



# RFS2, Biofuel Supply, Infrastructure & Agricultural Issues

## Transportation Committee Workshop on Transportation Fuel Infrastructure Issues

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# Transportation Energy Demand Forecast Post Processing Assumptions

- California will use “proportional share” of the RFS2 renewable volume obligations – no use of RIN credits
- Significant downward revisions to the cellulosic biofuels portion of the RFS2 requirements anticipated but not assumed for purposes of calculating demand for specific types of renewable fuels
- E10 will remain the upper limit for low-level ethanol blends throughout the forecast period – no use of E15



# Renewable Fuels Standard (RFS2) – Increased Demand for Ethanol and Biodiesel

- Federal standard (RFS2) *mandates* increased use of renewable fuel – both ethanol and biodiesel
- Obligated parties include refiners, importers, and blenders
- Companies can generate Renewable Identification Number (RIN) credits for excess renewable fuel use or purchase credits
- Program is not a “per-gallon” regulation
- Regulation impacts can include:
  - Increased demand for & production of ethanol
  - Increased demand for ethanol feedstock such as corn
  - Displacement of gasoline
  - Need for expanded renewable fuel infrastructure



# Renewable Fuels Standard (RFS2)

Year	Total Renewable Fuel Requirement Bil. Gallons	Starch Derived Biofuel Bil. Gallons	Advanced Biofuels			
			Cellulosic Biofuels Bil. Gallons	Other Advanced Biofuels Bil. Gallons	Biomass Based Diesel Bil. Gallons	Total Advanced Biofuels Bil. Gallons
2008	9.00	9.00				0.00
2009	11.10	10.50		0.10	0.50	0.60
2010	12.95	12.00	<del>0.10</del> <b>0.0065</b>	<del>0.20</del> <b>0.294</b>	<del>0.65</del> <b>1.15</b>	0.95
2011	13.95	12.60	<del>0.25</del> <b>0.0066</b>	<del>0.30</del> <b>0.543</b>	0.80	1.35
2012	15.20	13.20	<del>0.50</del> <b>0.0035 - 0.0126</b>	<del>0.50</del> <b>0.987 - 0.997</b>	1.00	2.00
2013	16.55	13.80	1.00	0.75	<del>1.00</del> <b>1.28</b>	2.75
2014	18.15	14.40	1.75	1.00	1.00	3.75
2015	20.50	15.00	3.00	1.50	1.00	5.50
2016	22.25	15.00	4.25	2.00	1.00	7.25
2017	24.00	15.00	5.50	2.50	1.00	9.00
2018	26.00	15.00	7.00	3.00	1.00	11.00
2019	28.00	15.00	8.50	3.50	1.00	13.00
2020	30.00	15.00	10.50	3.50	1.00	15.00
2021	33.00	15.00	13.50	3.50	1.00	18.00
2022	36.00	15.00	16.00	4.00	1.00	21.00
2023	36.00	15.00	16.00	4.00	1.00	21.00
2024	36.00	15.00	16.00	4.00	1.00	21.00
2025	36.00	15.00	16.00	4.00	1.00	21.00
2026	36.00	15.00	16.00	4.00	1.00	21.00
2027	36.00	15.00	16.00	4.00	1.00	21.00
2028	36.00	15.00	16.00	4.00	1.00	21.00
2029	36.00	15.00	16.00	4.00	1.00	21.00
2030	36.00	15.00	16.00	4.00	1.00	21.00

Progress of cellulosic biofuels is lagging Congressional expectations

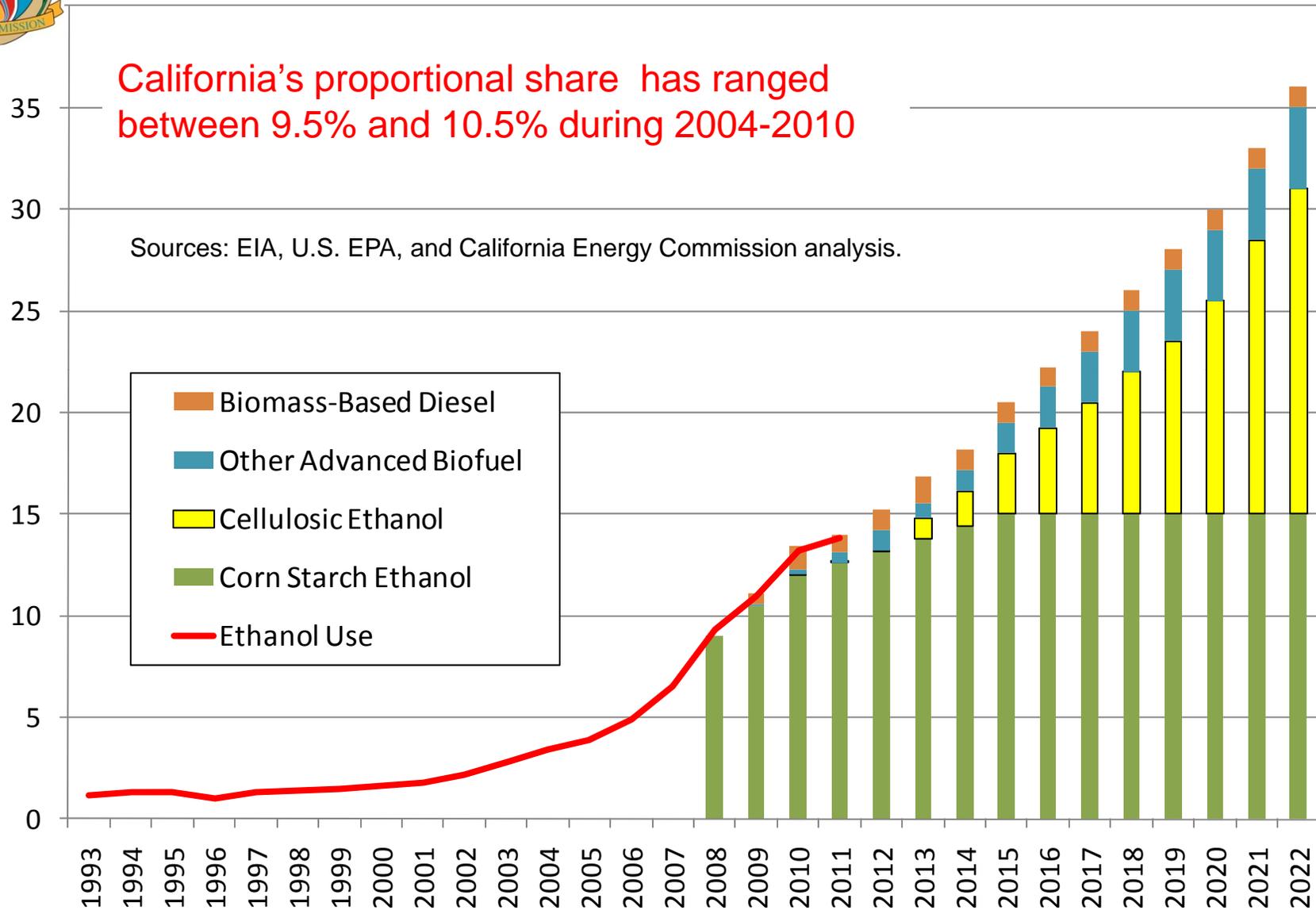


# U.S. Ethanol Use and RFS2 Obligations

California's proportional share has ranged between 9.5% and 10.5% during 2004-2010

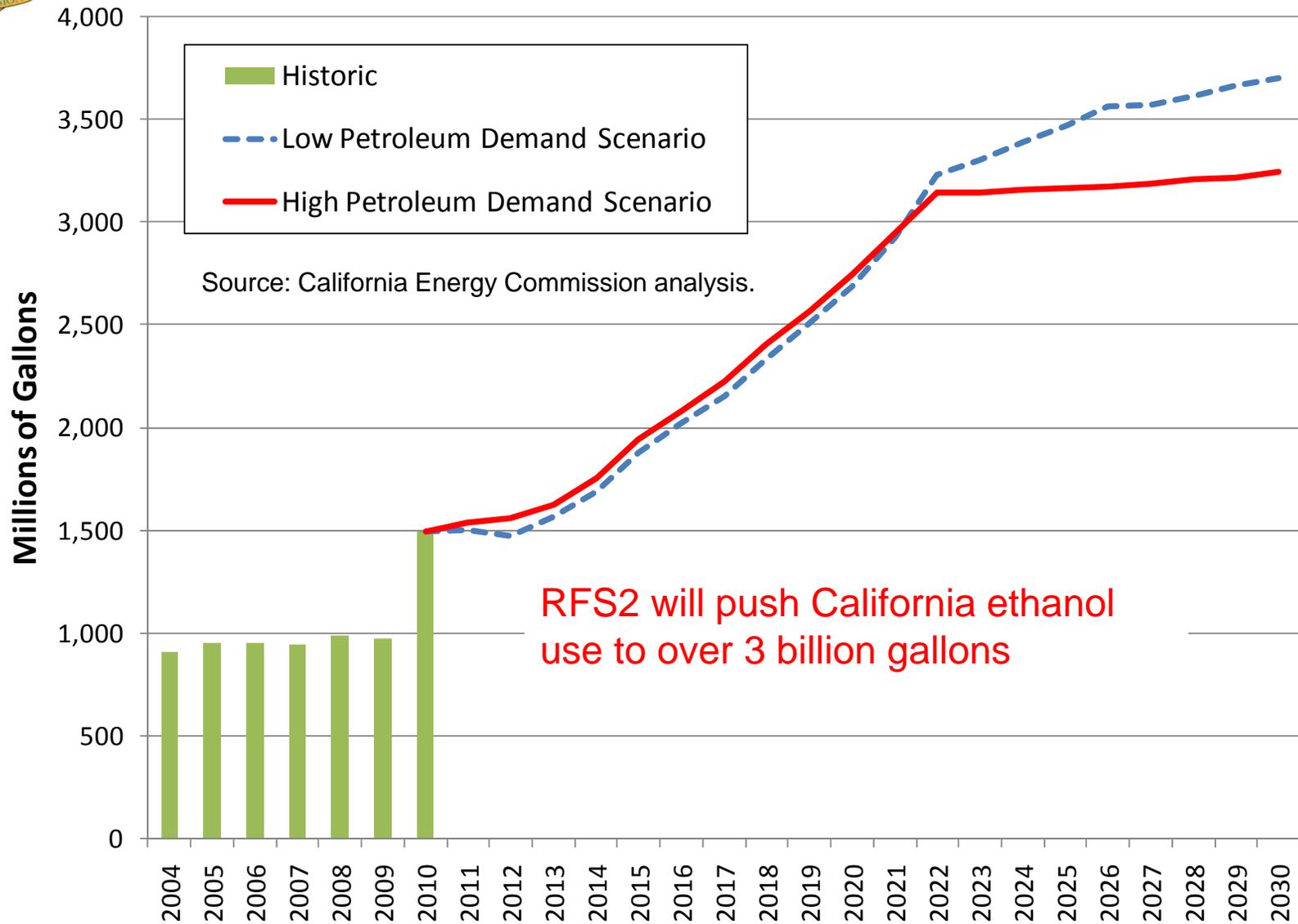
Sources: EIA, U.S. EPA, and California Energy Commission analysis.

