



Renewable Fuels: Standards, Supply and Demand Projections, & Infrastructure

Joint Transportation and IEPR Committee Workshop
Transportation Fuel Forecasts and Analyses

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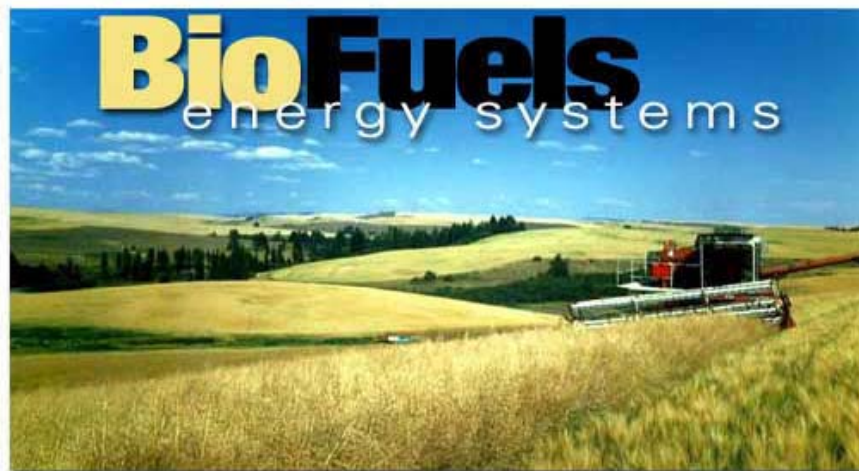


Renewable Fuels - Overview

- California use of renewable fuels expected to grow
- Federal and State programs mandate greater use
- Increased use of renewable fuels expected to further decrease initial gasoline demand forecasts
- Existing renewable infrastructure lacking, but new projects should provide necessary logistical import capability
- However, retail and vehicle infrastructure for increased use of ethanol above 10 percent limit (E10) will require significant and rapid expansion to ensure adequate capability to utilize projected penetration of E85

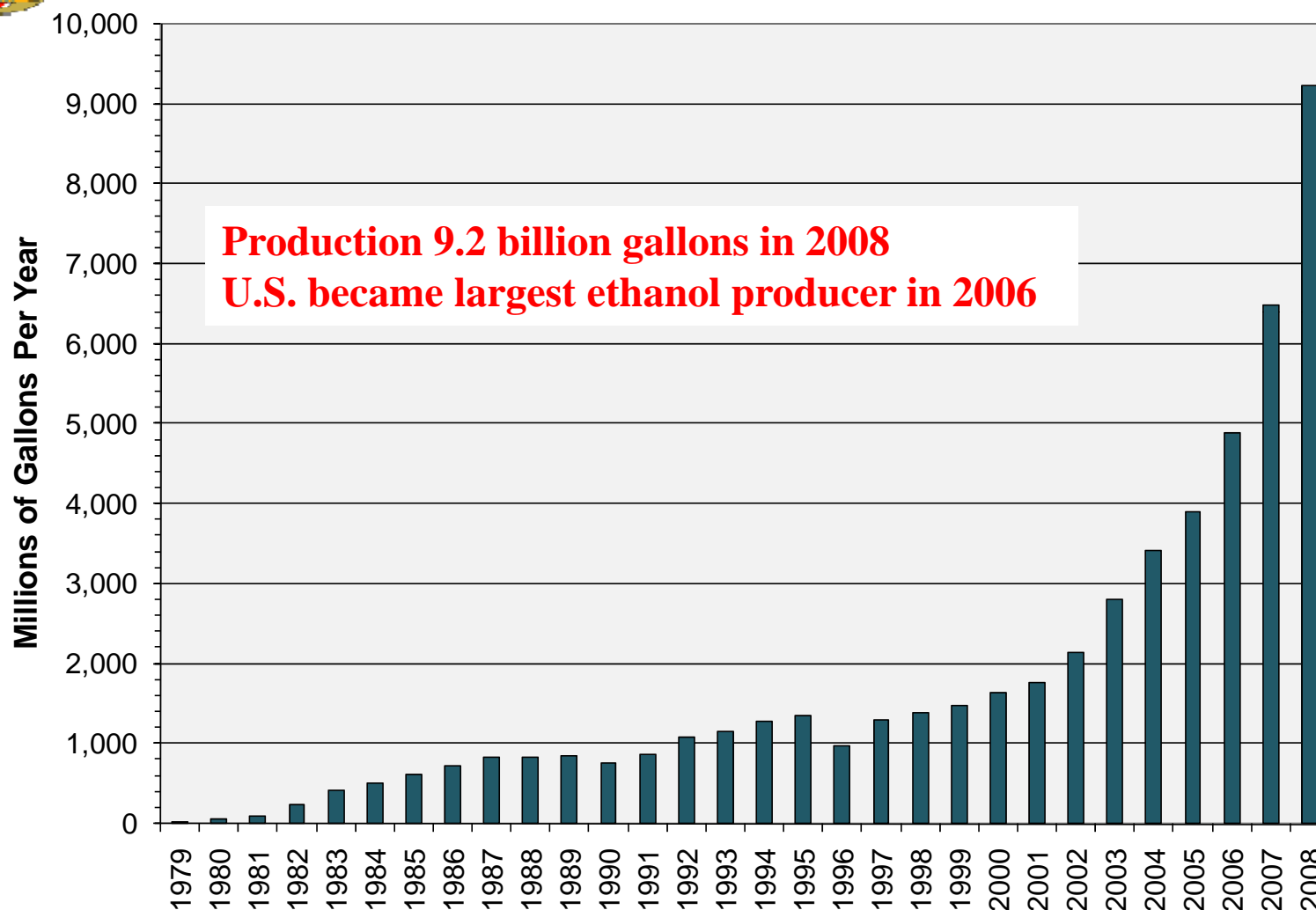


Renewable Fuels Forecasting & Issues





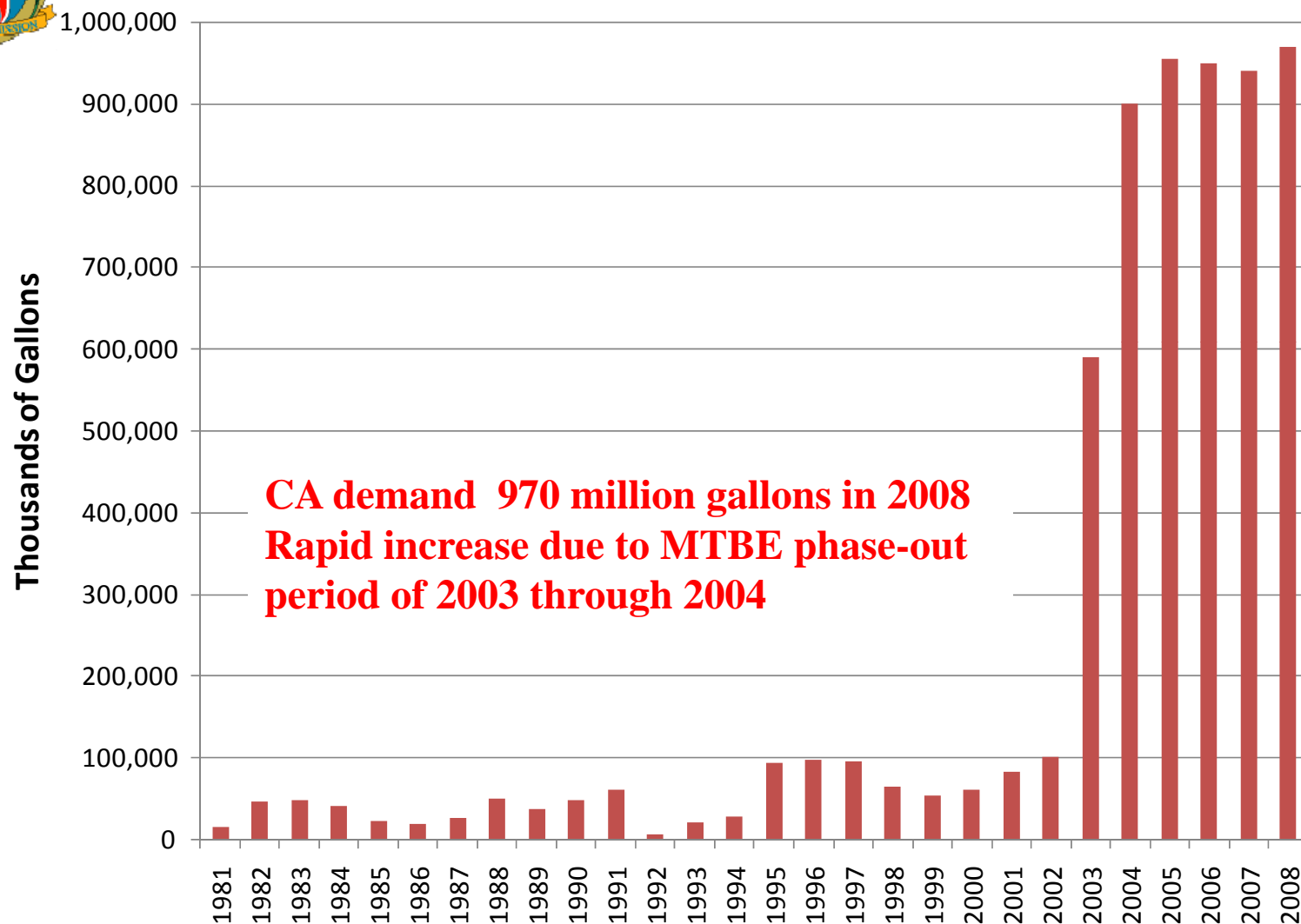
U.S. Ethanol Production Continues to Increase



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California Ethanol Demand - Historical



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Renewable Fuels Standard – Increased Demand for Ethanol and Biodiesel

- Federal standard (RFS2) mandates increased use of renewable fuel – both ethanol and biodiesel
- Obligated parties (refiners, importers, and blenders) have minimum obligations that gradually rise between 2009 and 2022 – referred to as their Renewable Volume Obligation (RVO)
- Companies can generate Renewable Identification Number (RIN) credits for excess renewable fuel use
- Compliance may include purchase of RIN credits
- Program *is not* a “per-gallon” regulation

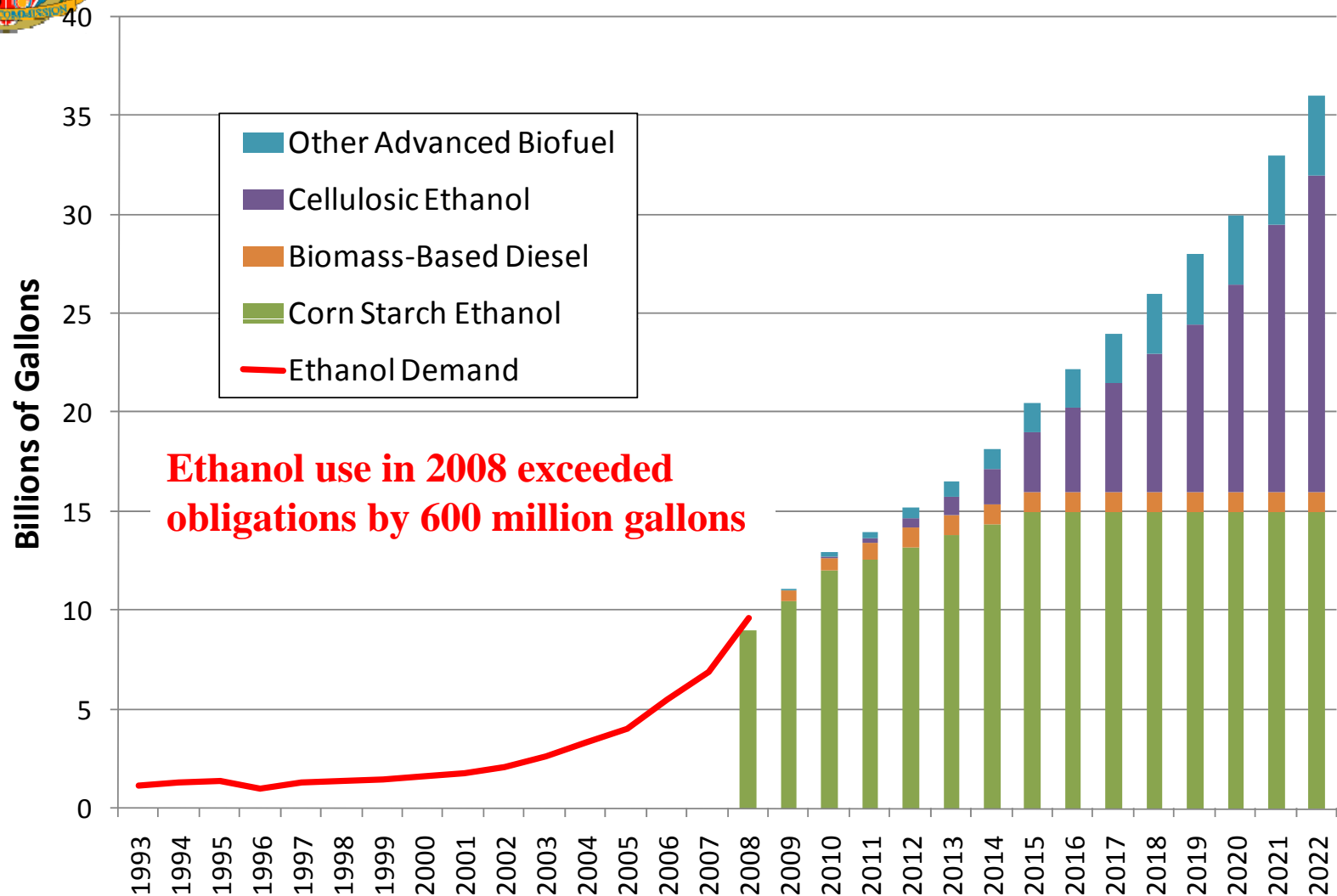


Renewable Fuels Standard (RFS2)

