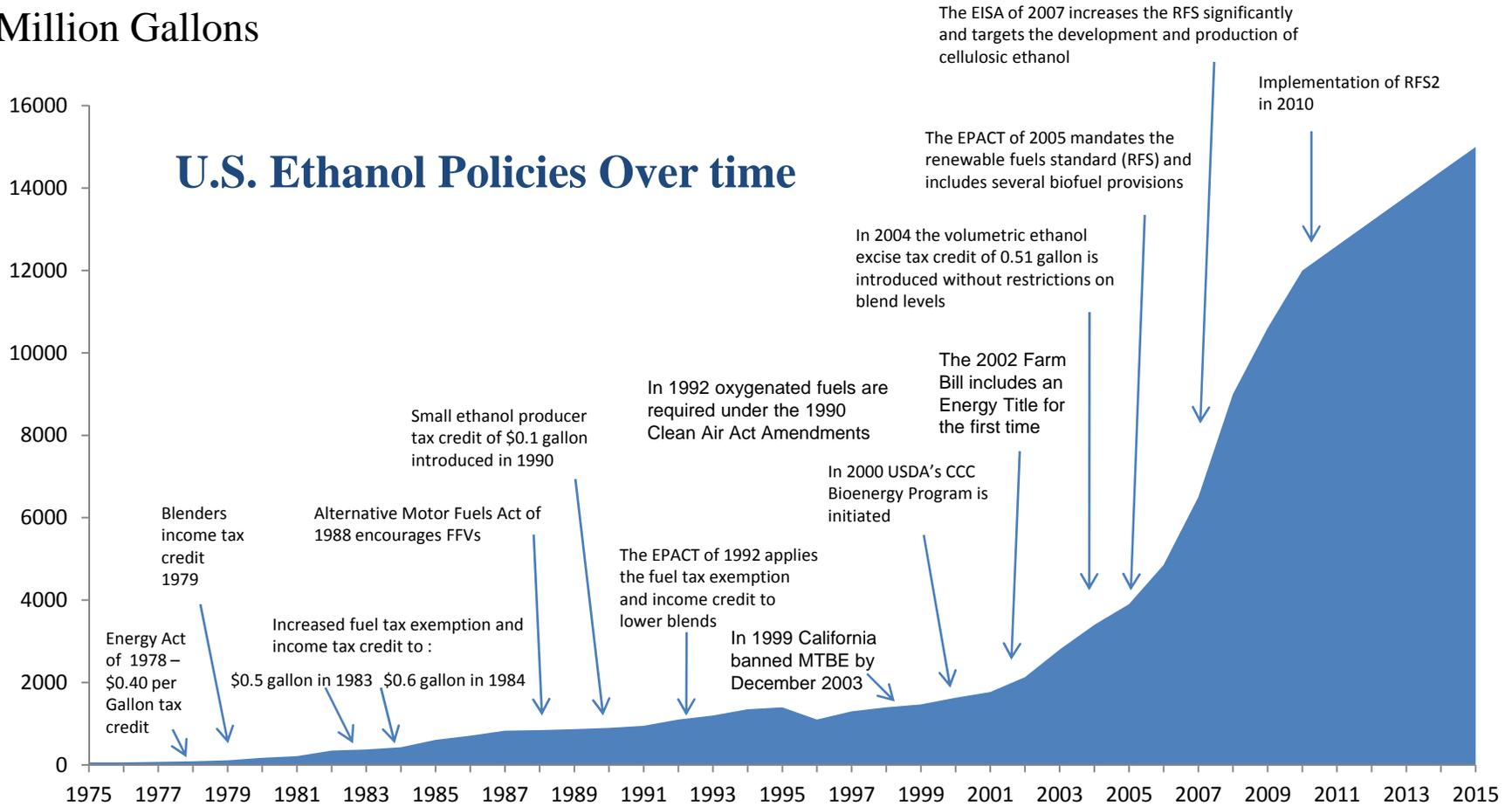
More Examples of Biofuel Phase-in Policies

- Thailand passed a B3 mandate in June 2010
- Indonesia requires E3 and B2.5 in some fuel markets
- Malaysia will begin phasing in B5 in June 2011
- Philippines has E5-10 and a B2-5 mandates
- United States passed a RFS in 2007 of 12 billion gallons of ethanol and 650 million gallons of biodiesel in 2010. The total renewable fuel requirement increases every year until it reaches 36 billion gallons in 2022

Do Government Policies Work?

Million Gallons

U.S. Ethanol Policies Over time



Many Countries Can't Meet Ambitious Targets

- Poor Economics
- Bad weather
- Infrastructure Costs
- Vehicle Compatibility, e.g., Blend Wall
- Feedstock Supply Limitations

Controversies Making Biofuel Policies Less Popular

- Biofuels require subsidies and/or mandates
- Are biofuels causing commodity prices to rise?
- The Food Versus Fuel issue
- Indirect land use change increases greenhouse gases
- Competing policies, e.g., environmental/sustainability policies that restrict land use; or energy policies that encourage transportation technologies that don't use liquid fuels, e.g., electric cars

Where Do We Go From Here?

Table 1 -- Volume Requirements for the Renewable Fuel Standard -2

	Cellulosic Biofuel Requirement	Biomass-Based Diesel Requirement	Advanced Biofuel Requirement	Renewable* Fuel Requirement	Total Renewable Fuel Requirement
			Billion Gallons		
2009	NA	0.50	0.60	10.9	11.50
2010	0.10	0.65	0.95	12.0	12.95
2011	0.25	0.80	1.35	12.6	13.95
2012	0.50	1.00	2.00	13.2	15.20
2013	1.00	**	2.75	13.8	16.55
2014	1.75	**	3.75	14.4	18.15
2015	3.00	**	5.50	15.0	20.50
2016	4.25	**	7.25	15.0	22.25
2017	5.50	**	9.00	15.0	24.00
2018	7.00	**	11.0	15.0	26.00
2019	8.50	**	13.0	15.0	28.00
2020	10.5	**	15.0	15.0	30.00
2021	13.5	**	18.0	15.0	33.00
2022	16.0	**	21.0	15.0	36.00

* Corn-ethanol is not required but is fully expected to satisfy most of this requirement

** To be determined by Environmental Protection through future rulemaking, but no less than 1.0 billion gallons per year.

Second Generation Fuels Must Be Developed to Meet Future Goals

- Cellulosic Biofuels are made from non-crop biomass using biochemical conversion or thermalchemical conversion
- Advanced Biofuels
 - 1) Renewable Diesel produced from animal fats, vegetable oils, and waste greases using a chemical processes similar to those employed in petroleum hydrotreating.
 - 2) Biodiesel using traditional feedstocks and new feedstocks, such as non-food grade corn oil and algae
 - 3) Sugarcane Ethanol expected to come from Brazil

New Feedstocks From Cellulosic Materials

- Urban waste
- Agricultural residues, e.g., corn stover, rice and other cereal straws
- Wood, forest thinnings, wood chips, pulp and paper mill waste
- Dedicated Energy Crops, e.g., switchgrass, energy cane, energy sorghum, poplar, miscanthus and other fast-growing trees.

Feedstocks Are Available But More Research Needed On Cellulosic Biofuels Conversion to Meet the RFS

- The RFS for cellulosic biofuels was not met in 2010 and will not be met in 2011
- Over 100 cellulosic biofuel production facilities in the U.S.
- None are commercially viable and are only producing for testing purposes
- The RFS for cellulosic biofuels is 250 million gallons for 2011, but EPA only expects about 7 million gallons
- Its to early to predict the future production of cellulosic ethanol since the conversion technology is still on the learning curve