Billions of Gallons



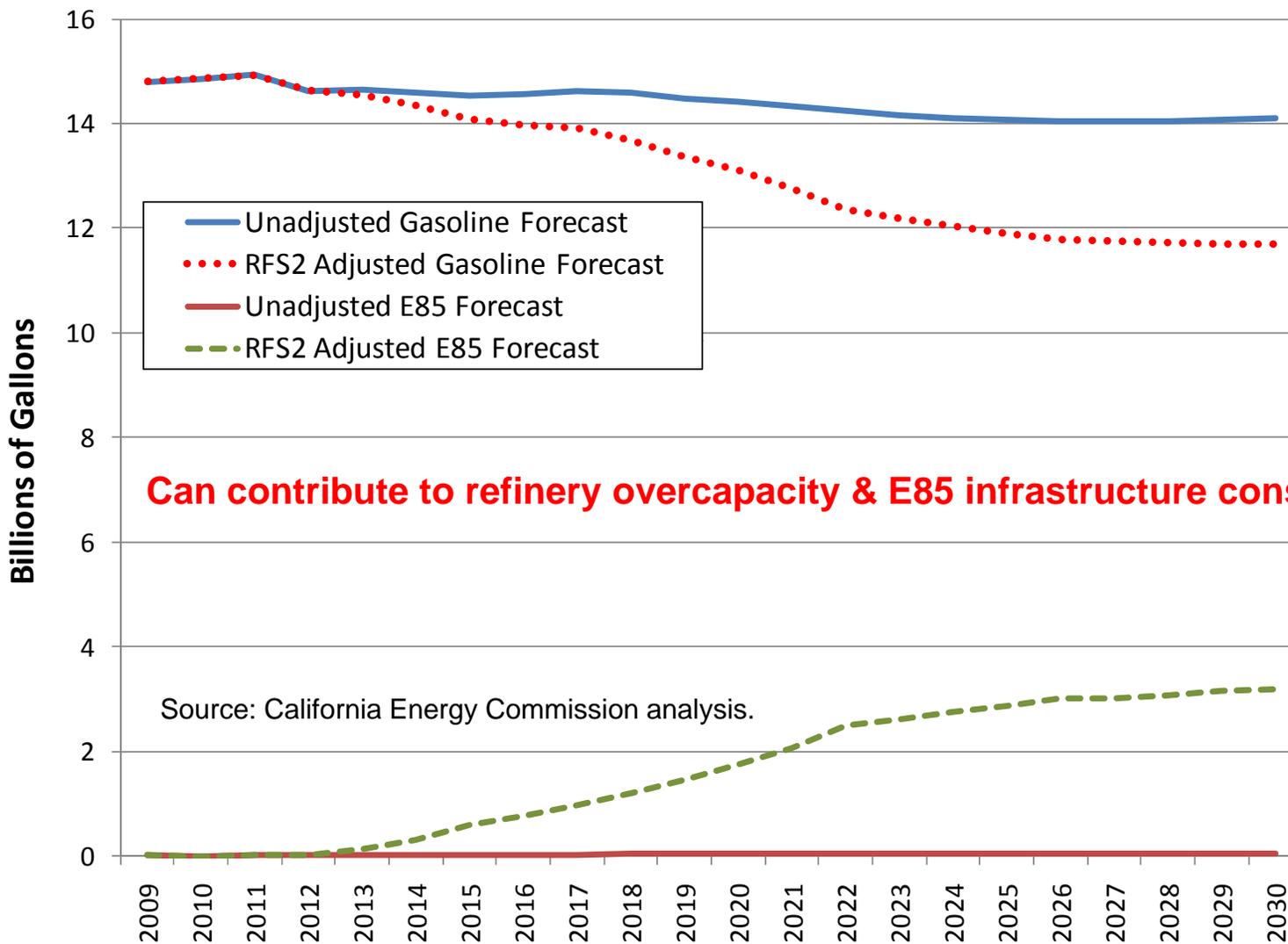


# CA Historical and Forecast Ethanol Demand



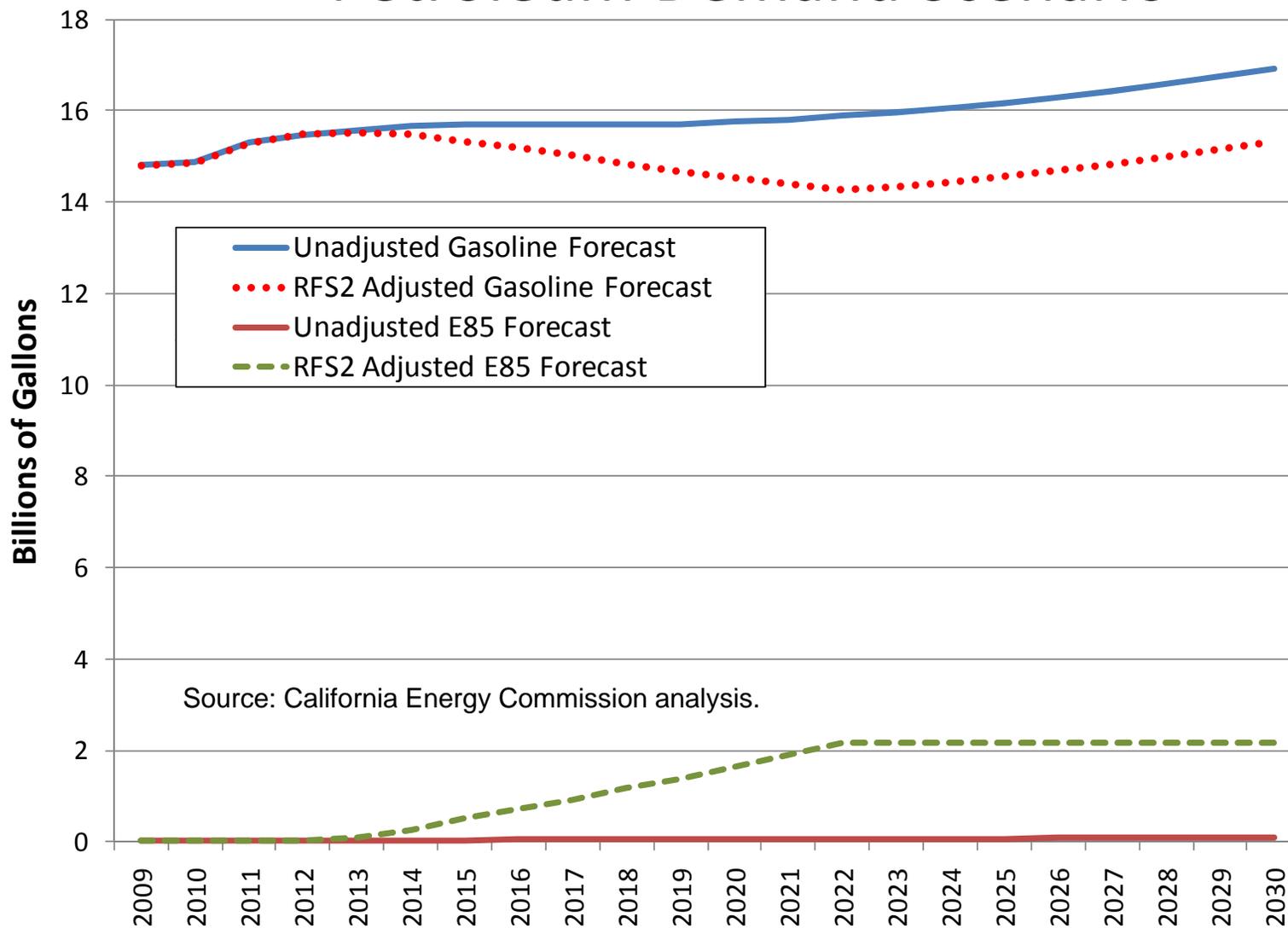


# RFS2 Impact on CA Gasoline Use in the Low Petroleum Demand Scenario



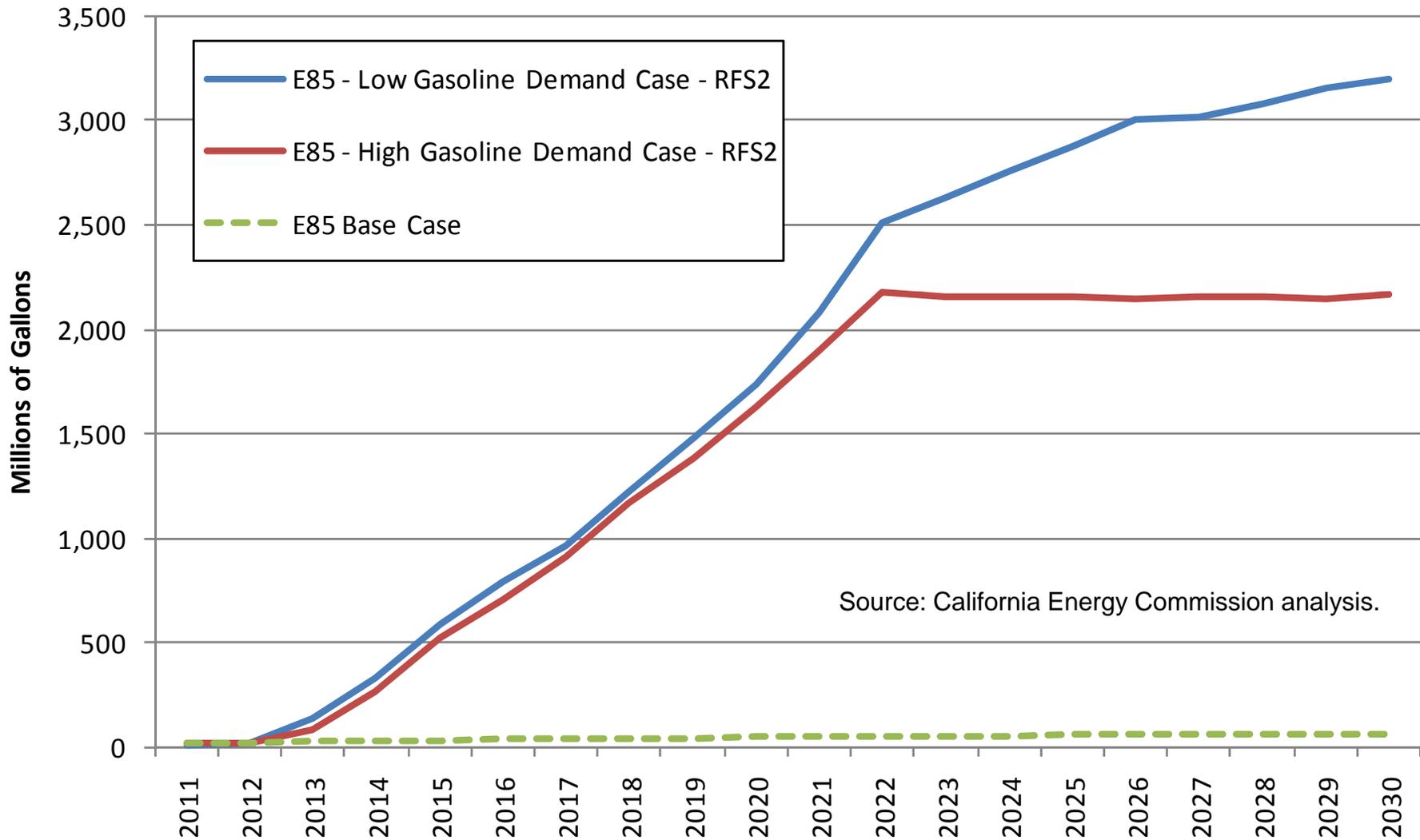


# RFS2 Impact on CA Gasoline Use in the High Petroleum Demand Scenario





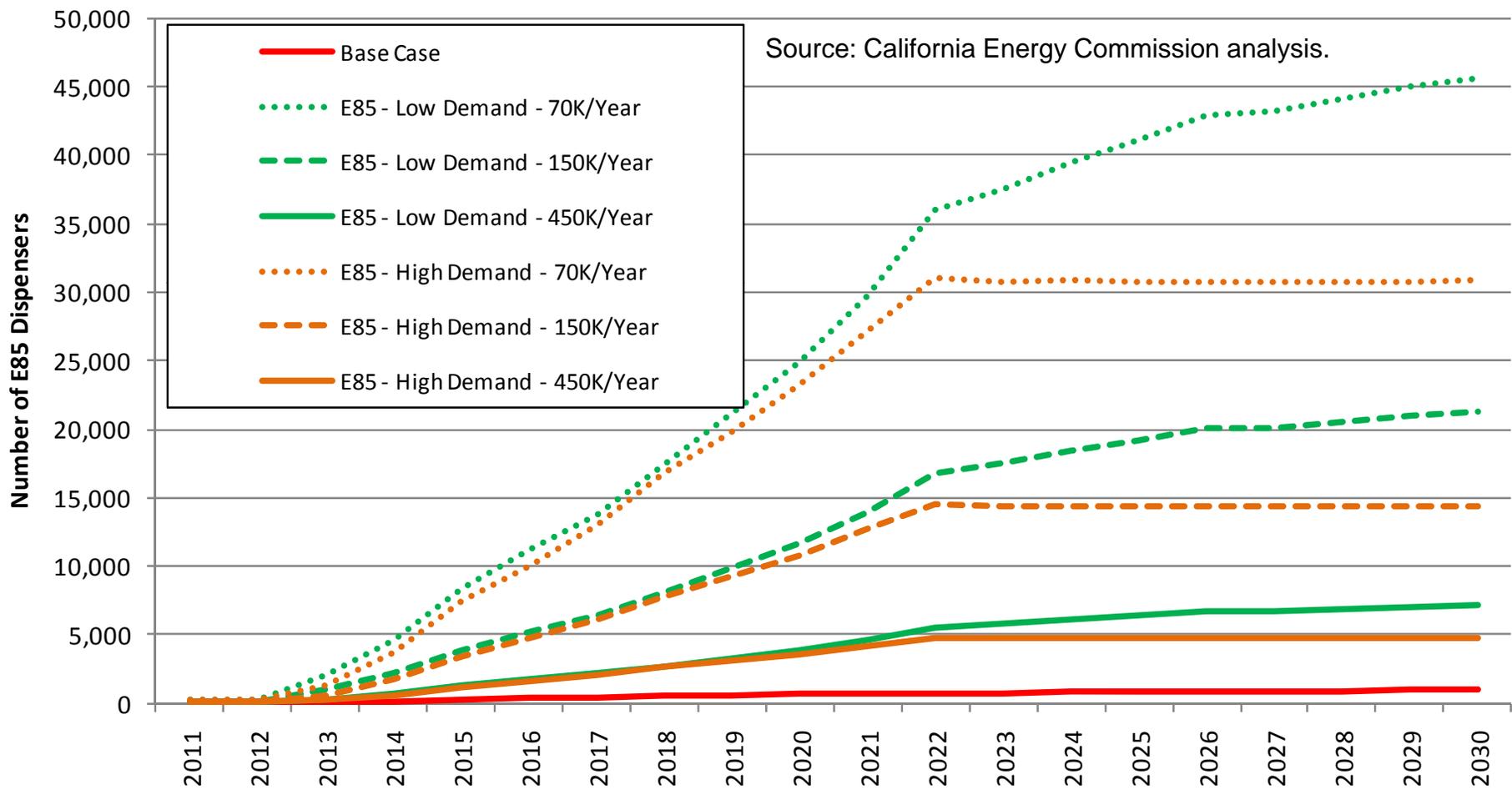
# California E85 Demand Forecast



Source: California Energy Commission analysis.