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	0.10	0.20	0.65	0.95
2011	13.95	12.60	0.25	0.30	0.80	1.35
2012	15.20	13.20	0.50	0.50	1.00	2.00
2013	16.55	13.80	1.00	0.75	1.00	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



U.S. Ethanol Use and RFS Obligations



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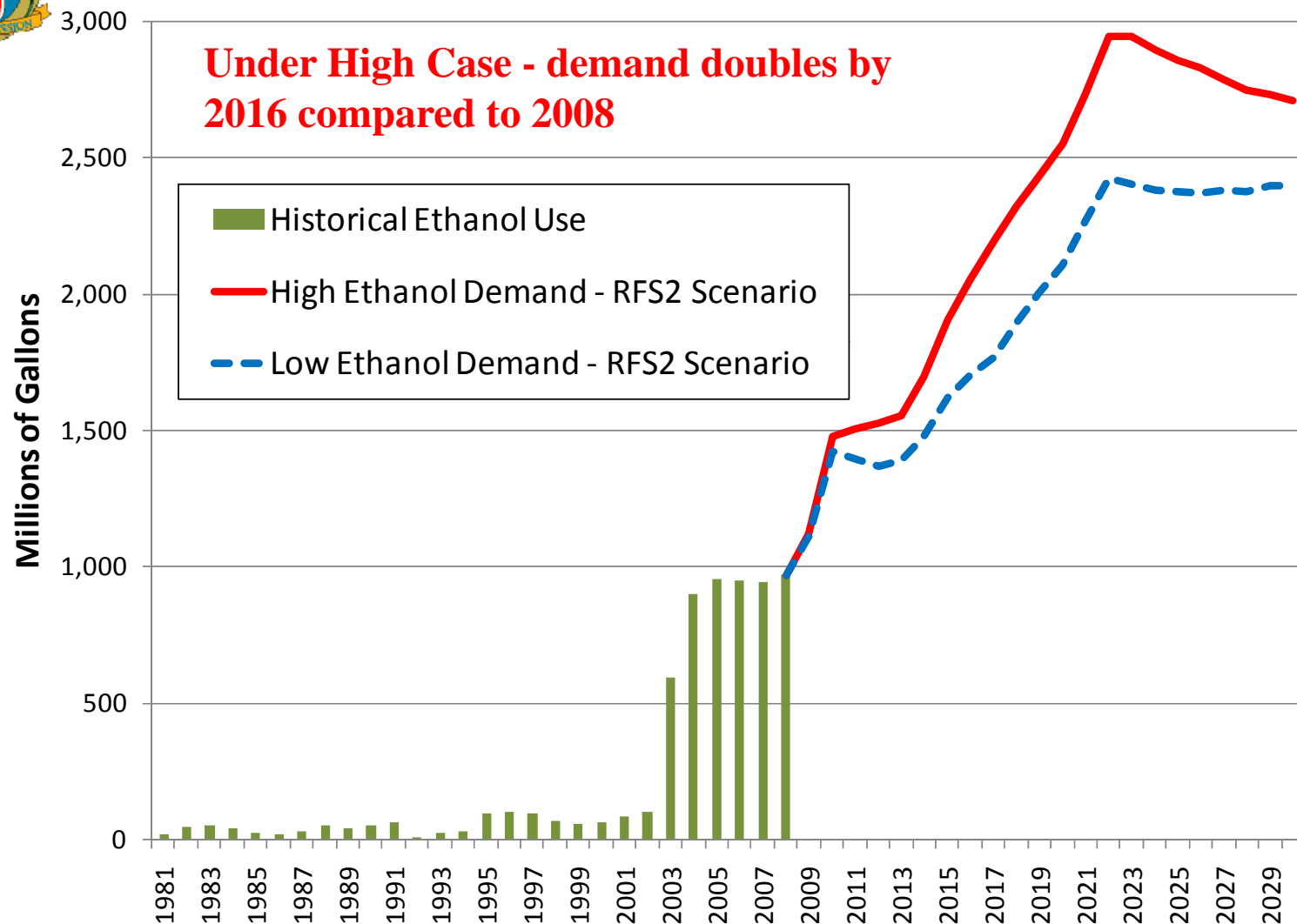


California “Fair Share” Calculations

- Staff assumed obligated parties in California would be blending their “fair share” within the state’s borders
- Also assumed ethanol blend limit of 10 volume percent
- This approach yielded more of a “worst case” demand and infrastructure assessment, but still recognizing that the forecasted demand for ethanol and biodiesel could be a bit less than presented in this staff report
- RFS2 compliance - impacts
 - Gasoline demand lower
 - E85 demand significantly higher
 - E85 retail dispenser availability needs to increase rapidly
 - Flexible fuel vehicle (FFV) population much greater



California Ethanol Demand - Projected



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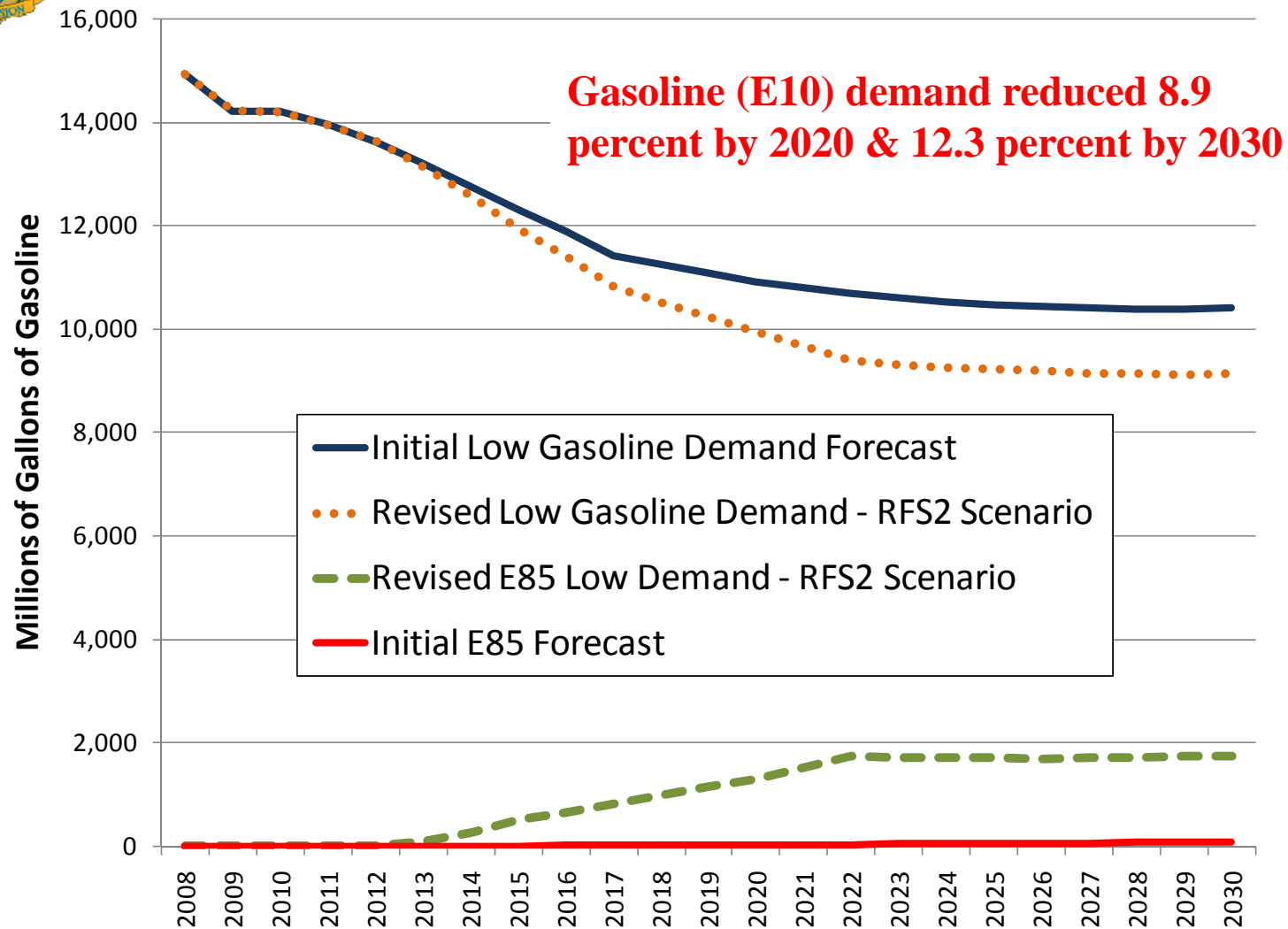


RFS2 - California Ethanol Impacts

- Under the Low Demand Case for gasoline, total ethanol demand in California is forecast to rise from 1.2 billion gallons in 2010 to 2.1 billion gallons by 2020
- Under the High-Demand Case for gasoline, total ethanol demand in California is forecast to rise from 1.2 billion gallons in 2010 to 2.6 billion gallons by 2020
- Ethanol demand will exceed an average of 10 percent by volume in all gasoline sales between 2012 and 2013
- However, it is unlikely that the low-level ethanol blend limit in California will be greater than E10, even if the U.S. EPA grants permission for use of E15



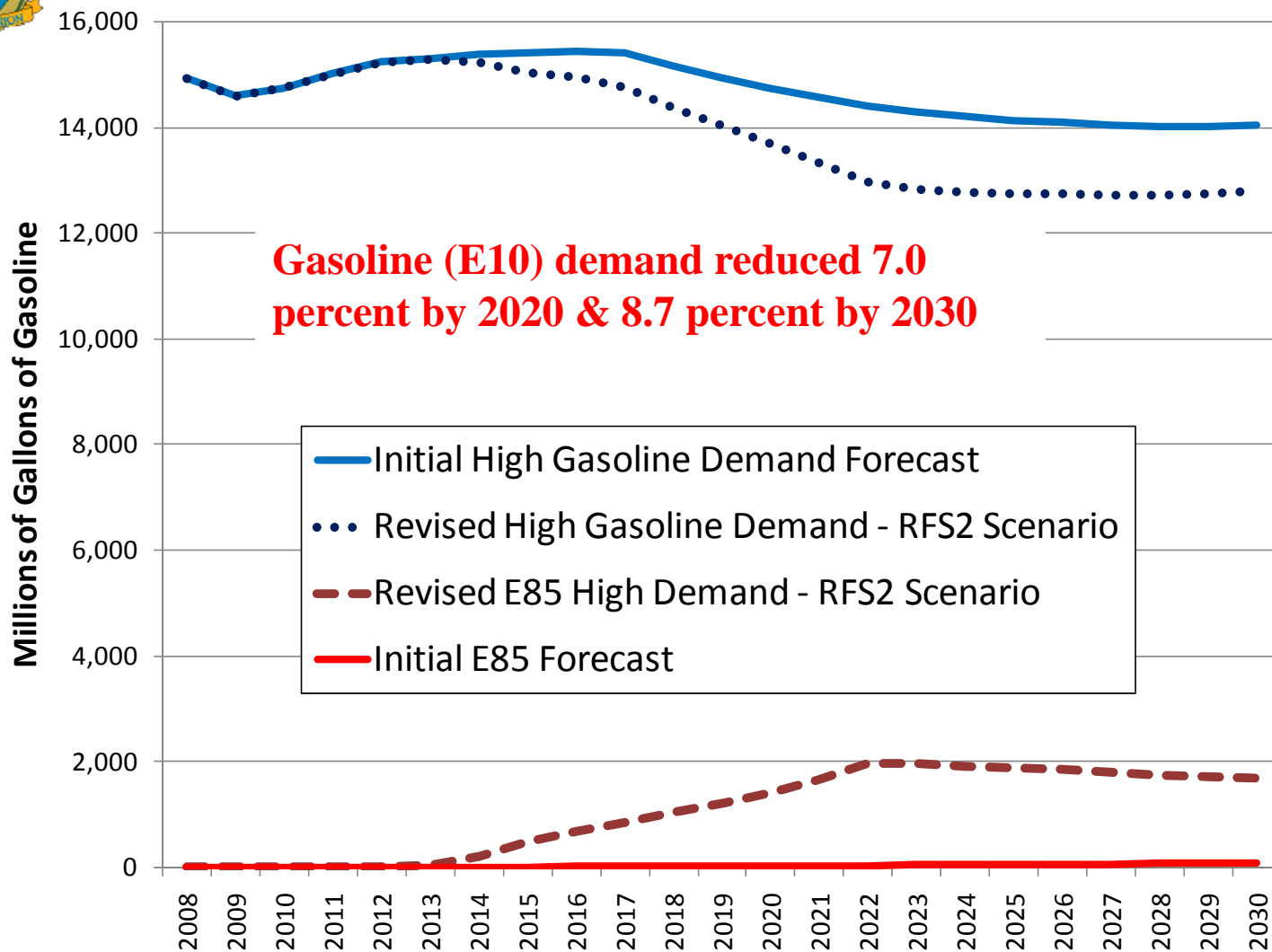
California Low Gasoline Demand – RFS2 Impact