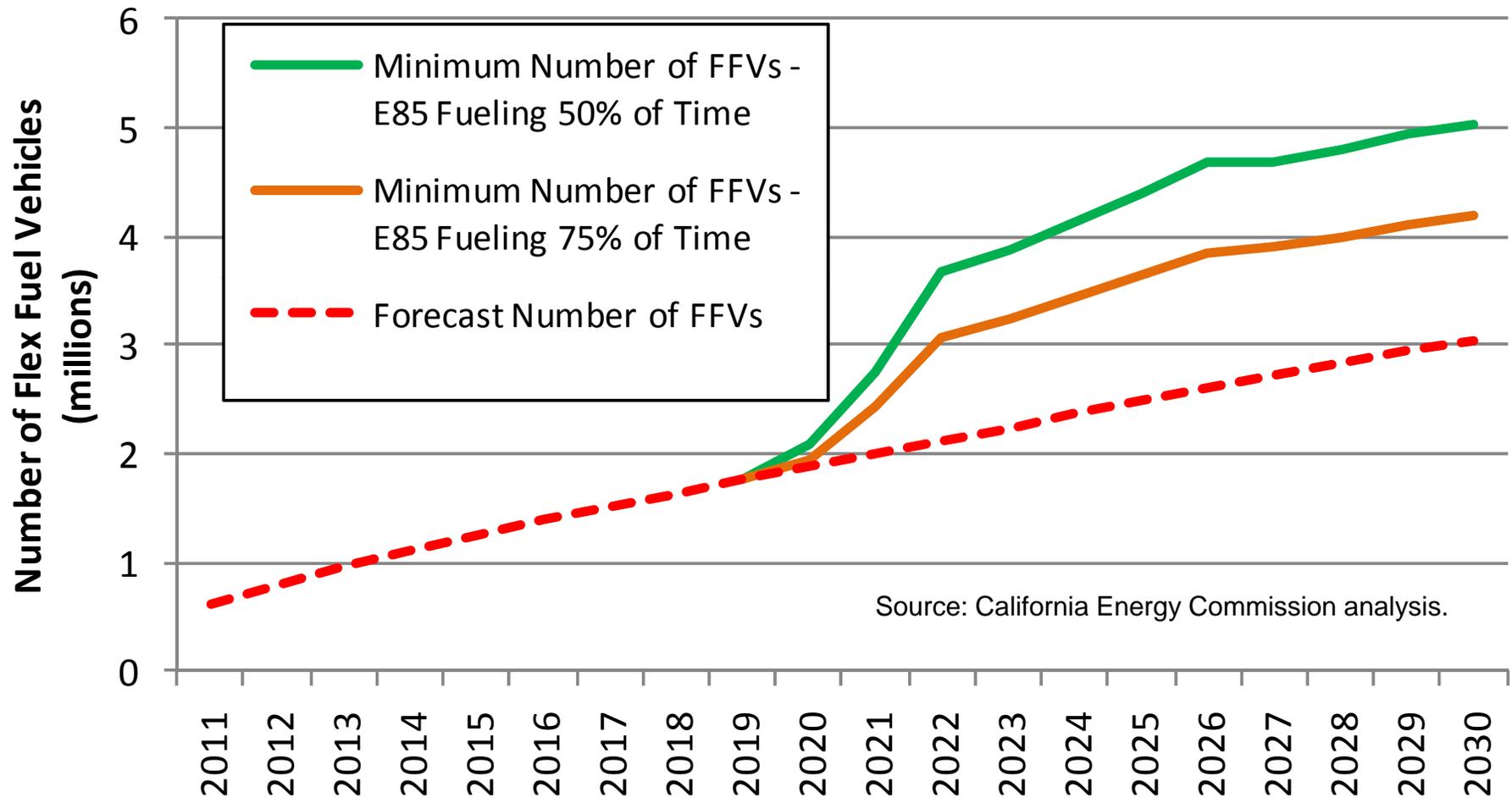


# California E85 Dispenser Forecast





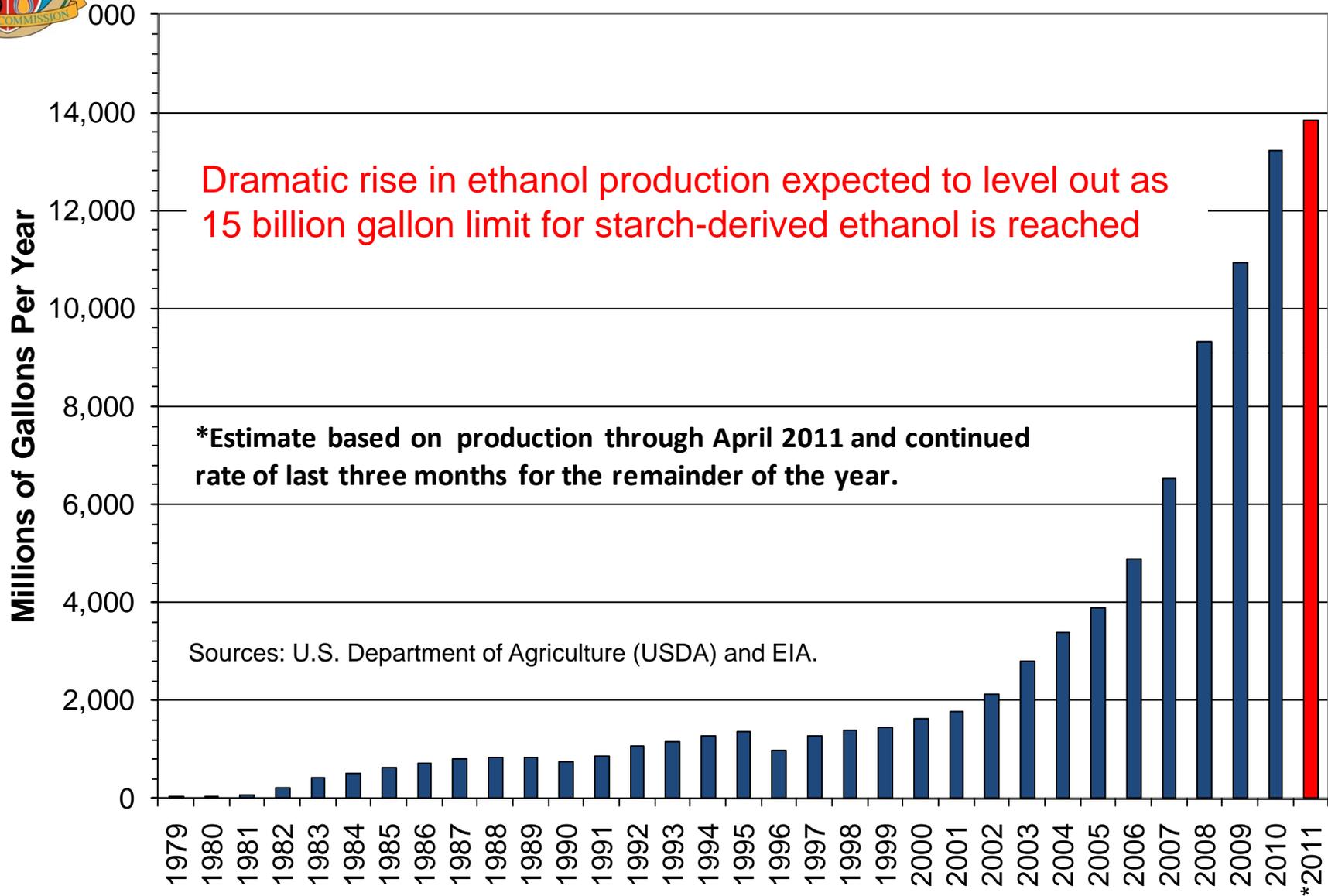
# California E85 Dispenser Forecast



Source: California Energy Commission analysis.

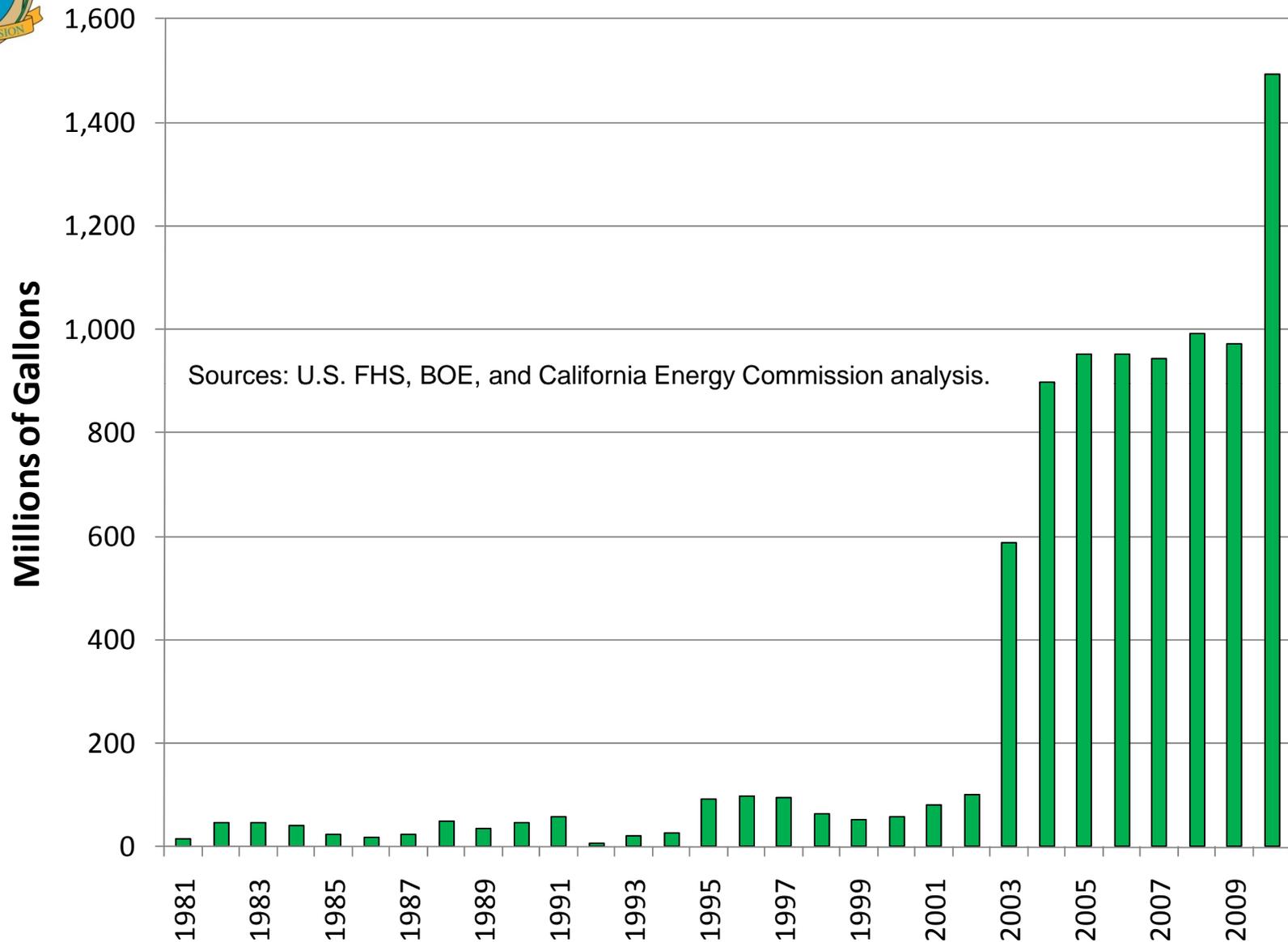


# U.S. Ethanol Production



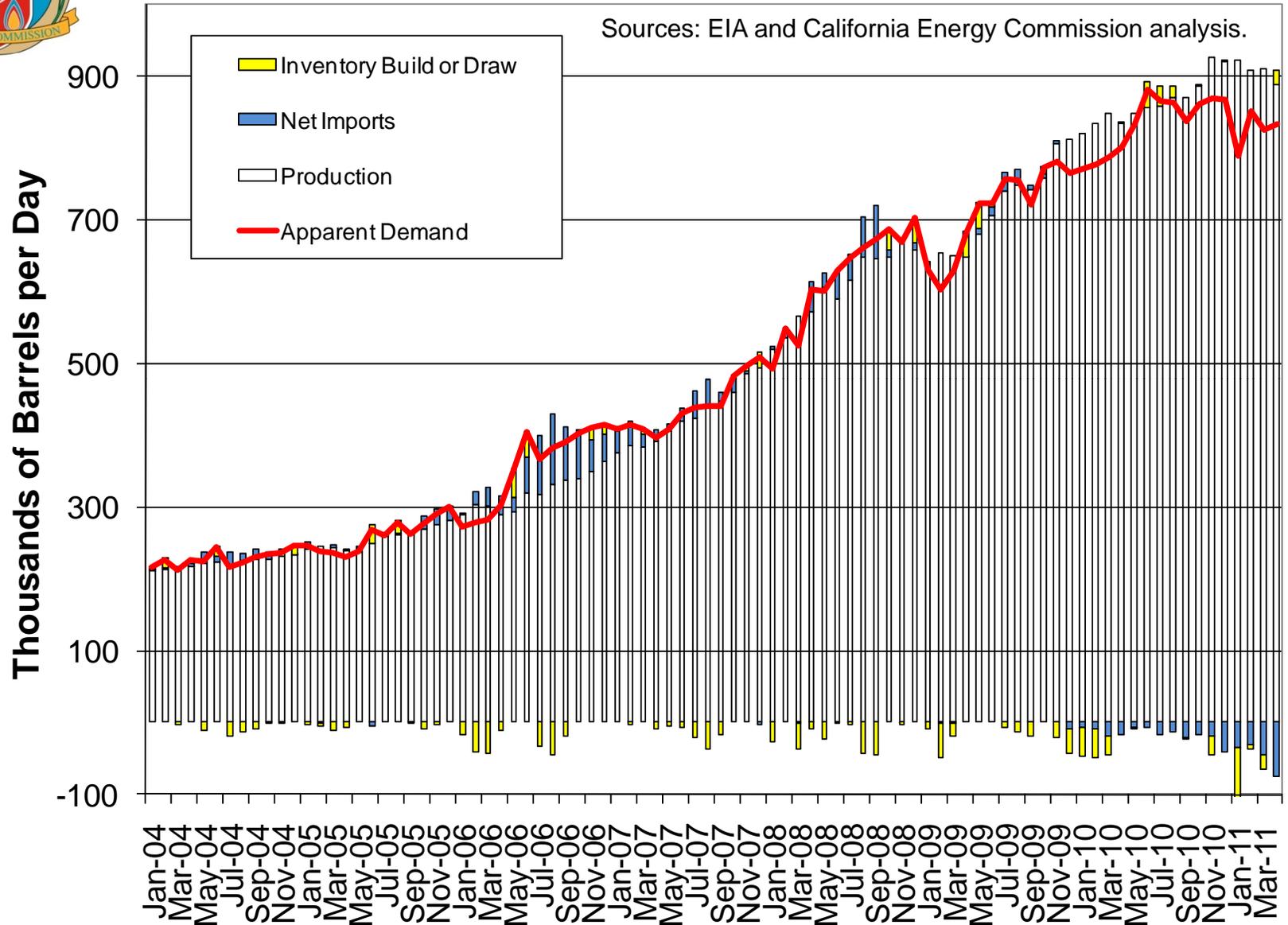


# California Fuel Ethanol Consumption



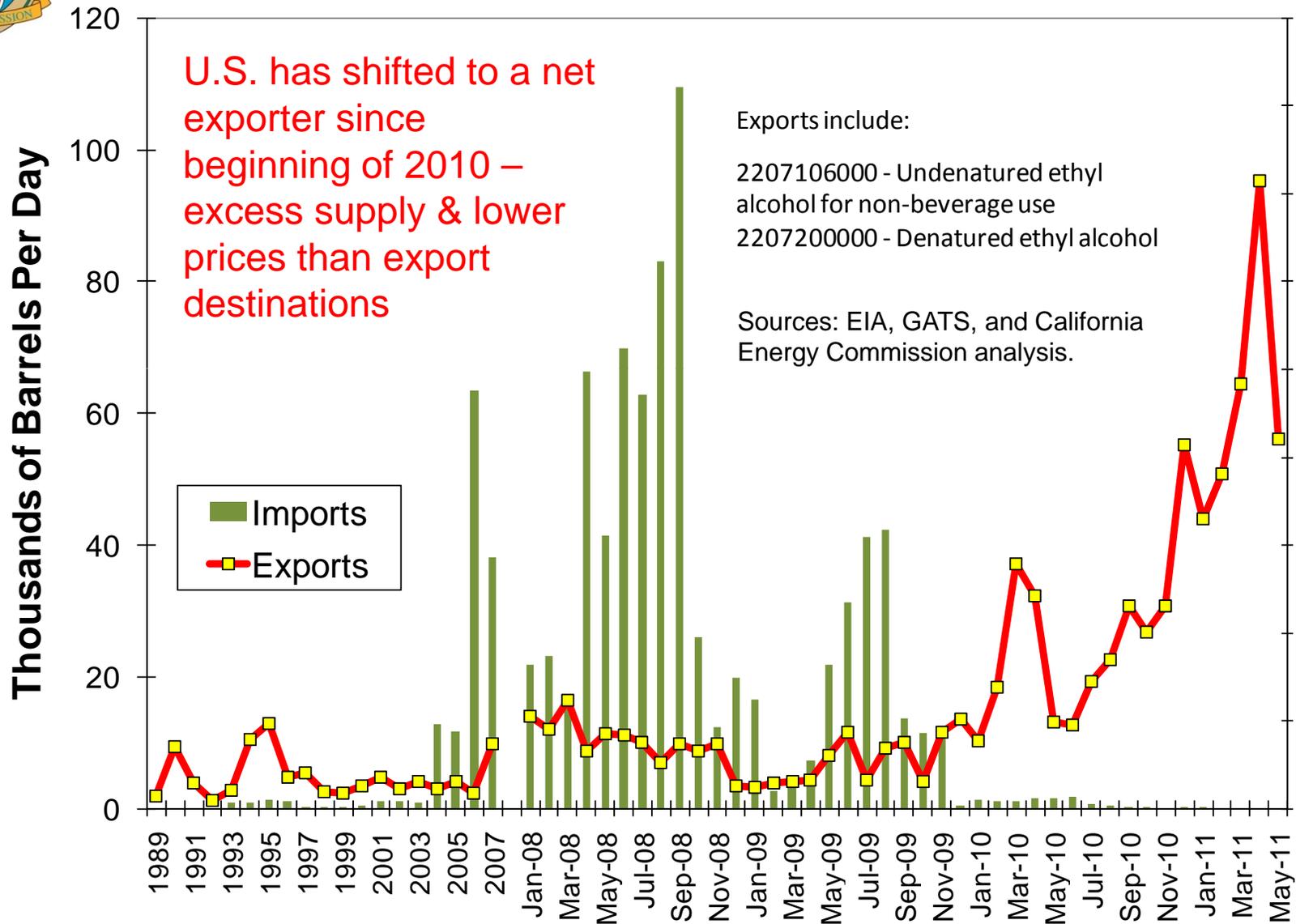


# U.S. Ethanol Supply and Demand



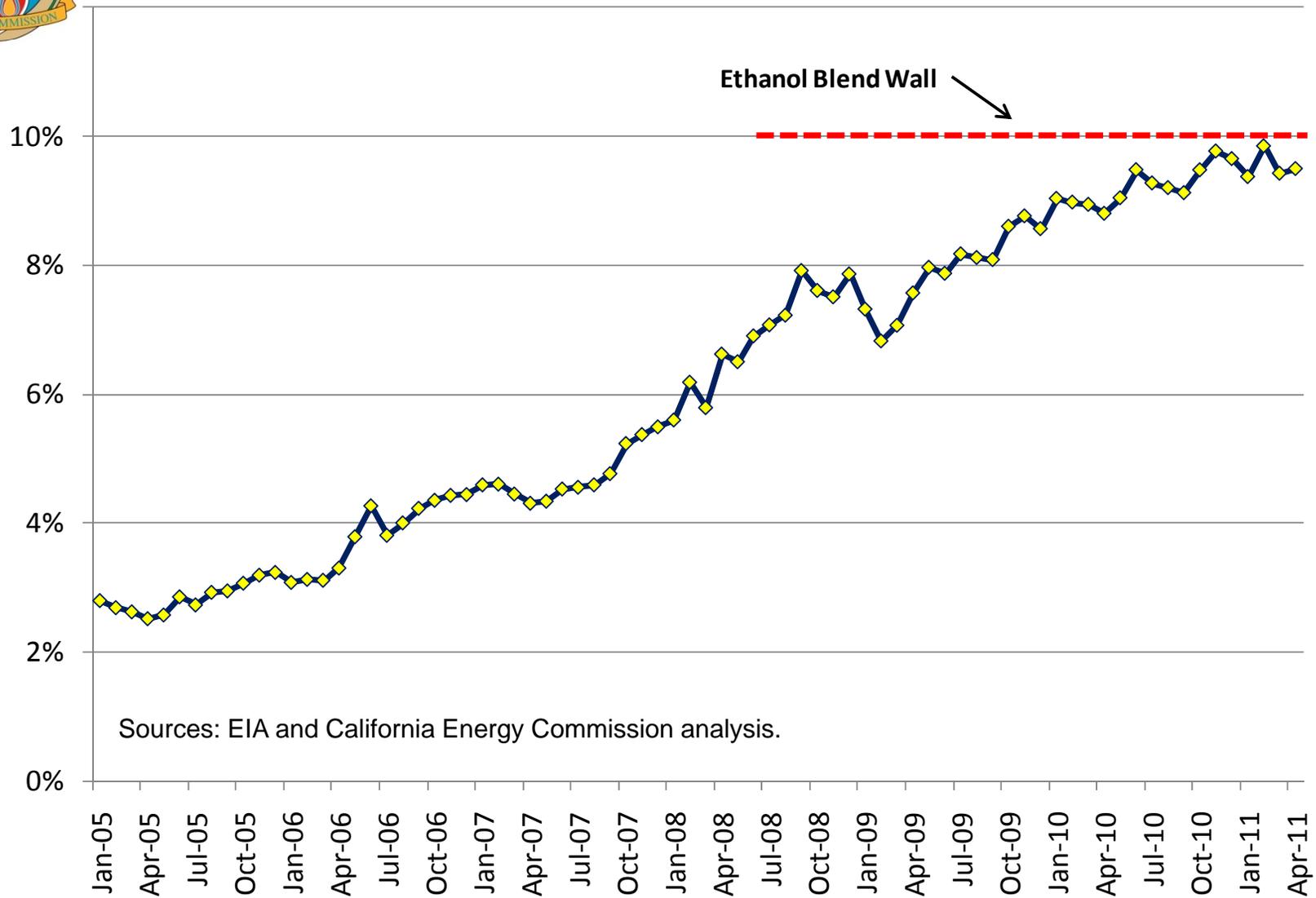


# U.S. Ethanol Imports and Exports





# U.S. Ethanol Concentration in Gasoline



Sources: EIA and California Energy Commission analysis.



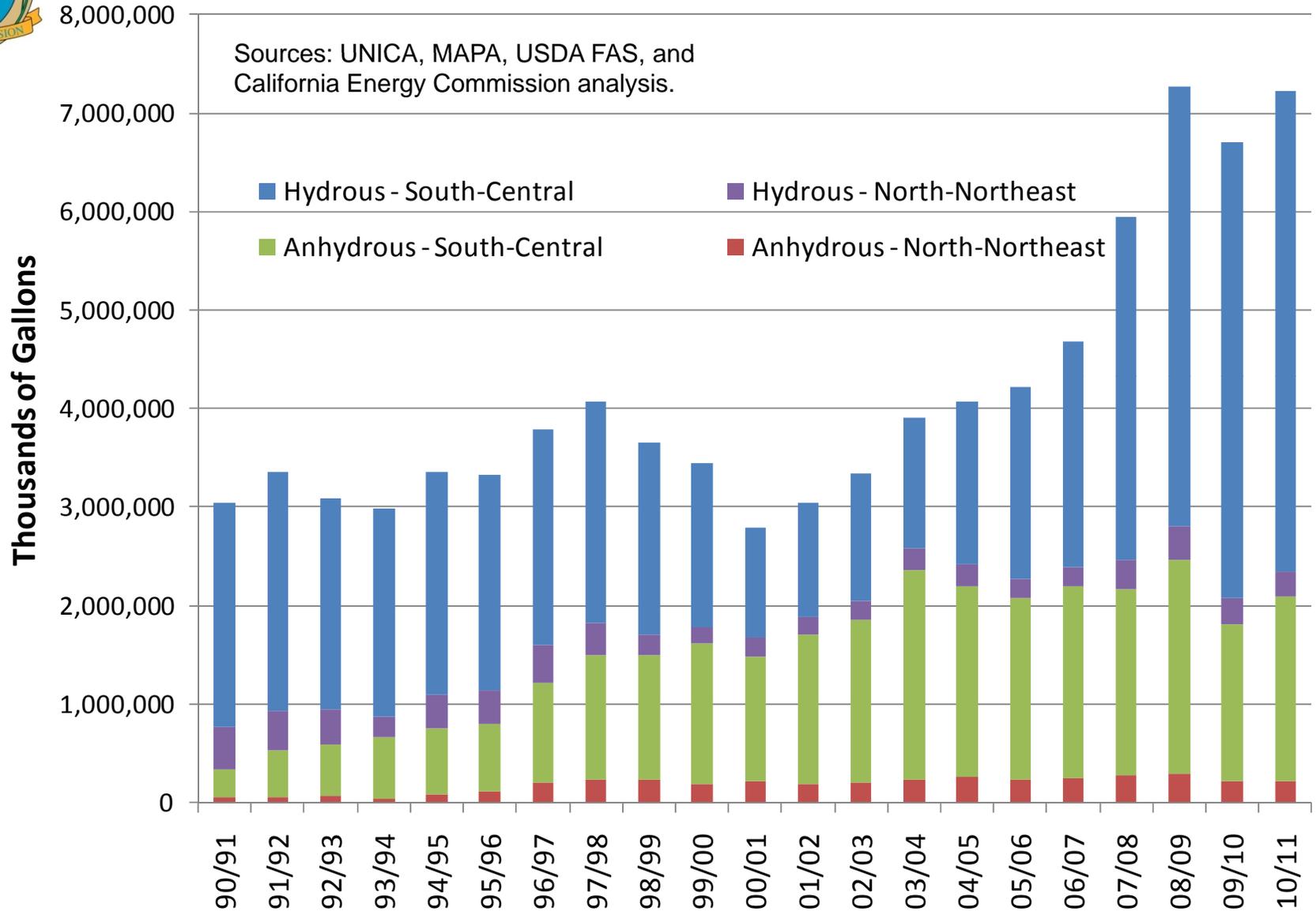
# Brazilian Ethanol

- The United States surpassed Brazil as the top ethanol producer during 2007 and will nearly double Brazil's output for 2011
- However, Brazilian ethanol will be a commodity in high demand as companies strive to source adequate quantities of biofuels to meet the Other Advanced requirements under RFS2 and meet obligations under the LCFS

2010 Comparison	Brazil	United States
Number of Ethanol Plants	162	209
Combined Number of Ethanol & Sugar Mill Facilities	251	
Total Ethanol Plants	413	209
Total Ethanol Production (Billions of Gallons)	7.2	13.2
Average Plant Production (Millions of Gallons/Year)	17.5	63.2
Ethanol Production Per Acre of Feedstock (Gallons)	655.5	424.9
Ethanol Plant Operation	Seasonal	Year-round
Long-Term Feedstock Storage	No	Yes