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California High Gasoline Demand – RFS2 Impact



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E85 Outlook & Issues

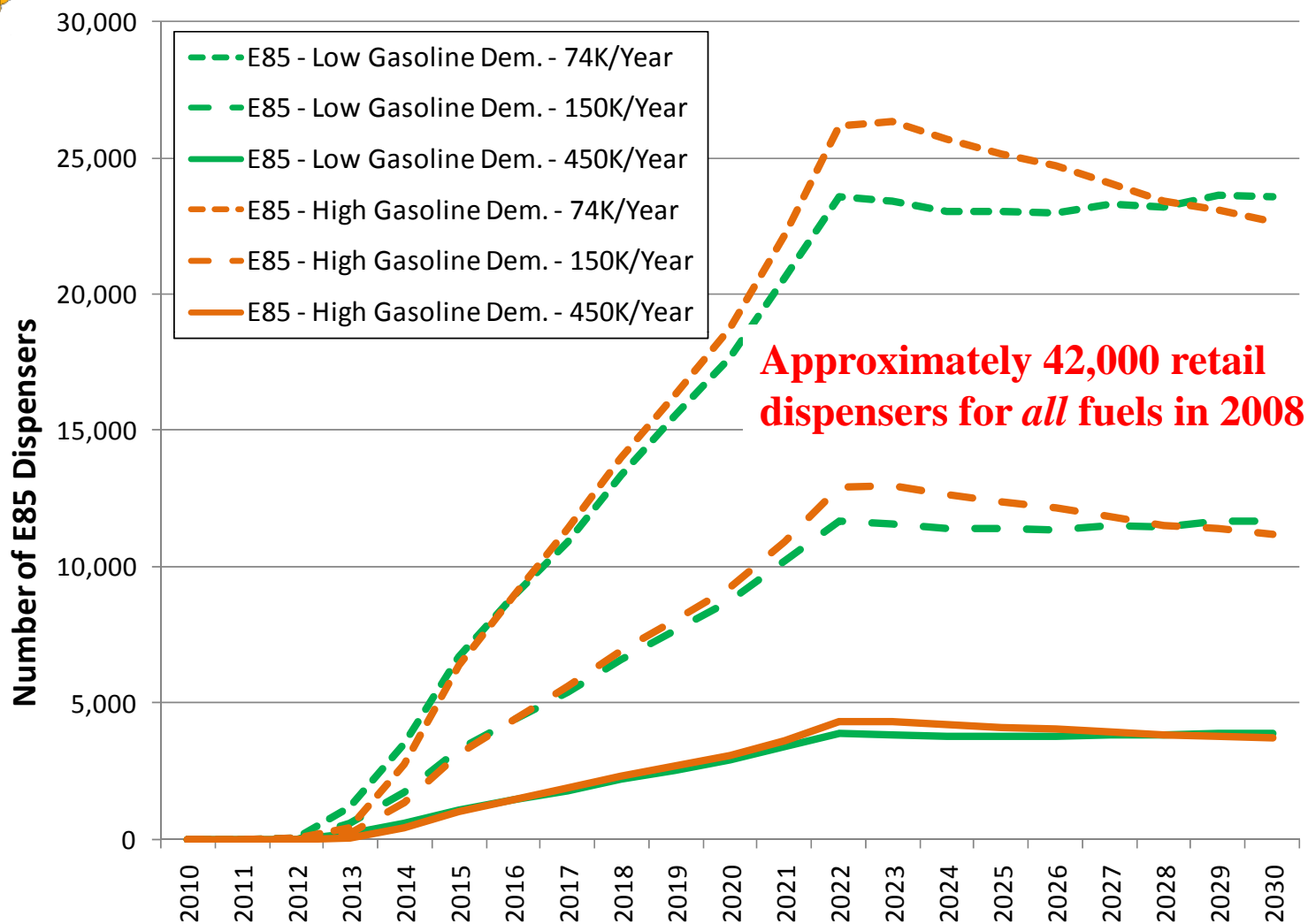


E85 Retail Infrastructure Issues

- The proposed RFS2 regulations do not have any requirements that retail station owners and operators make available E85 for sale to the public
- Refiners, importers, and blenders have an obligation to comply with the RFS2 standards, but retail station operators do not have any obligation
- This is an apparent “disconnect” in the RFS2 policy that could easily result in a retail infrastructure that is inadequate to handle the necessary increase in E85 sales



E85 Dispenser Need Forecast



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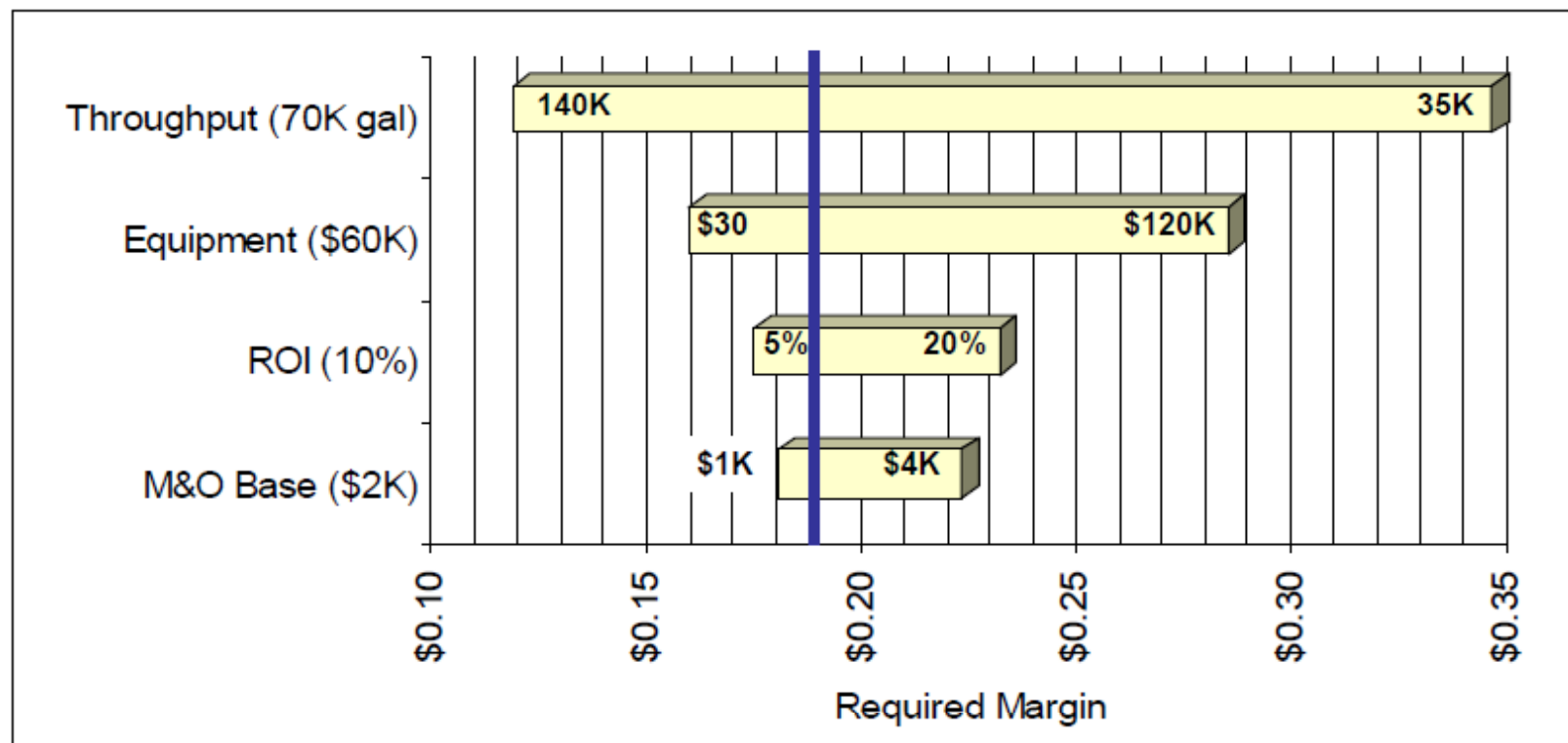


E85 Retail Infrastructure Costs & Issues

- Costs for dispensing E85 can range between \$50,000 and \$200,000 per location (includes dispenser, equipment, piping & labor)
- Pre-tax profits at retail convenience stores selling fuel have averaged nearly \$32,700 between 1999 and 2008
- Majority of retail locations that have recently installed E85 dispensers in California have done so with either partial or complete financial assistance from other funding sources
- There are no E85 dispensers that have Underwriter Laboratory (UL) approval – recent installations in California have been accomplished by receiving waivers from local agencies



E85 Break-even Margins Can Vary



Actual level of E85 sales is probably the most important variable for determining the per-gallon margin necessary to be profitable – retail margins in California have averaged 12 cents per gallon during 2009

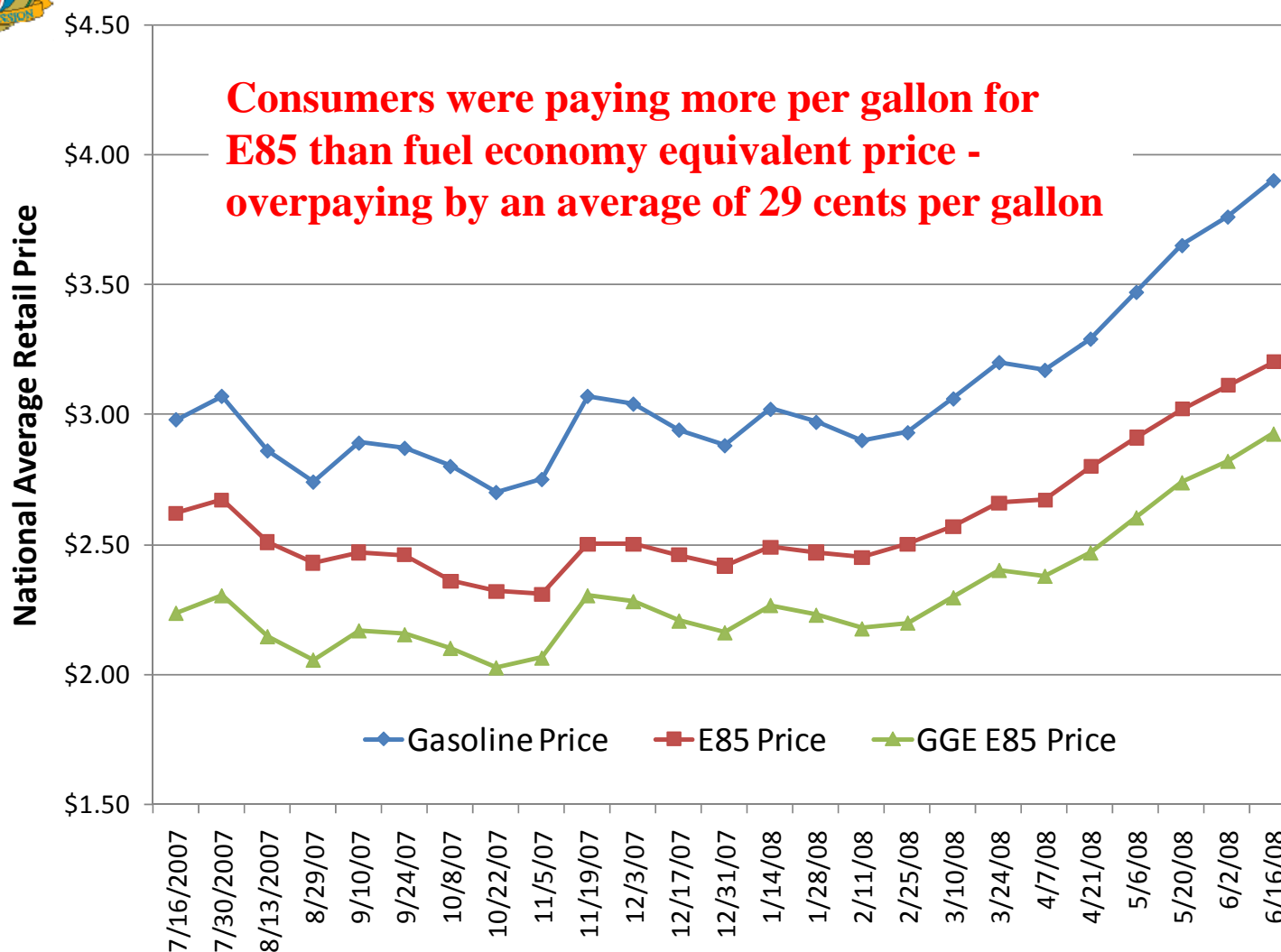


E85 Retail Pricing

- As sales of E85 increase, there should be steps taken to help ensure that FFV motorists are receiving adequate pricing information at retail stations to put them in a position of making more informed fuel purchase decisions
- Over time, FFV consumers may elect, on average, to pay a premium for E85 above the GGE price
- However, the California Division of Measurement Standards (DMS) should expand their posted retail price standards to include some form of energy-equivalent or fuel economy-equivalent pricing information at all retail stations offering E85 in California



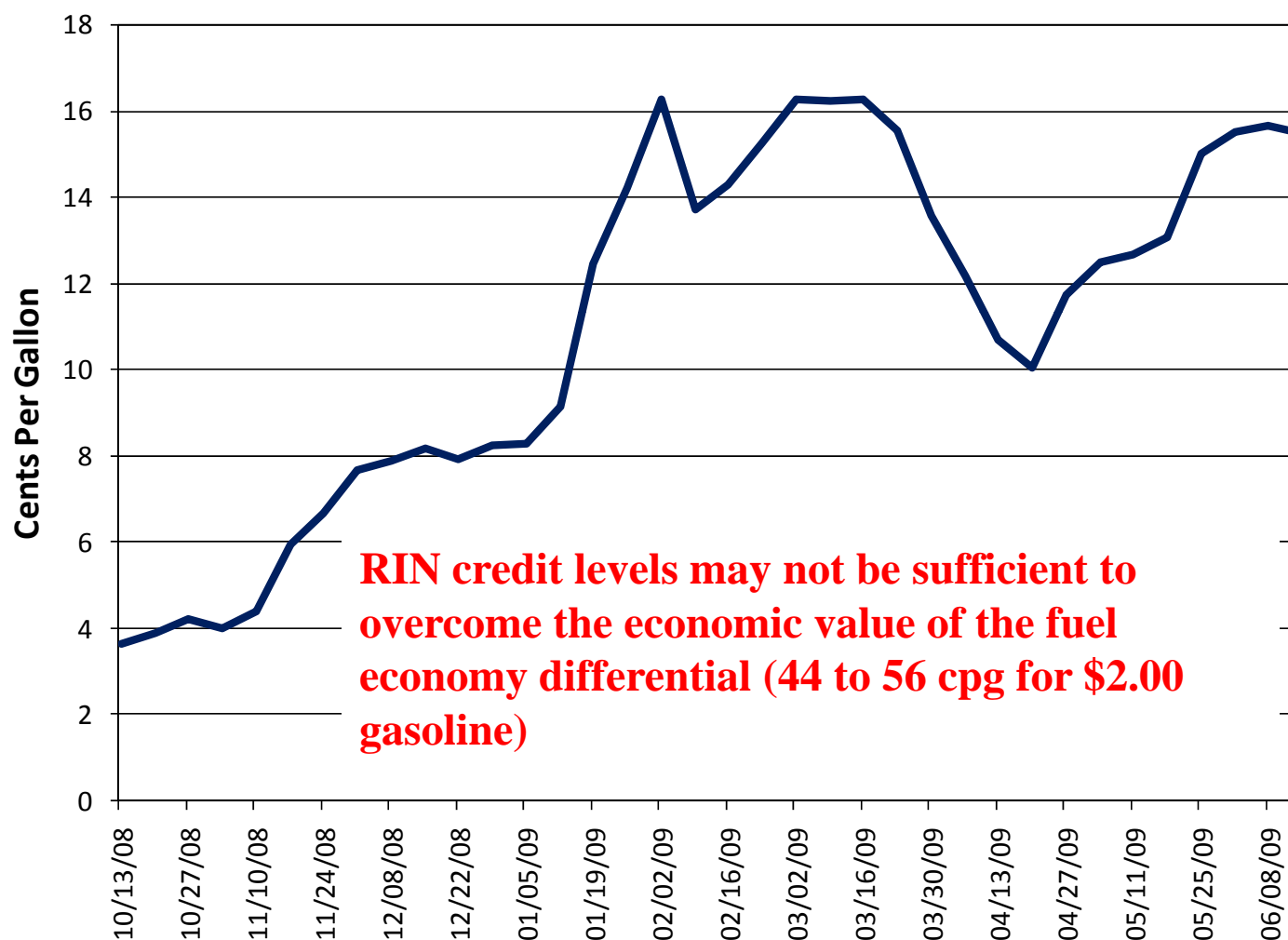
U.S. Gasoline & E85 Retail Prices



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RIN Values October 2008 - June 2009



RIN credit levels may not be sufficient to overcome the economic value of the fuel economy differential (44 to 56 cpg for \$2.00 gasoline)

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Flexible Fuel Vehicles (FFVs)

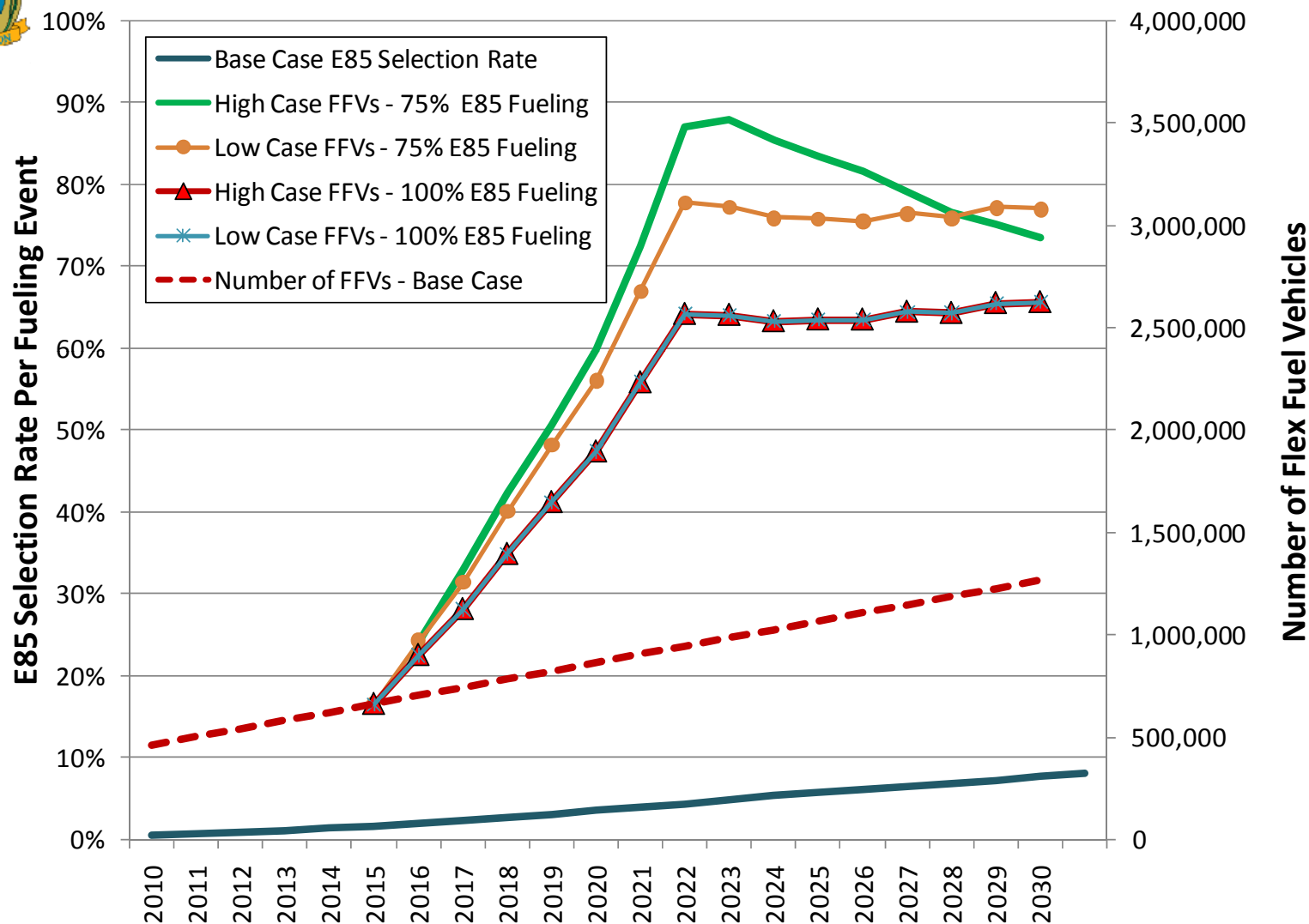


FFV Outlook & Issues

- FFV population would also need to grow from a total of 382,000 vehicles in October of 2008 to as many as 2.4 million FFVs by 2020 and 3.3 million by 2025
- Number of FFVs depends on the frequency that their owners select E85 during each fill-up – the lower the percentage, the greater the number of FFVs required
- 100 percent E85 fueling by FFV owners is likely an unrealistic scenario
- Based on consumer survey work, FFV owners indicated that they would purchase E85 less than 10 percent of the time when retail price was equivalent to gasoline on a GGE basis



Californian FFV Demand Forecast



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Low Carbon Fuel Standard - Gasoline



Low Carbon Fuel Standard (LCFS)

- CARB adopted the LCFS regulations on April 23, 2009
- Regulation is intended to reduce the per gallon carbon intensity of gasoline and diesel fuel by 10 percent between 2010 and 2020
- Types of ethanol that have lower carbon intensity values will probably become more desirable as refiners and other obligated parties strive to achieve compliance with the RFS2 and LCFS simultaneously
- Shifting from one type of ethanol to others will create potential supply and logistical challenges that could be difficult to overcome and probably result in higher compliance costs that will be passed along to consumers.



LCFS – Complying E10 Blends

Gasoline with 10 Percent Ethanol (E10)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Midwest Wet Mill (60% NG and 40% coal)										
Midwest Dry Mill - Dry DGS (NG)										
Midwest Dry Mill - Dry DGS (80% NG and 20% Biomass)										
Midwest Dry Mill - Wet DGS										
Midwest Dry Mill - Wet DGS (80% NG and 20% Biomass)										
California Dry Mill - Dry DGS (NG)										
California Dry Mill - Dry DGS (80% NG and 20% Biomass)										
California Dry Mill - Wet DGS (NG)										
California; Dry Mill - Wet DGS (80% NG and 20% Biomass)										
Brazilian Sugarcane - Average Production Process										
Brazilian Sugarcane (Cogeneration Credits)										
Brazilian Sugarcane (Mech. Harvesting & Cogen. Credits)										

This chart depicts the various types of ethanol and how long they can be used absent over-compliance and acquisition of off-setting credits
The lower the carbon intensity of ethanol, the longer it will be used as a blend in E10

Early or increased use of E85 can extend the period of time various types of ethanol can be blended at 10 percent levels



LCFS – Complying E85 Blends

Gasoline with 85 Percent Ethanol (E85)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020			
Midwest Wet Mill (60% NG and 40% coal)													
Midwest Dry Mill - Dry DGS (NG)													
Midwest Dry Mill - Dry DGS (80% NG and 20% Biomass)													
Midwest Dry Mill - Wet DGS													
Midwest Dry Mill - Wet DGS (80% NG and 20% Biomass)													
California Dry Mill - Dry DGS (NG)													
California Dry Mill - Dry DGS (80% NG and 20% Biomass)													
California Dry Mill - Wet DGS (NG)													
California; Dry Mill - Wet DGS (80% NG and 20% Biomass)													
Brazilian Sugarcane - Average Production Process													
Brazilian Sugarcane (Cogeneration Credits)													
Brazilian Sugarcane (Mech. Harvesting & Cogen. Credits)													