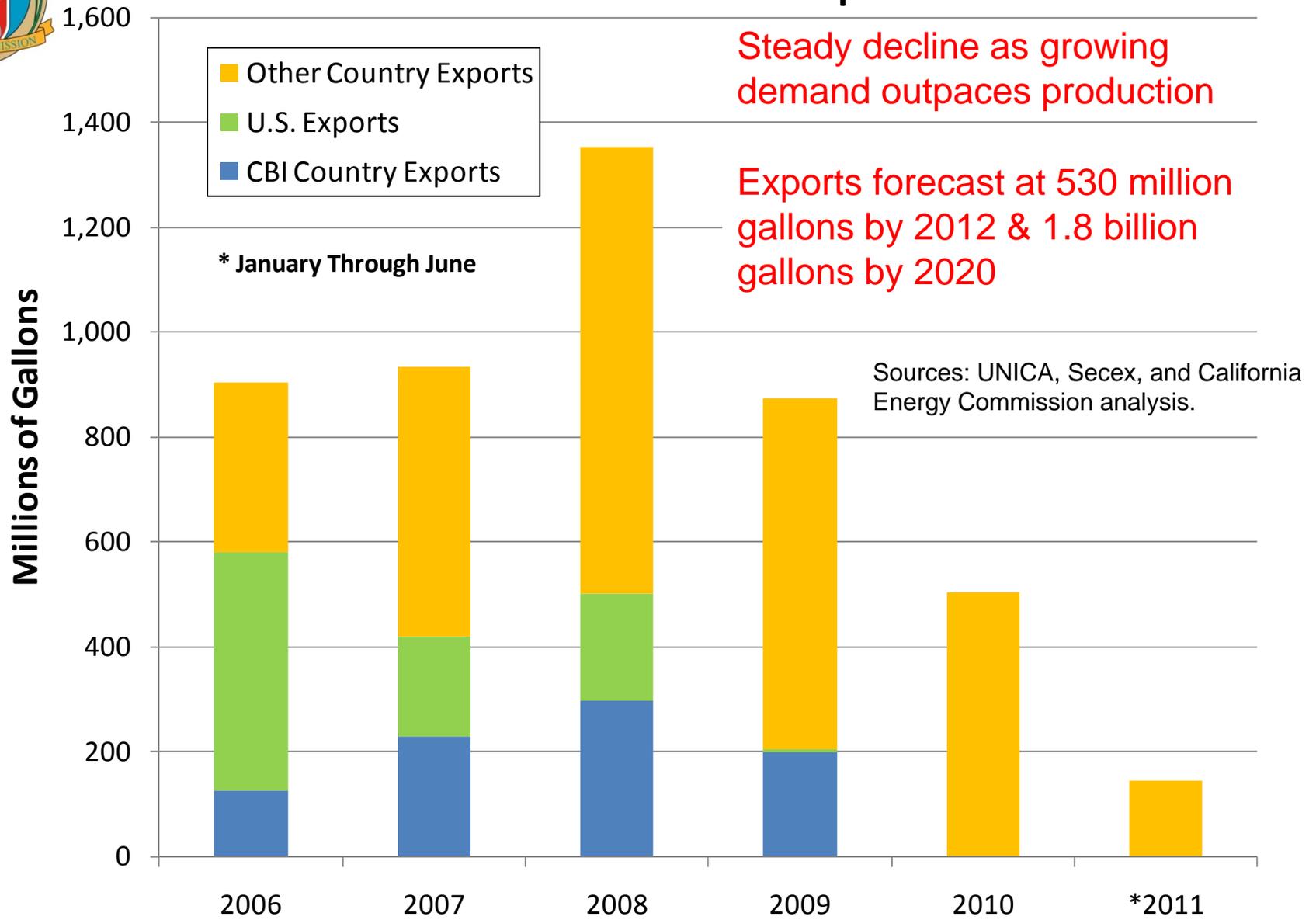


# Brazil Ethanol Production





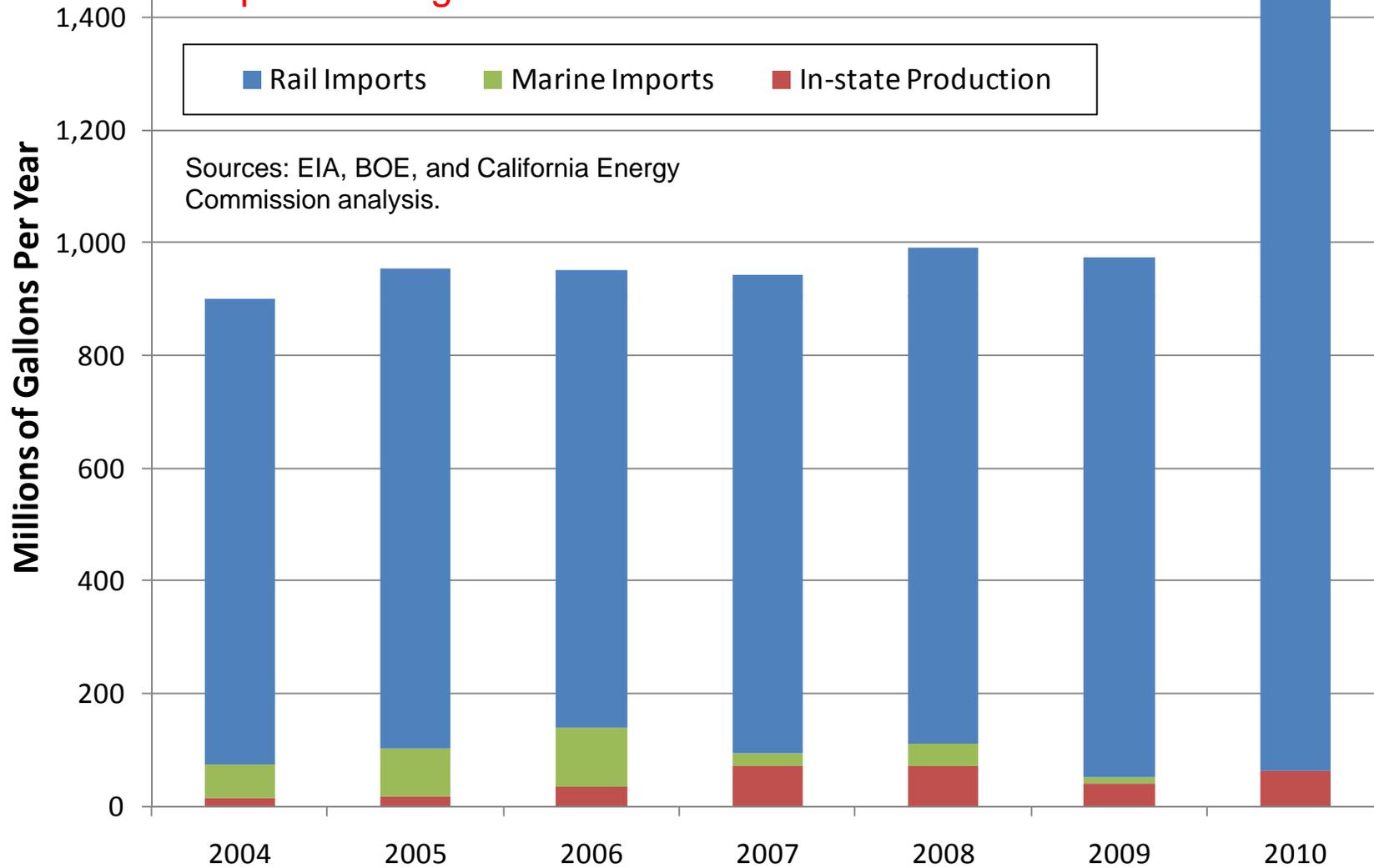
# Brazil Ethanol Exports





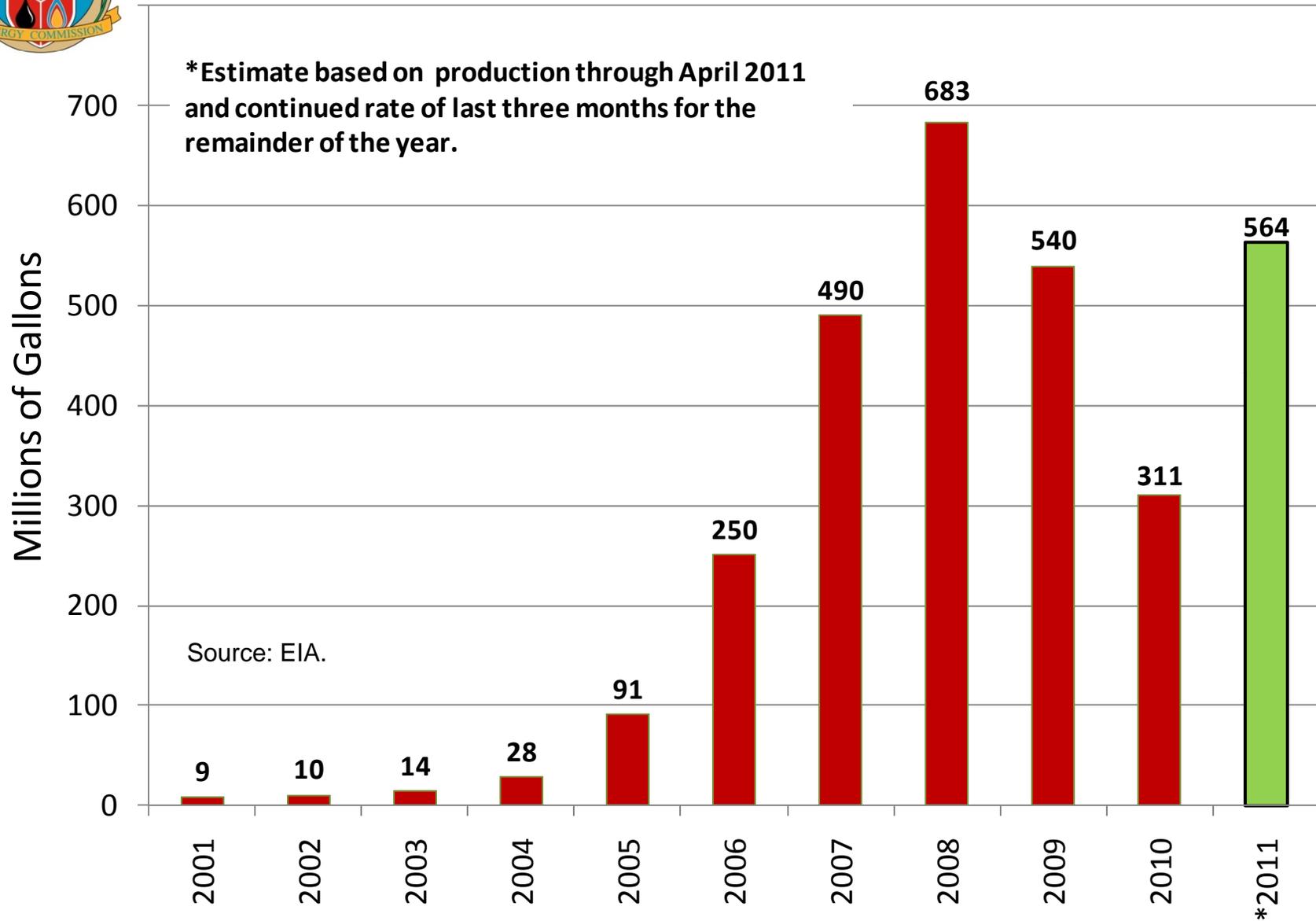
# California Ethanol Infrastructure

Rail infrastructure adequate to handle Brazil imports through Houston to California