Increasing use of E85 allows obligated parties to utilize various types of ethanol over a longer period of time

Verification of lower CI pathways is expected to continue over the next couple of years - this is especially the case once cellulosic ethanol and diesel fuel production is achieved and verified on a commercial scale



LCFS Uncertainties

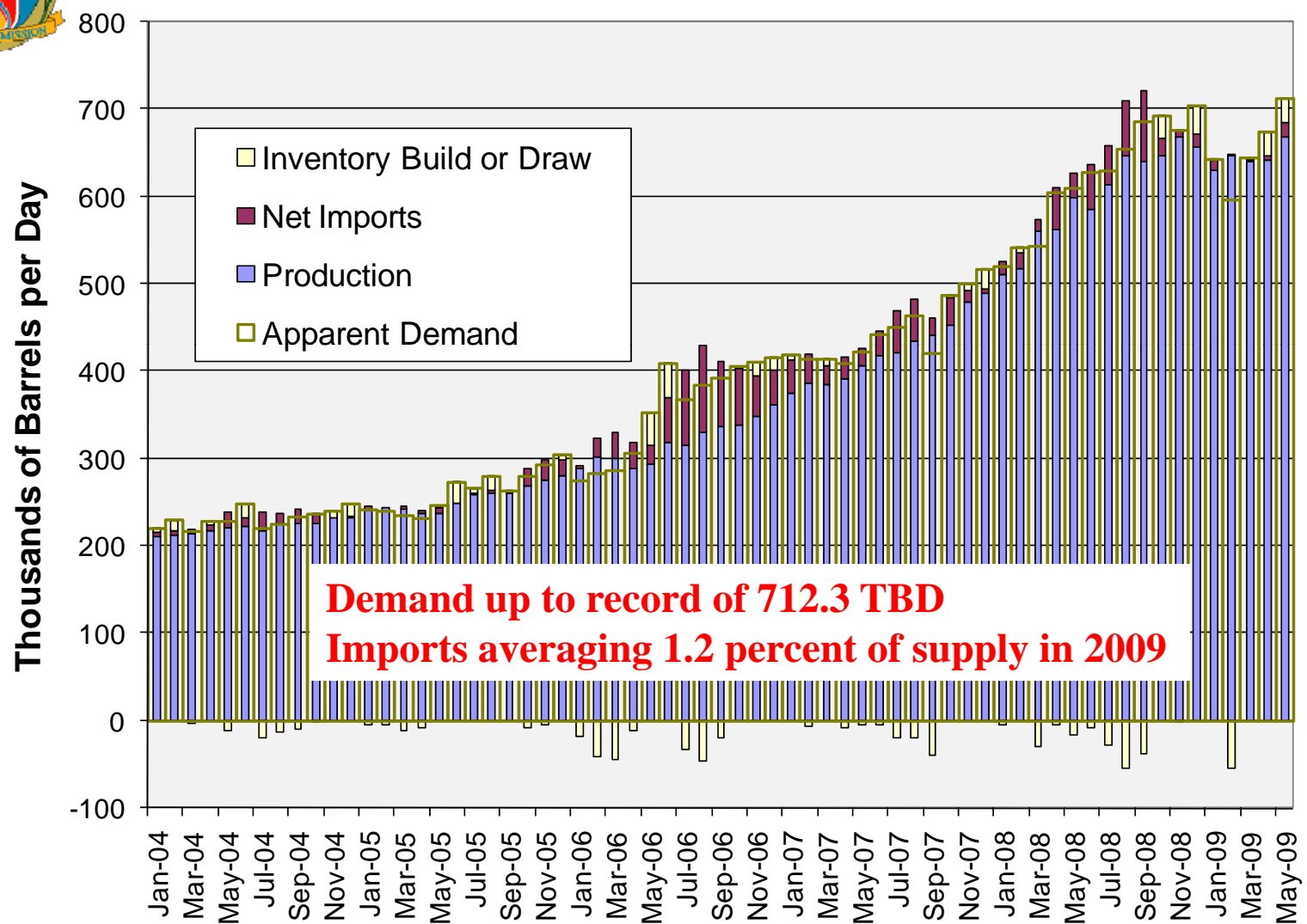
- It is not known how much additional E85 may be required to achieve LCFS compliance beyond the volumes forecast for RFS2
- Various LCFS compliance strategies may be employed by obligated parties that are designed to minimize the costs of compliance & maximize flexibility
- It is uncertain as to the exact nature of these various strategies – over-compliance and purchase of mobile carbon credits – and how the volumes and types of ethanol required over the next several years could differ from the levels currently forecast by staff
- Staff will continue to monitor these developments



Ethanol Supply Outlook U.S. and Brazil



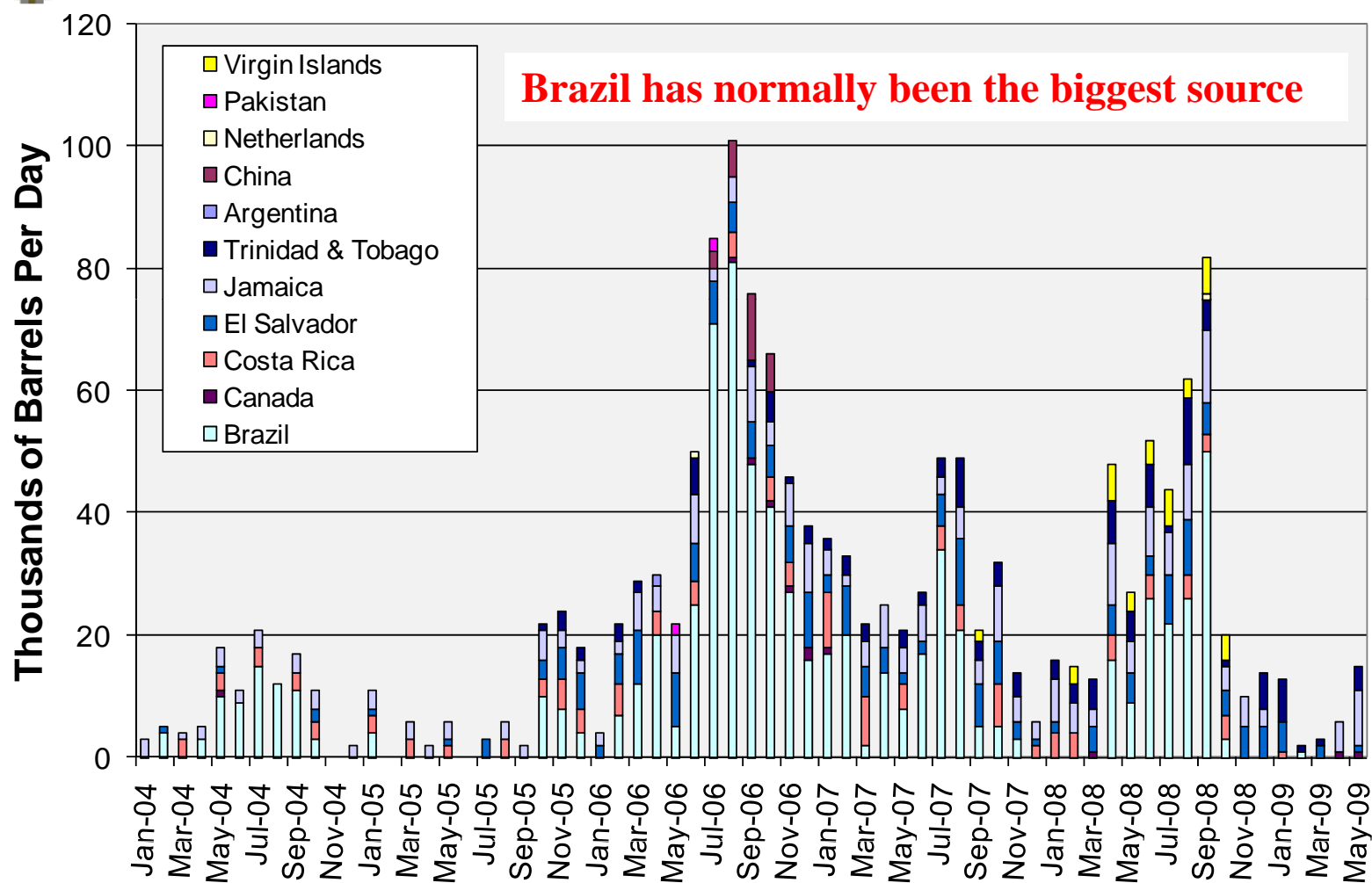
U.S. Ethanol Supply Balance (2004-2009)



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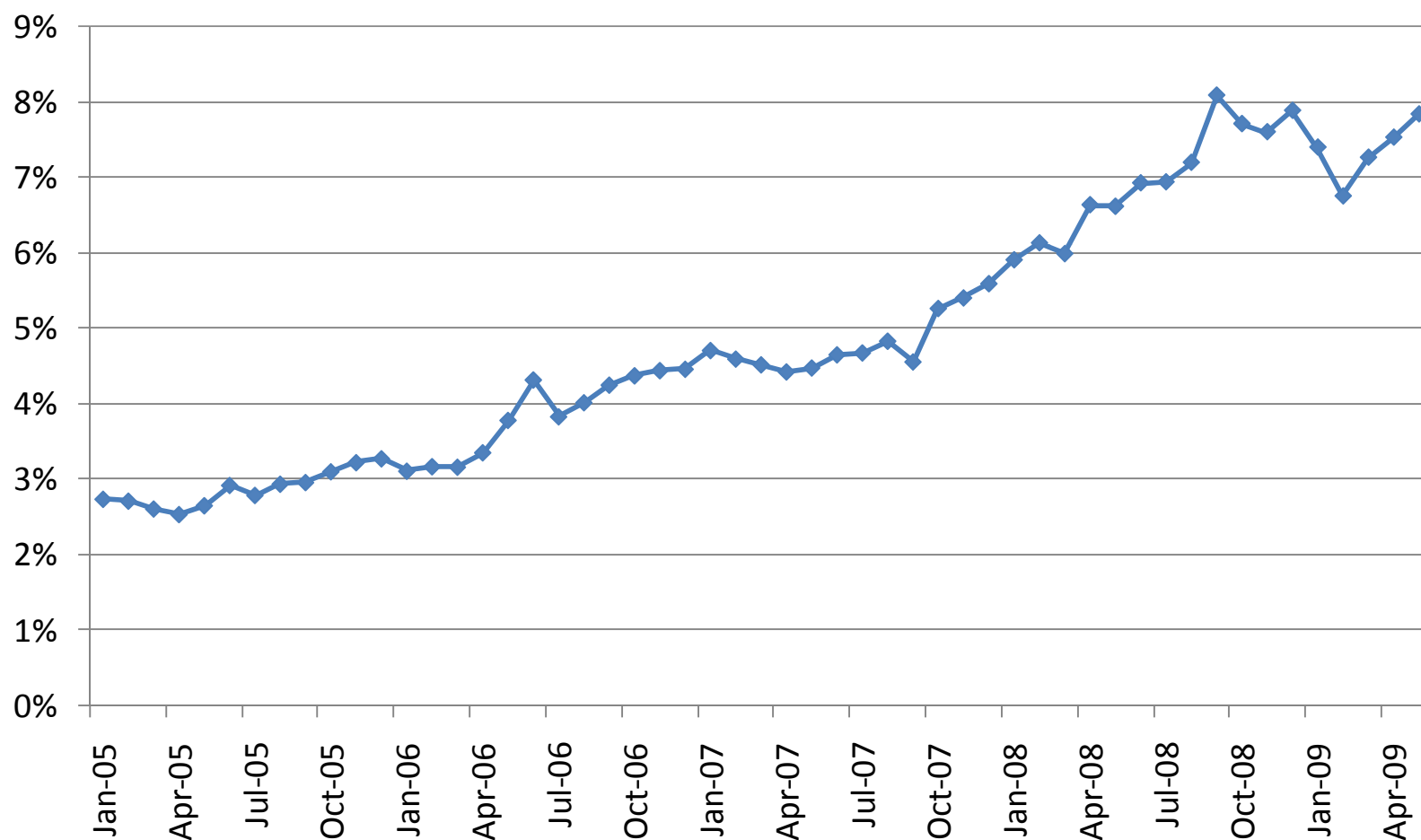


U.S. Net Ethanol Imports





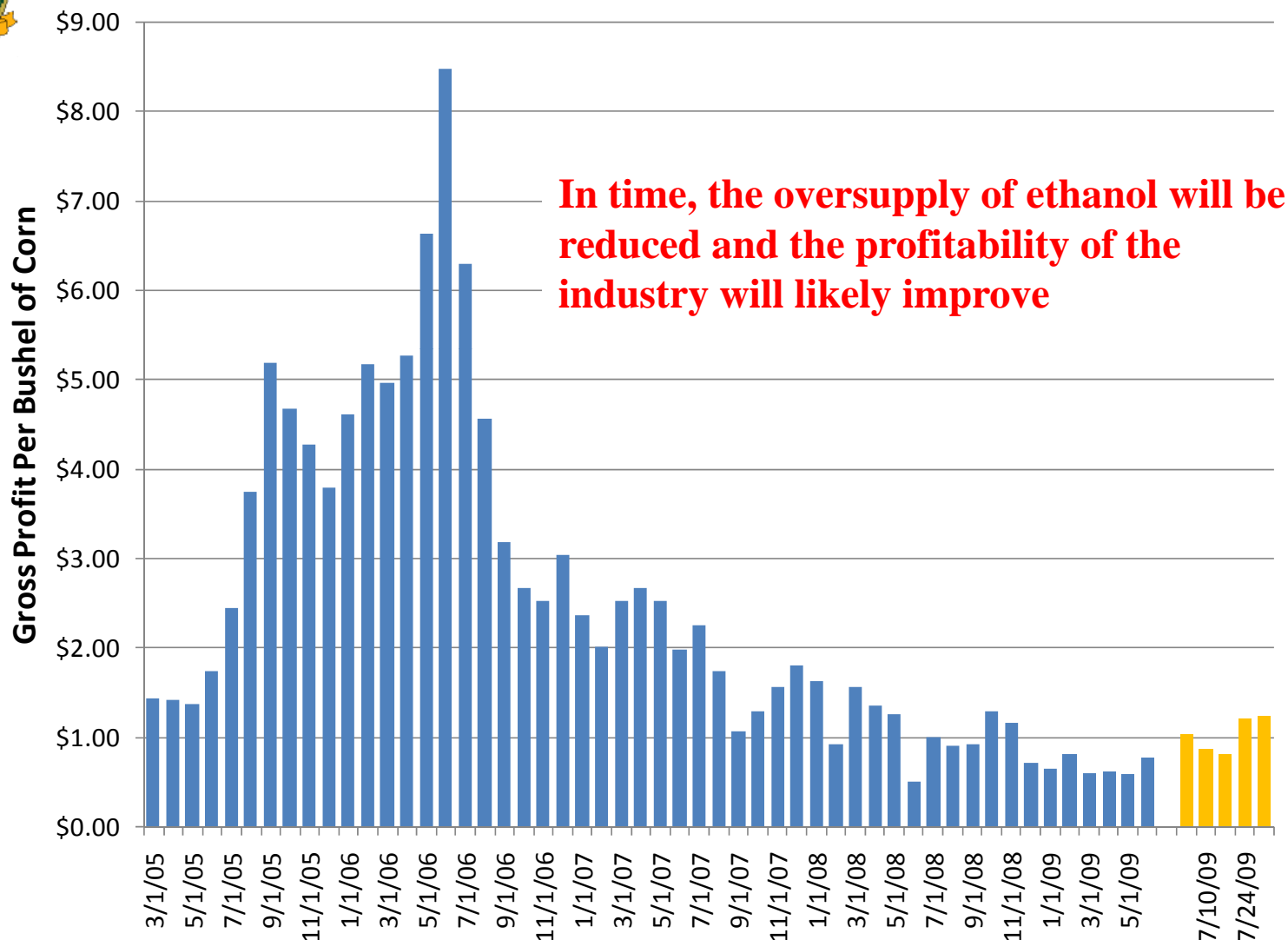
Mandated Use of Renewable Fuel Increasing U.S. Ethanol Concentration in Finished Gasoline



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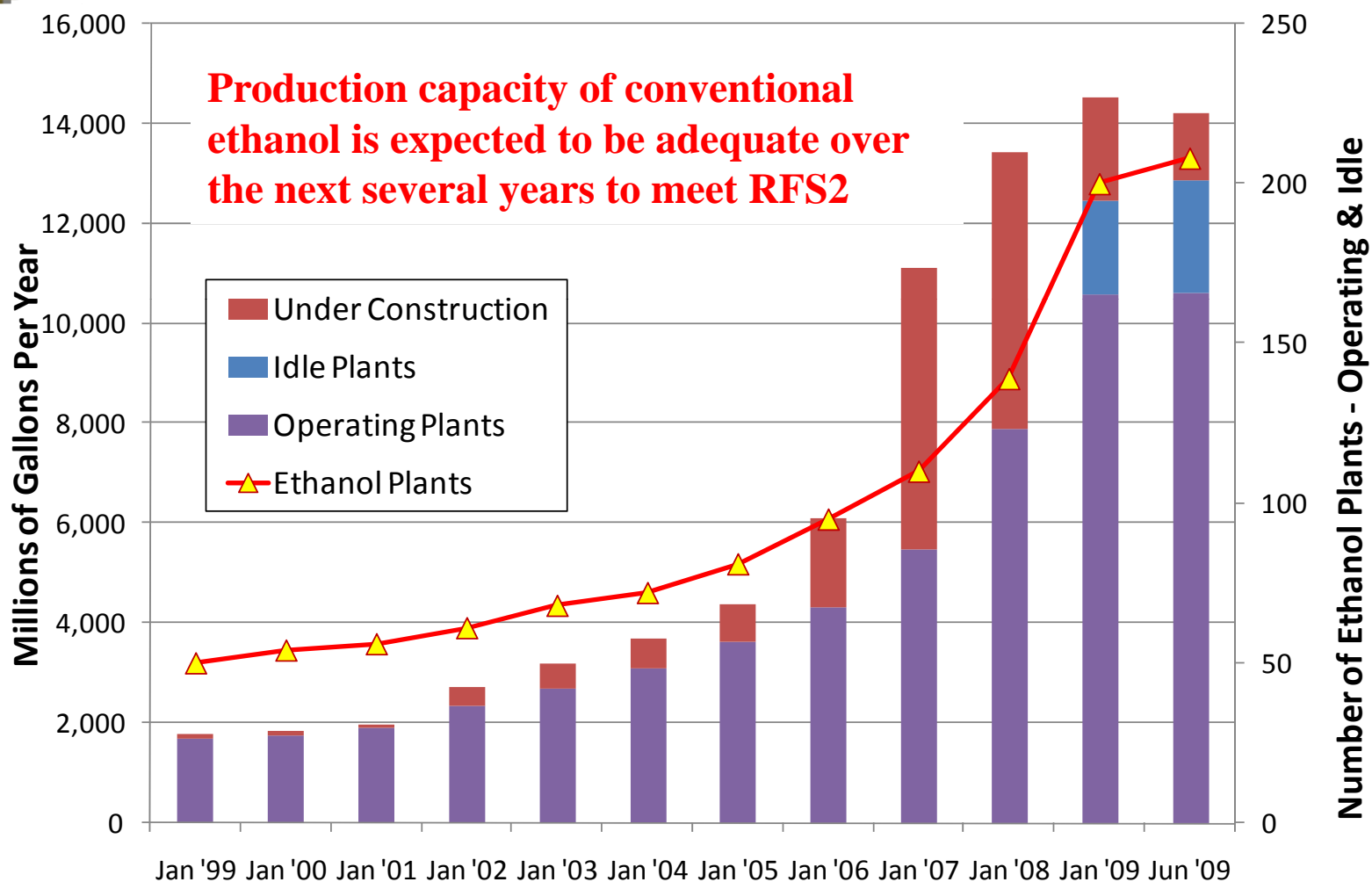
U.S. Ethanol Industry Profitability



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U.S. Ethanol Plant Numbers & Capacities



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Cellulosic Ethanol Supply Outlook

- Proposed federal RFS2 regulations require 100 million gallons of cellulosic ethanol use in 2010 and 250 million gallons in 2011
- Since there is less than 5 million gallons per year of cellulosic ethanol production capacity currently under construction (as of July 2009), it is unlikely that there will be sufficient cellulosic ethanol capacity in place to meet the RFS2 obligations in 2010
- EPA should delay the cellulosic obligations until such time that commercial production capacity is actually operational
 - similar to the biodiesel blending mandate in Oregon



Brazil & U.S. Ethanol Operations - 2008

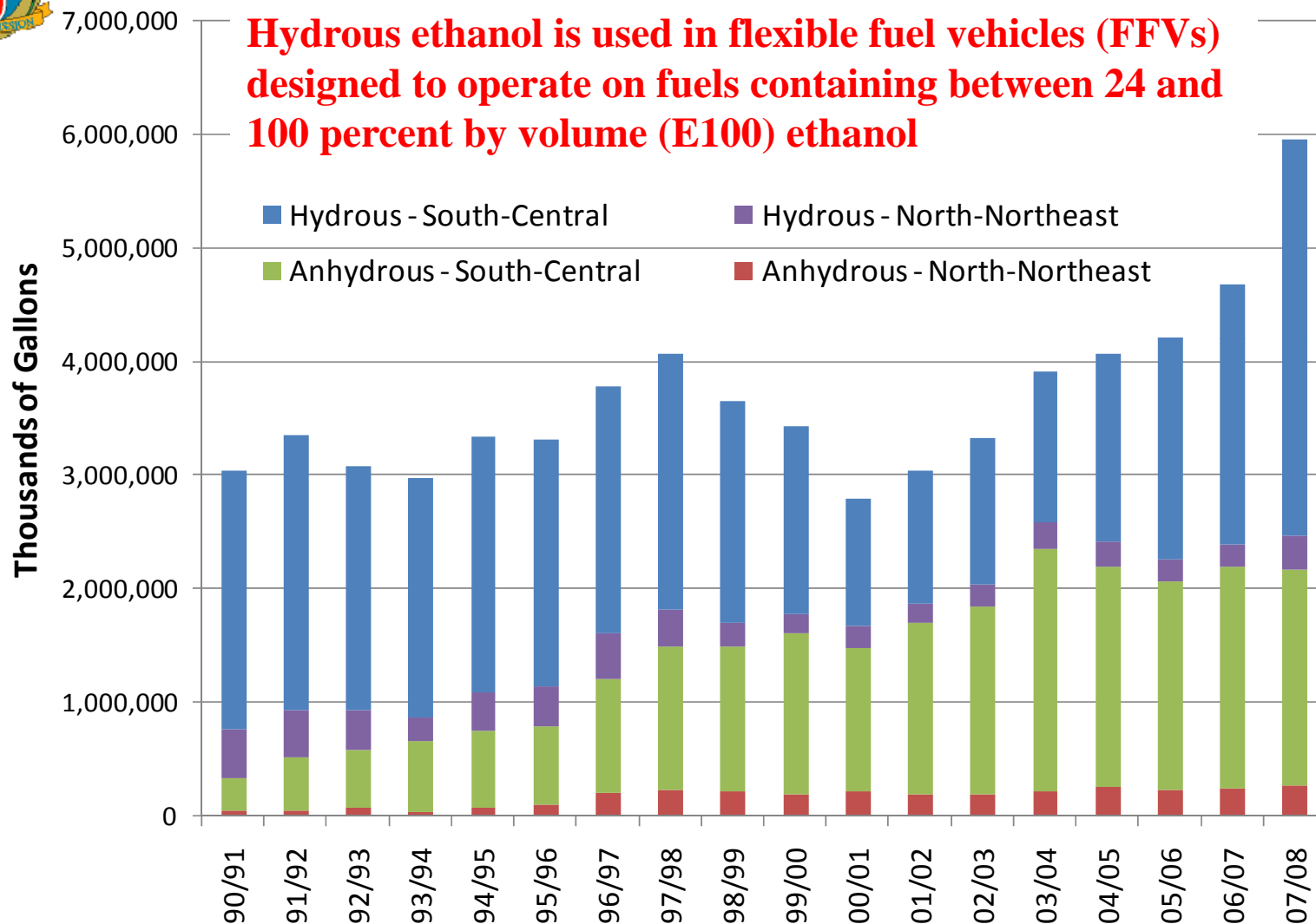
2008 Comparison	Brazil	United States
Number of Ethanol Plants	96	193
Combined Number of Ethanol & Sugar Mill Facilities	229	
Total Ethanol Plants	325	193
Total Ethanol Production (Billions of Gallons)	5.9	9.2
Average Plant Production (Millions of Gallons/Year)	18.2	47.7
Ethanol Production Per Acre of Feedstock (Gallons)	678.5	432.4
Ethanol Plant Operation	Seasonal	Year-round
Long-term Feedstock Storage	No	Yes

Since sugarcane cannot be stored once harvested, ethanol production in Brazil occurs on a seasonal basis

Ethanol plants in Brazil can adjust the ratio of ethanol-to-sugar in reaction to local ethanol demand/prices, export ethanol market economics, and world sugar demand/prices