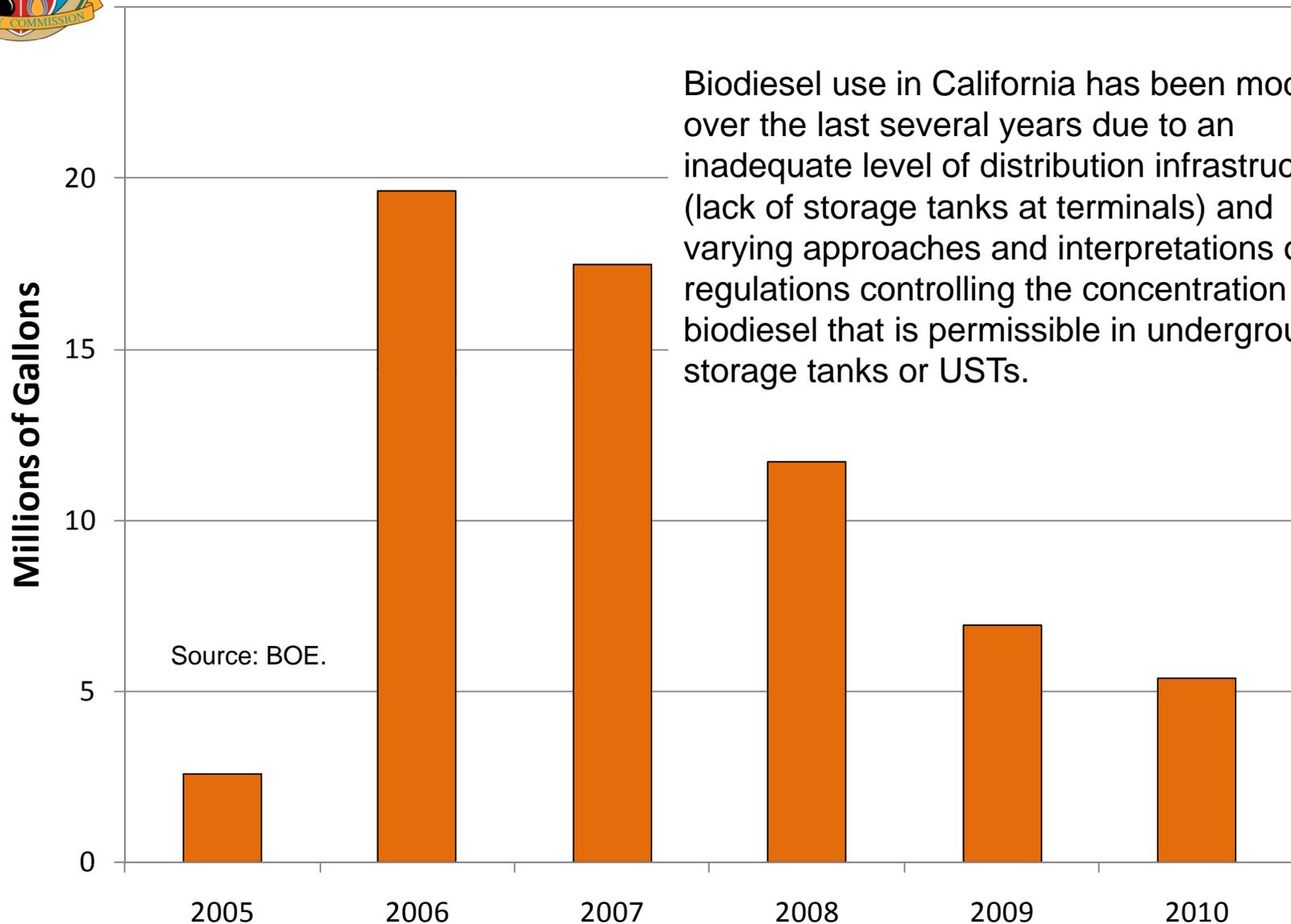


# U.S. Biodiesel Production





# California Biodiesel Consumption

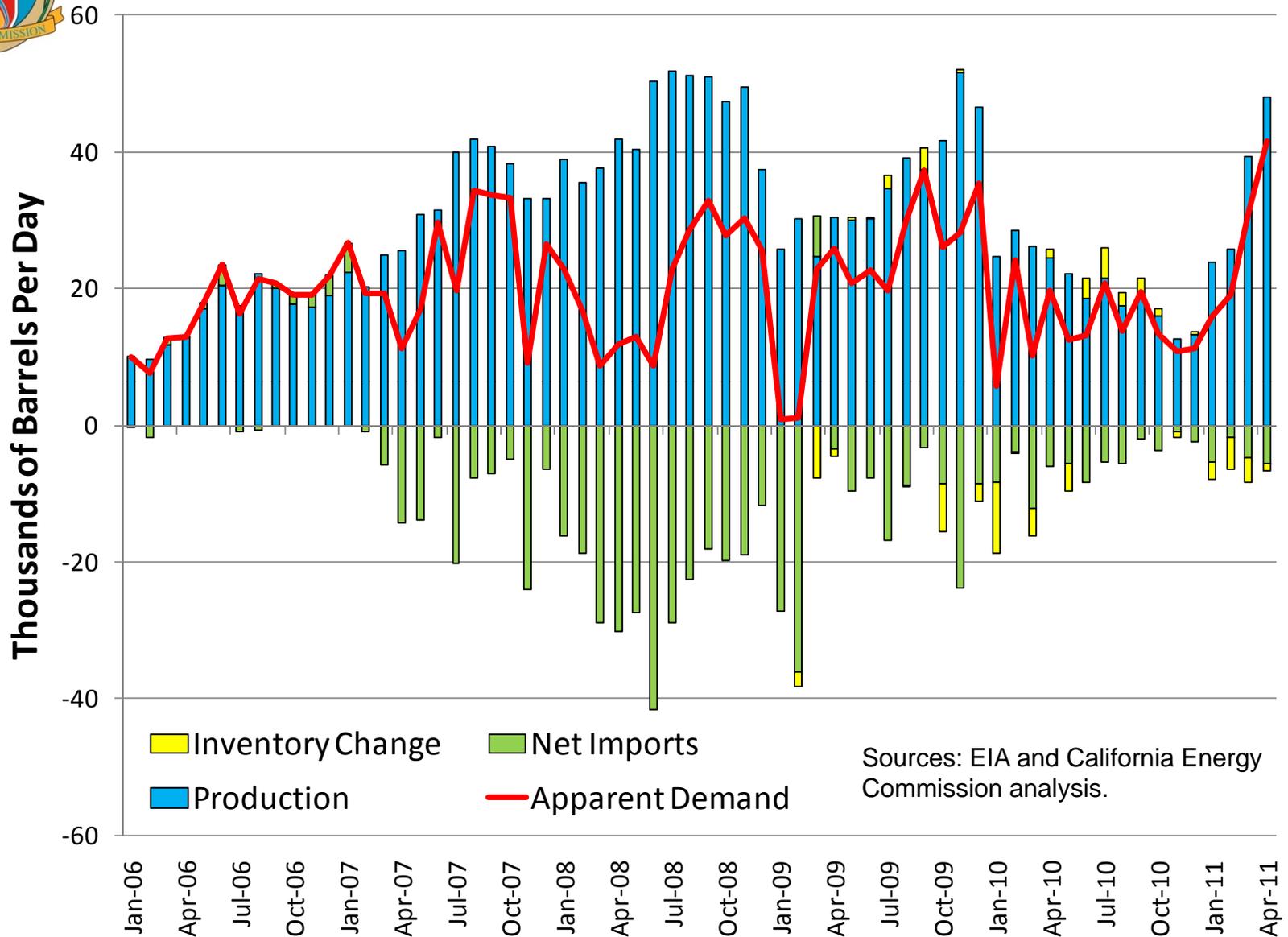


Biodiesel use in California has been modest over the last several years due to an inadequate level of distribution infrastructure (lack of storage tanks at terminals) and varying approaches and interpretations of regulations controlling the concentration of biodiesel that is permissible in underground storage tanks or USTs.

Source: BOE.



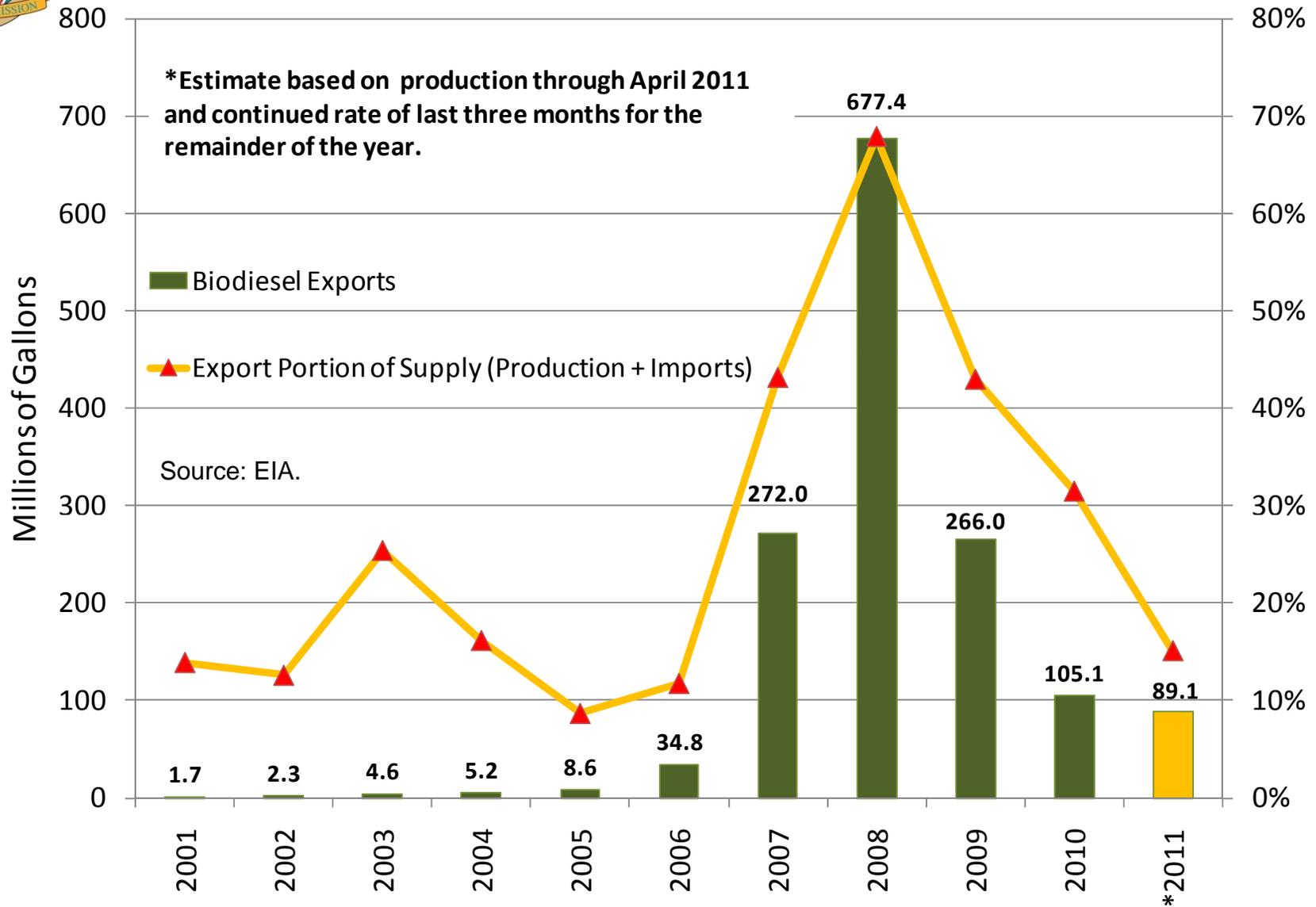
# U.S. Biodiesel Supply and Demand



Sources: EIA and California Energy Commission analysis.



# U.S. Biodiesel Exports





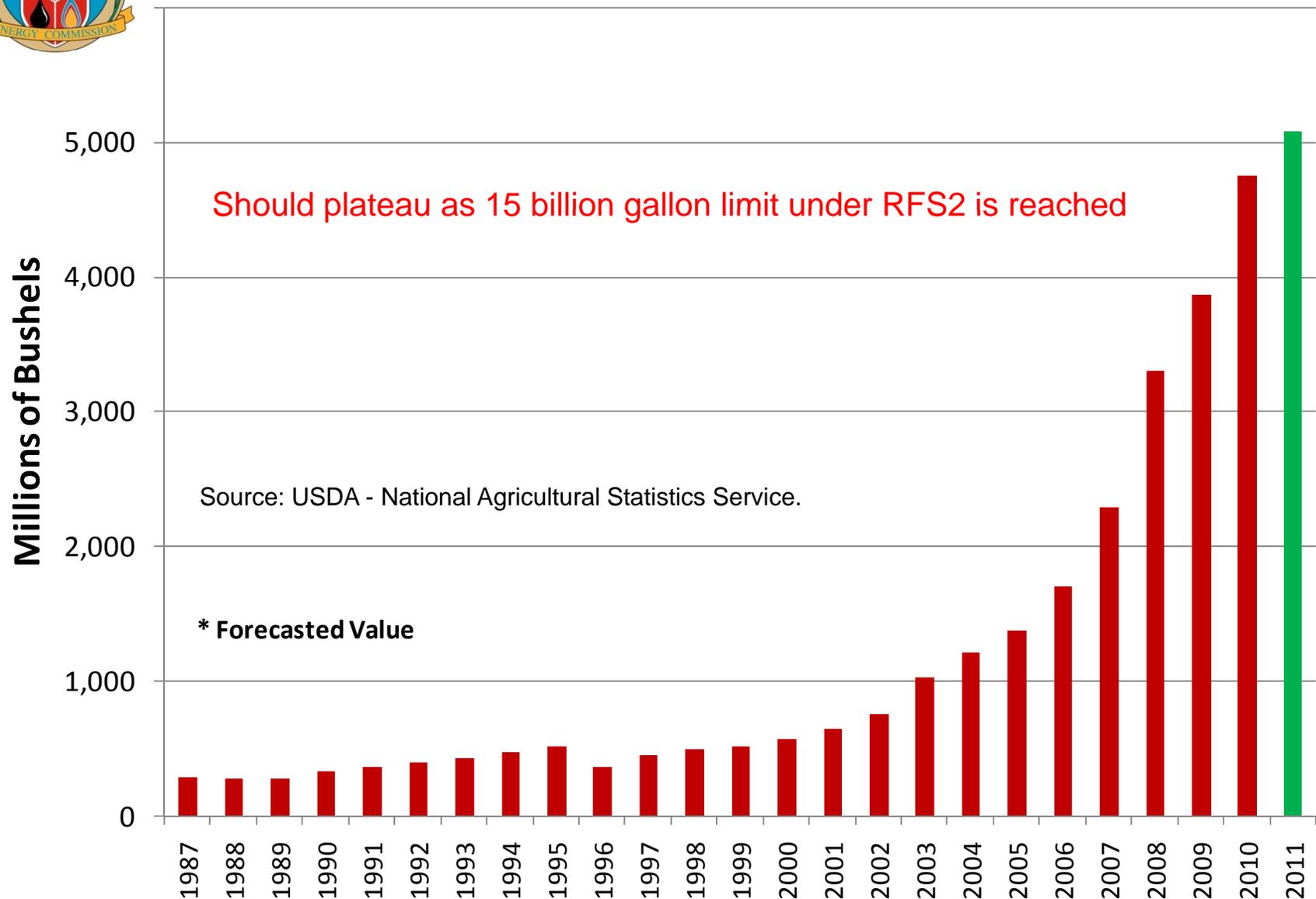


# Biodiesel Issues

- High feedstock costs have limited increased use of biodiesel, despite federal mandate to use one billion gallons per year
- Inadequate storage infrastructure at distribution terminals decreases blending opportunities
- Biodiesel blends in excess of 5 percent by volume have become a potential incremental source of air pollution – oxides of nitrogen
  - Higher blend rates will likely have challenges depending on the nature of the mitigation options that are ultimately determined through the development of new regulations
- Vehicle warranty issues in excess of B10 could limit an increased biodiesel contribution from this fuel
- Renewable diesel fuel does not have most of these issues.