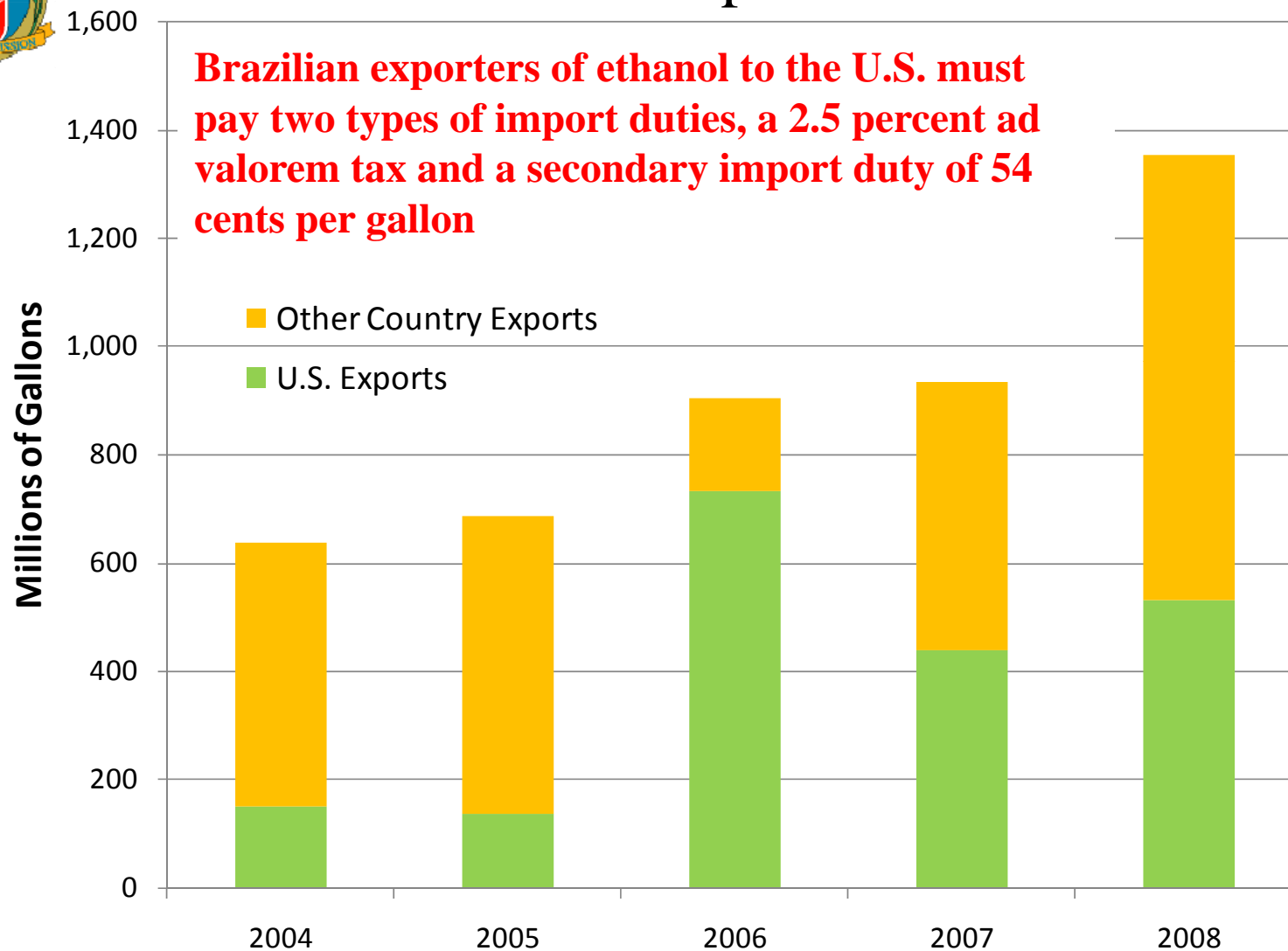
Brazil Ethanol Production



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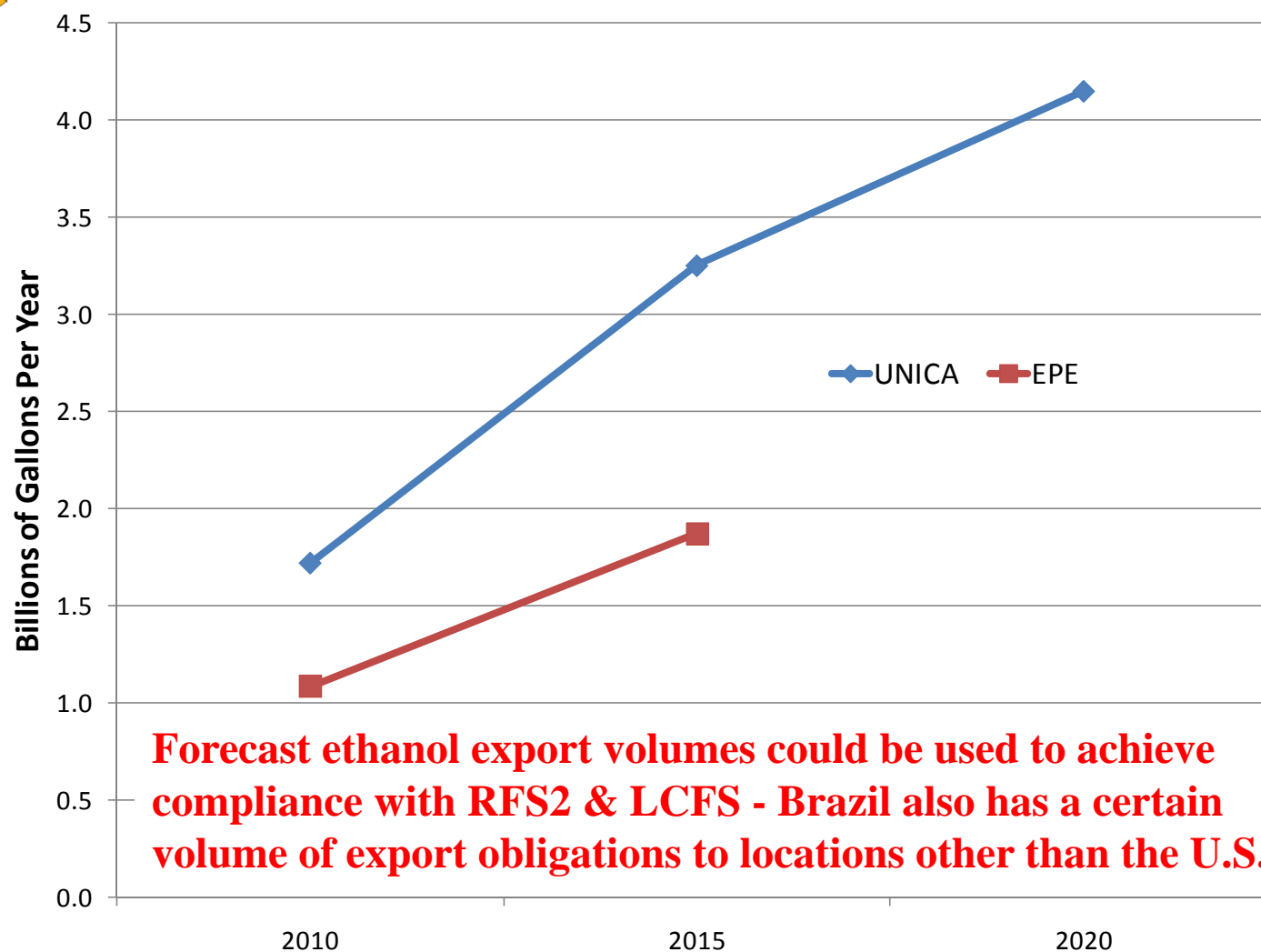
Brazil Ethanol Exports - Historical



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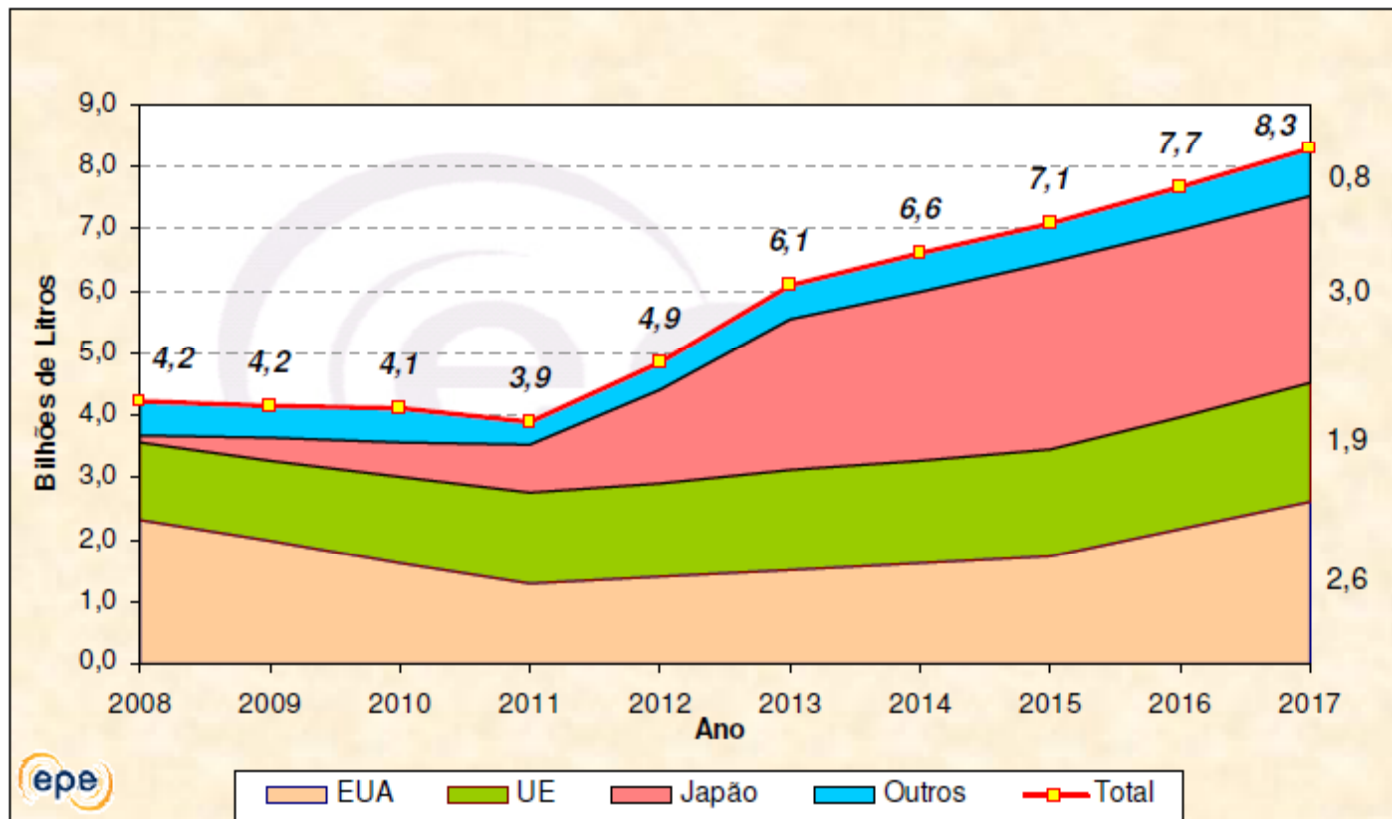
Brazil – Ethanol Export Outlook



Forecast ethanol export volumes could be used to achieve compliance with RFS2 & LCFS - Brazil also has a certain volume of export obligations to locations other than the U.S.