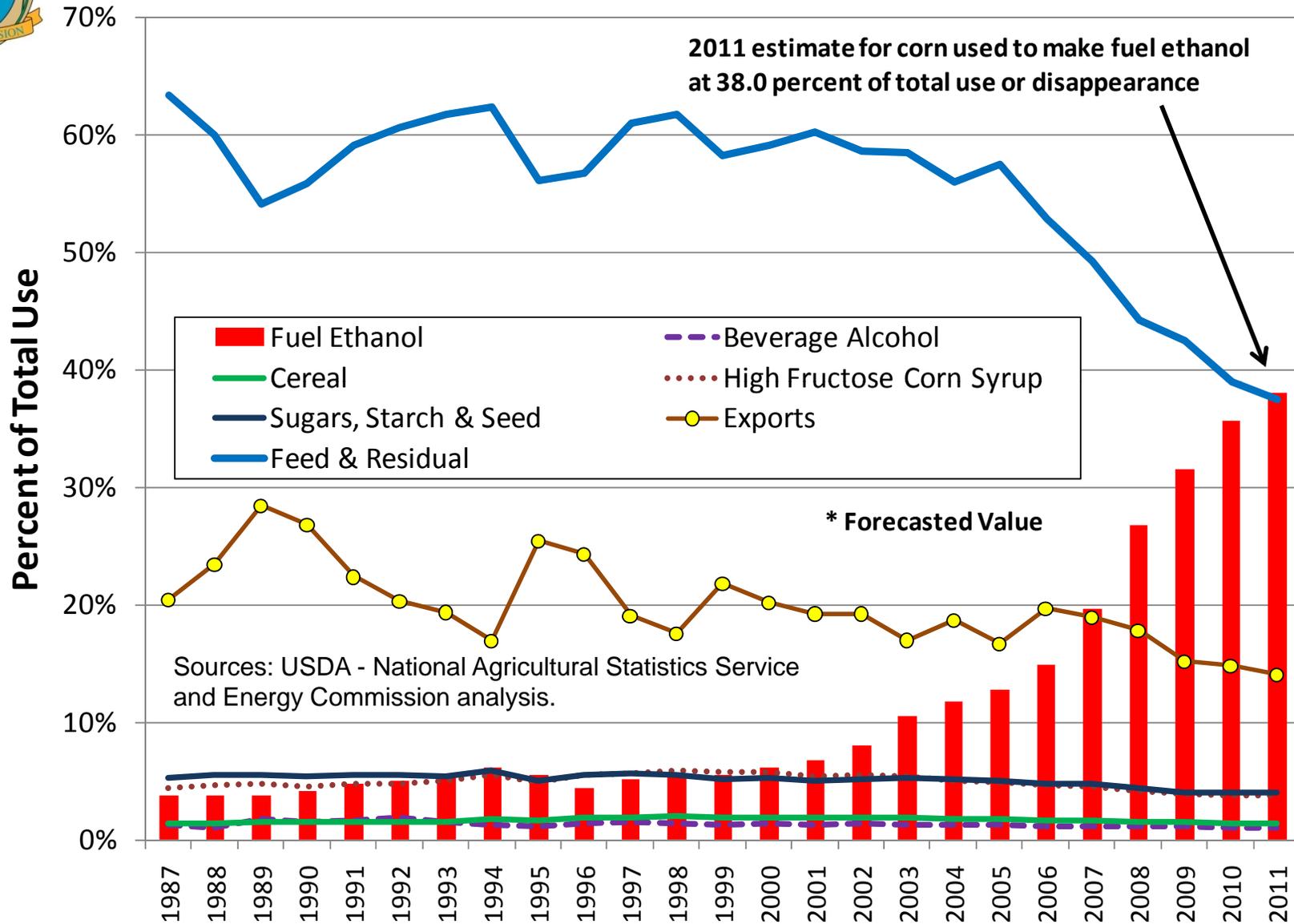


# U.S. Corn Demand for Ethanol Production



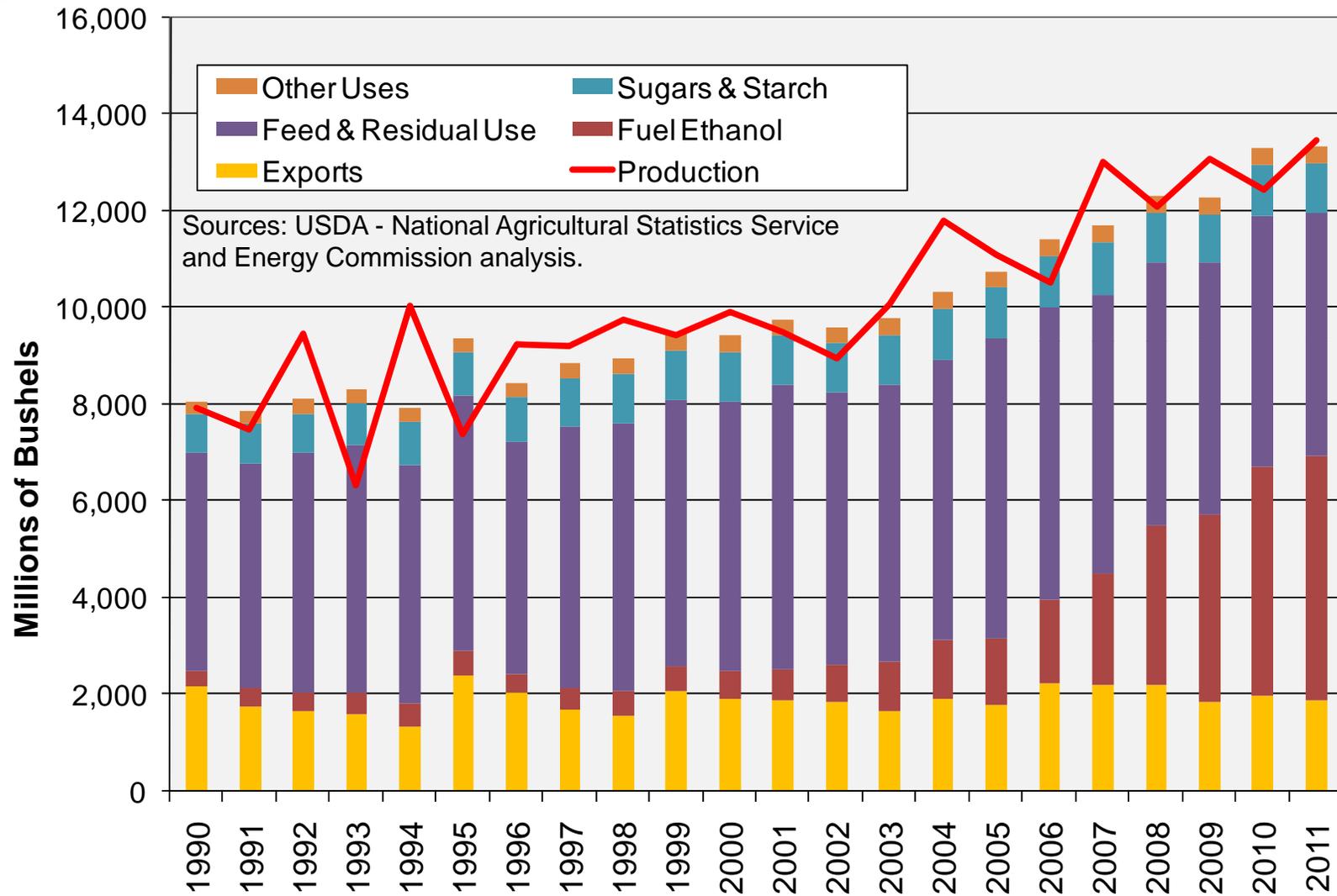


# U.S. Corn as a Percentage of Total Use



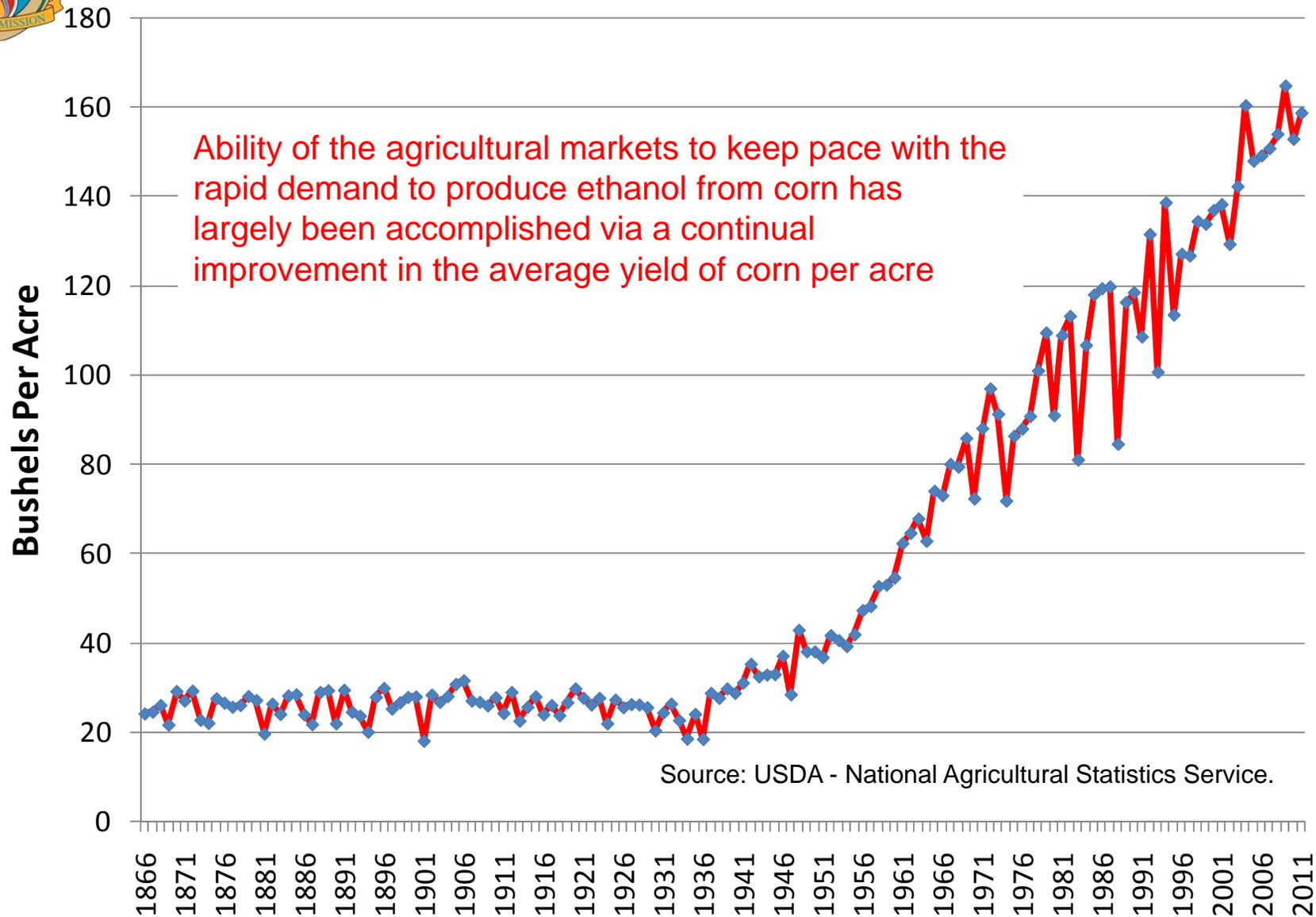


# U.S. Corn Production and End Use



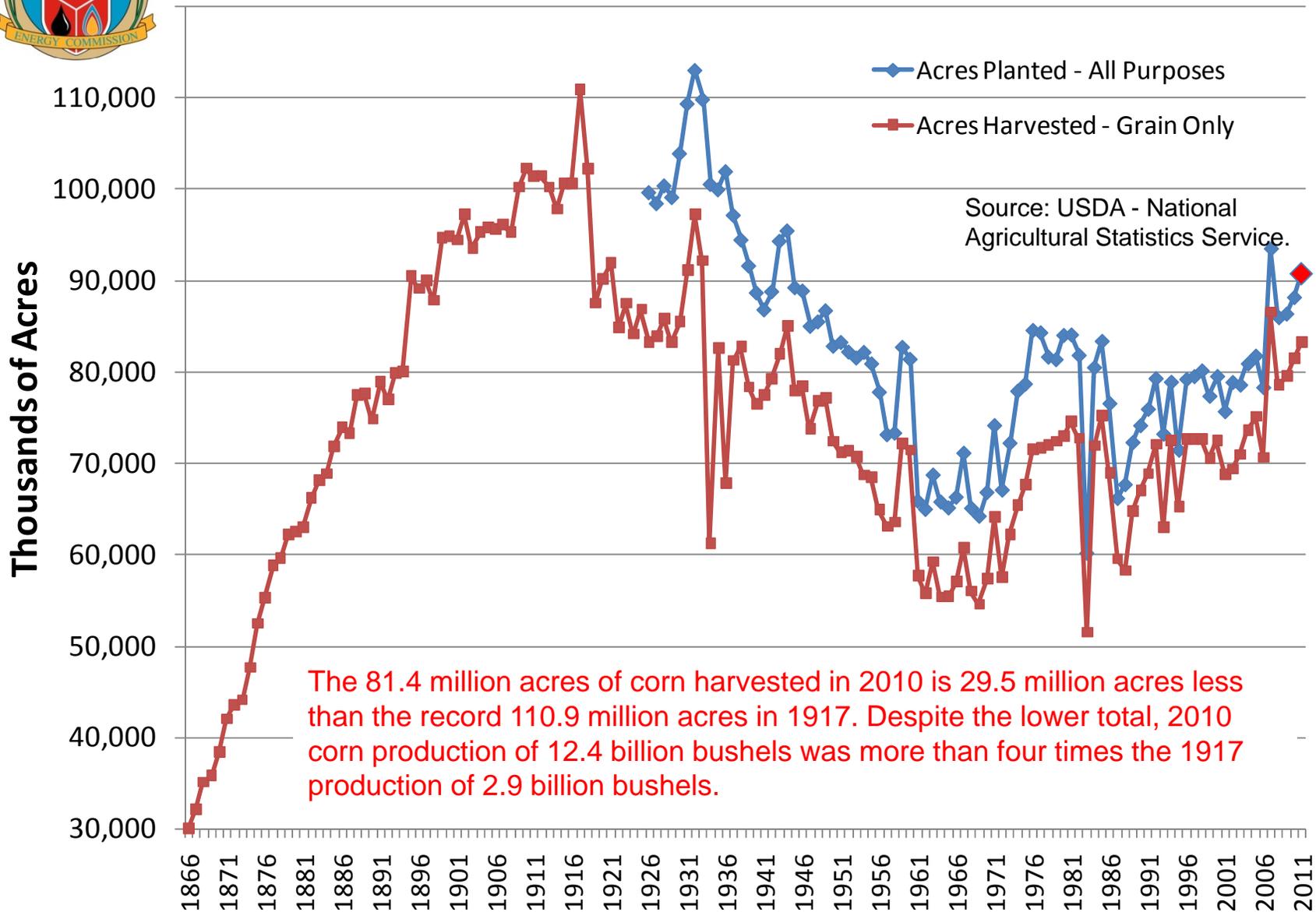


# U.S. Annual Corn Yield



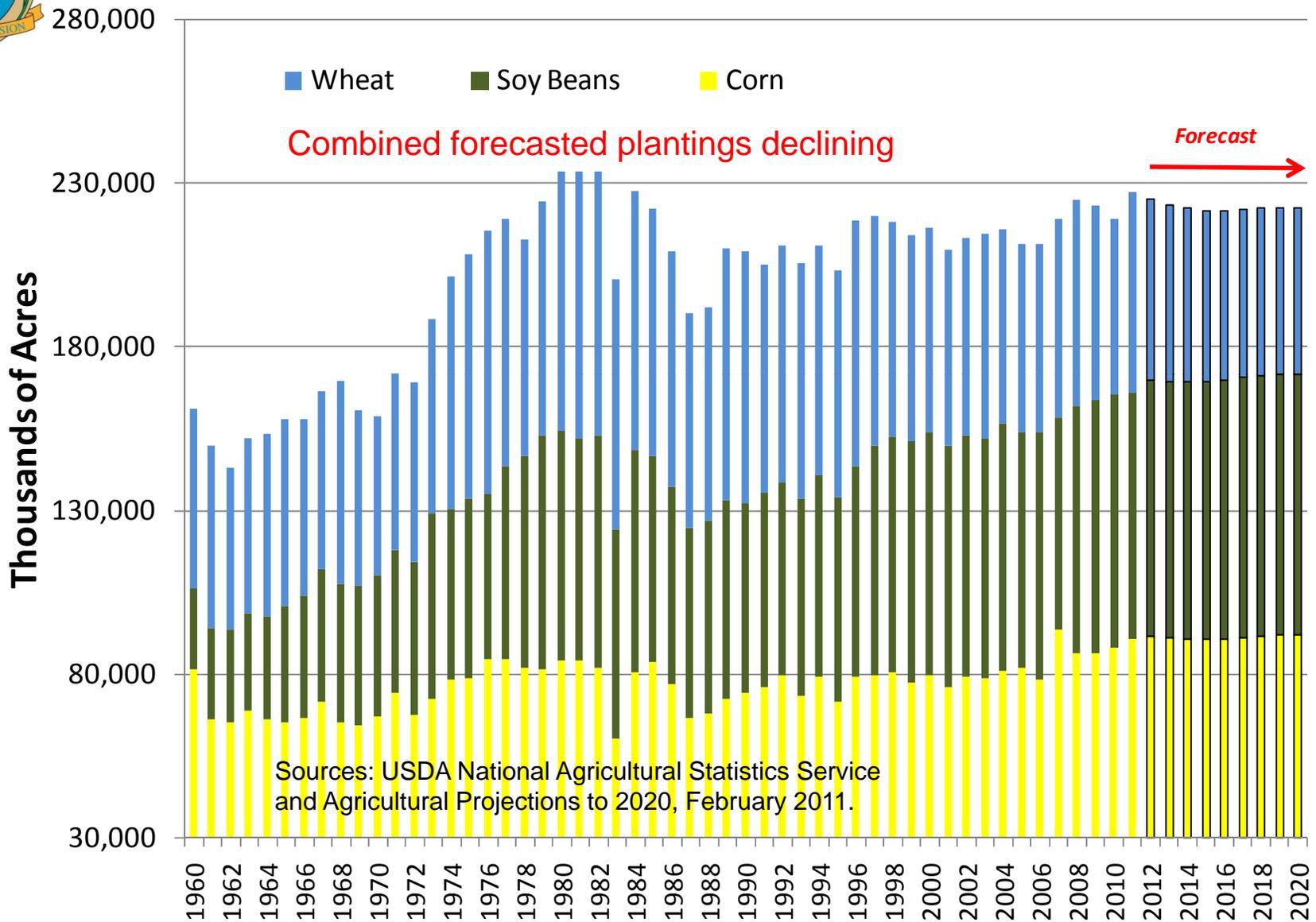


# Acres of Corn Planted and Harvested



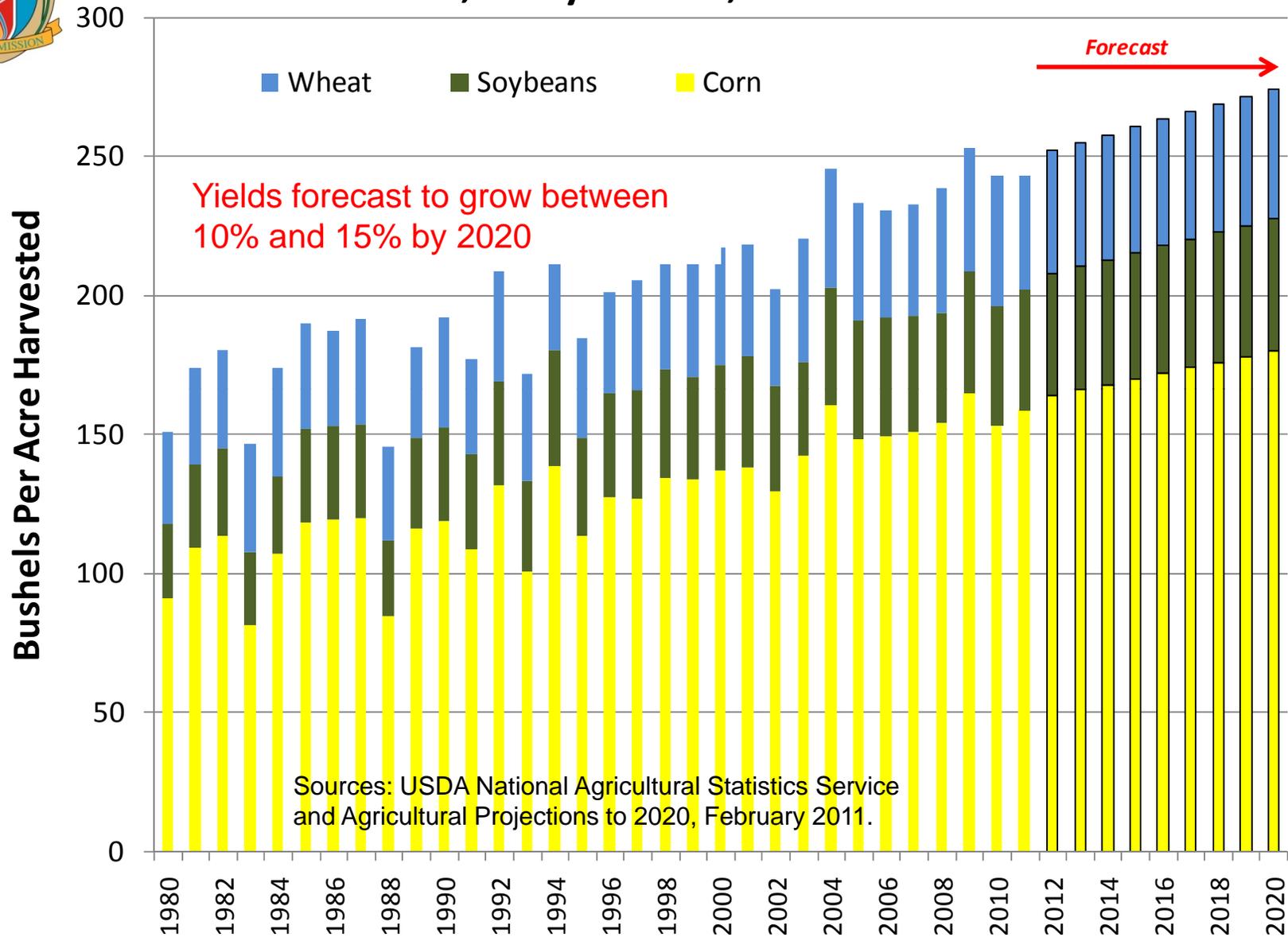


# U.S. Corn, Soybean, and Wheat Plantings



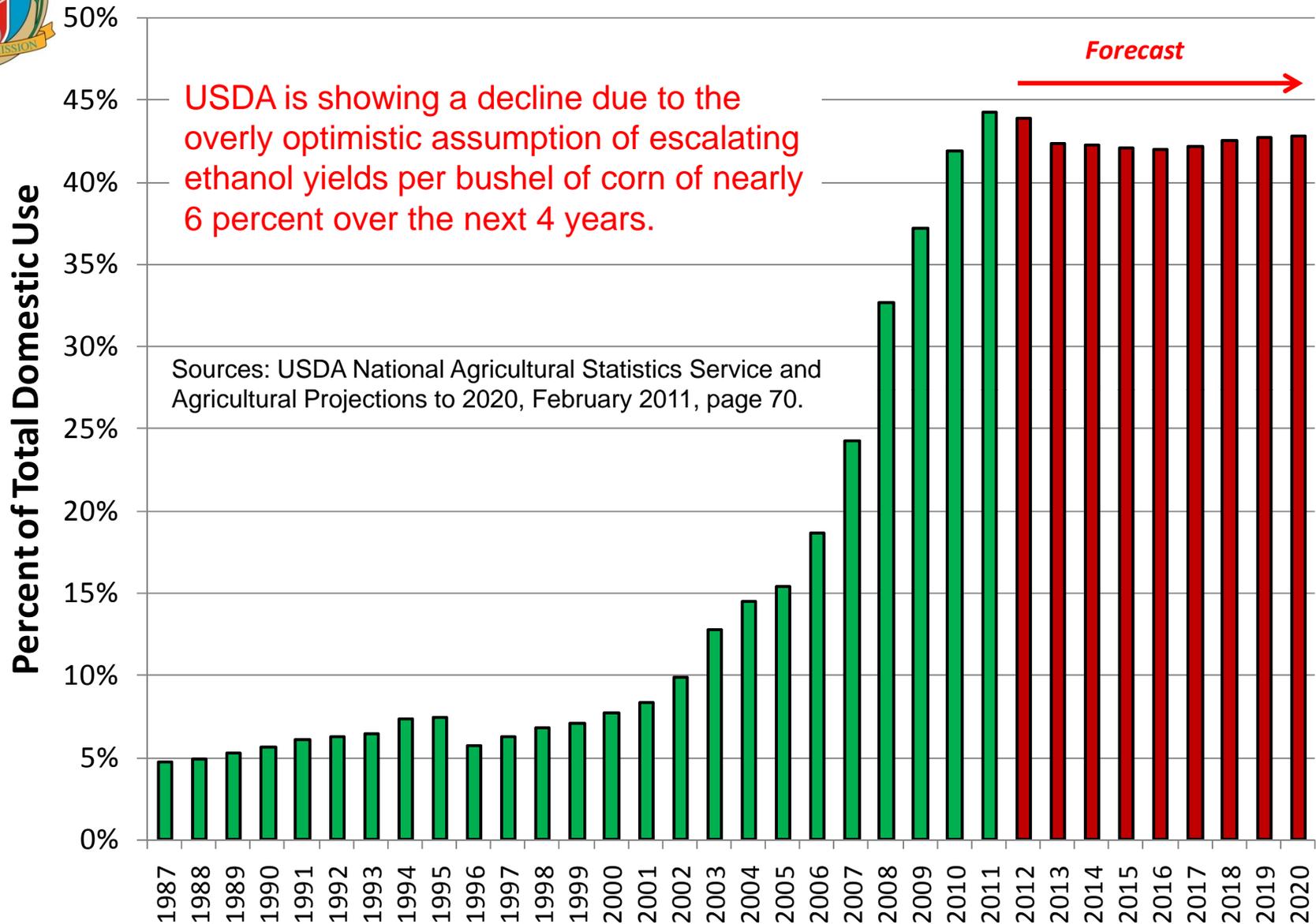


# U.S. Corn, Soybean, and Wheat Yields





# U.S. Corn Forecast for Ethanol Production





## Other Potential Agriculture Issues

- Water use associated with increased corn demand for ethanol has been raised by stakeholders
  - Majority of corn is grown without the use of any irrigated water, solely dependent on rainfall during the growing season - in 2007, only 15.3 percent of corn acres were irrigated
  - Assuming the ratio remains fairly constant, increasing corn production due to higher mandated ethanol demand should primarily occur through expansion of dry cropping
- Higher fertilizer use has also been cited as a concern
  - The application rate per acre of corn for nitrogen has increased 7.7 percent between 1980 and 2010, while the average corn yield has increased 67.9 percent over the same period
  - The continued improvement of corn yields is primarily a consequence of other improvements unrelated to increased use of nitrogen per acre