EPE Forecast of Brazil Ethanol Exports



Market price for Brazil ethanol is expected to command a premium to California-sourced ethanol, which should be more valuable than conventional corn-based ethanol produced outside the state



Ethanol Logistics

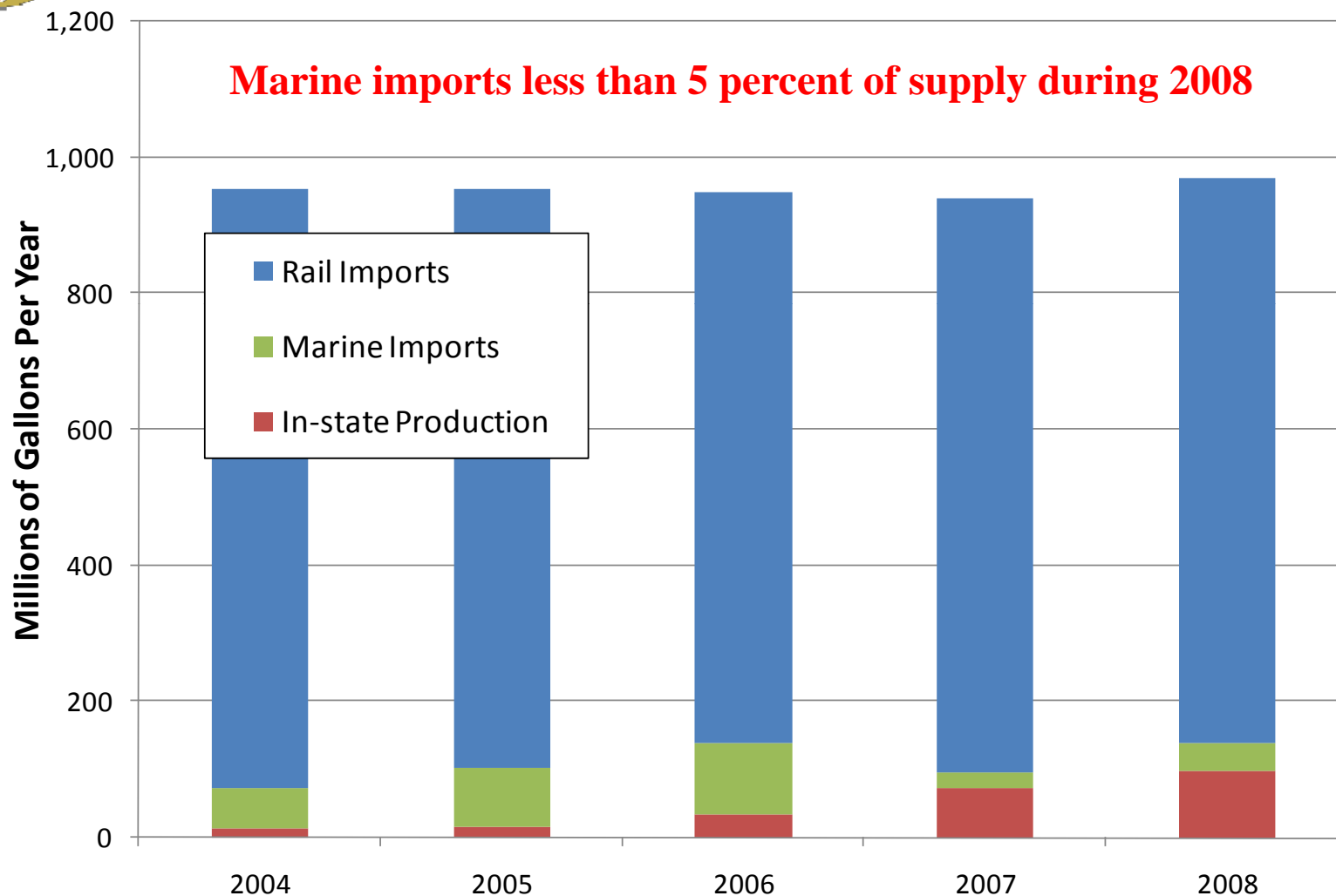


Ethanol Logistics Will Need to Evolve

- California LCFS is expected to further complicate matters by pushing obligated parties to select types of ethanol that have lower carbon intensities
- At this time, ethanol produced from sugarcane in Brazil is the type of commercially-available ethanol that has the lowest carbon intensity
- As such, it is anticipated that California's logistical infrastructure for the importation and re-distribution of ethanol will need to be modified to enable a greater quantity and flexibility of ethanol imports within the next 6 to 18 months



California – Ethanol Supply Sources



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Ethanol Logistics – Distribution Terminals

- California's ethanol import and redistribution infrastructure will need to change rather quickly to accommodate the anticipated transition to 10 percent (E10) blending beginning January 1, 2010
- It is likely that an adequate infrastructure will be in place to increase ethanol blending by over 50 percent (compared to 2009 levels)
- Types of modifications that are already underway or complete include the construction of new ethanol storage tanks and increased capacity to receive tanker trucks of ethanol



Ethanol Logistics – Rail Facilities

- Imports of ethanol via rail are the largest source of supply – nearly 86 percent during 2008
- Kinder Morgan continues to make progress on their project to enable the receipt of ethanol unit trains into the Richmond area – a first for Northern California
- Facility is designed to transfer the ethanol directly from the rail cars to the tanker trucks via a process called transloading
- Completion and operation of this project should help ensure that Northern California will have sufficient capacity to receive ethanol via rail cars to accommodate the increase to E10 blending during 2010



Ethanol Logistics – Marine Facilities

- The LCFS is expected to drive refiners and other obligated parties to seek out types of ethanol with lower carbon intensities, such as ethanol from Brazil
- This anticipated import requirement could be necessary as early as the beginning of 2011
- At this time, it is uncertain how much incremental ethanol could be imported into California via marine vessel
- If California were to transition to greater use of Brazilian ethanol, there are two pathways for this foreign ethanol to enter California: marine vessels directly from Brazil; and rail shipments from another marine terminal outside of California



Ethanol Logistics – Marine Facilities

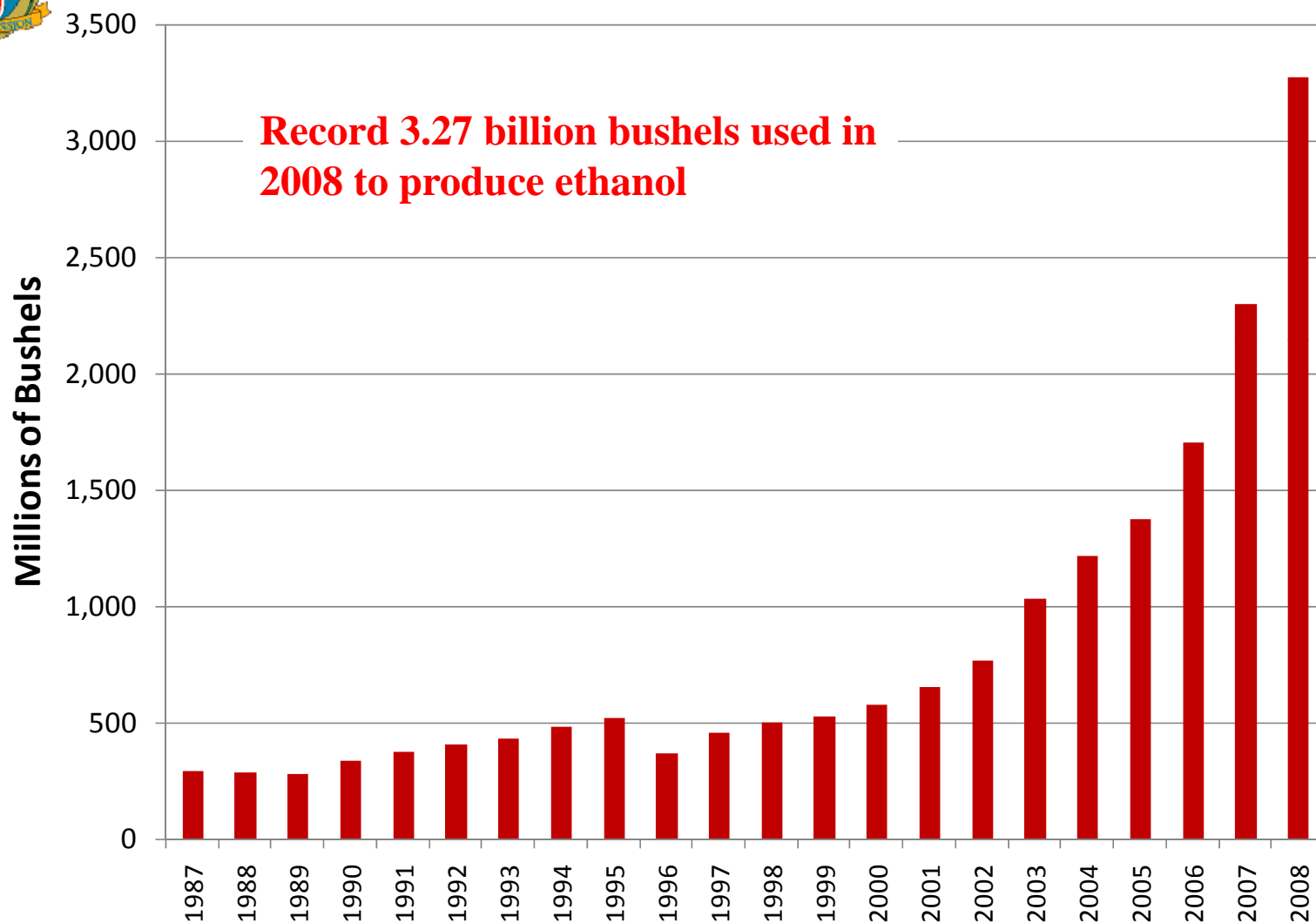
- Primagel has received permits to construct a new marine terminal in Sacramento that is designed to import up to 400 million gallons of ethanol per year
- If the facility were to be operational by January of 2011, construction would need to begin prior to the end of 2009
- Ethanol from Brazil could also be imported through the Houston ship channel and transferred to rail cars prior to delivery to California
- Development of this type of capability would increase the likelihood that sufficient capacity could be in place to import significant quantities of Brazilian ethanol



Ethanol & Agriculture



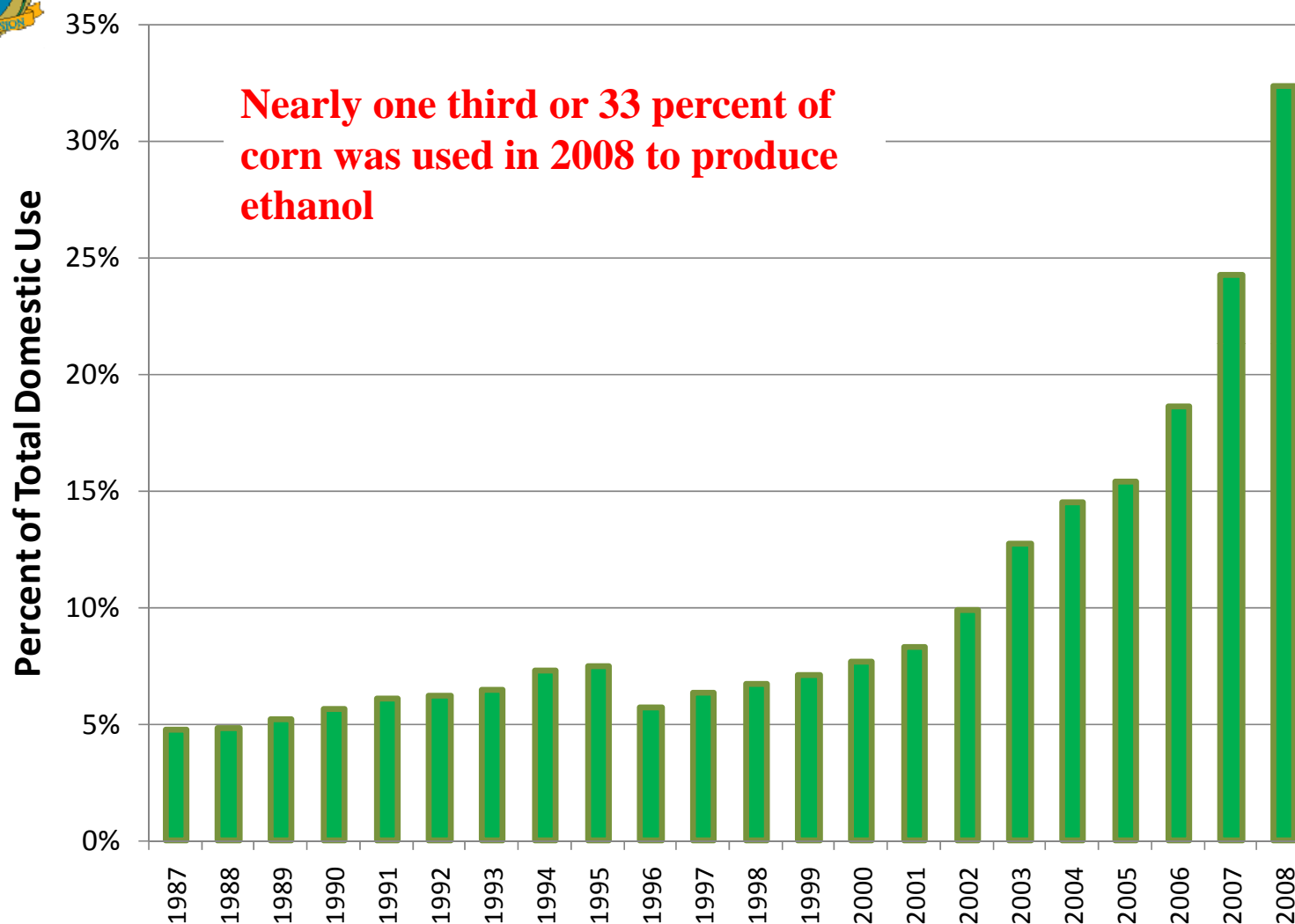
U.S. Corn Demand for Ethanol Production



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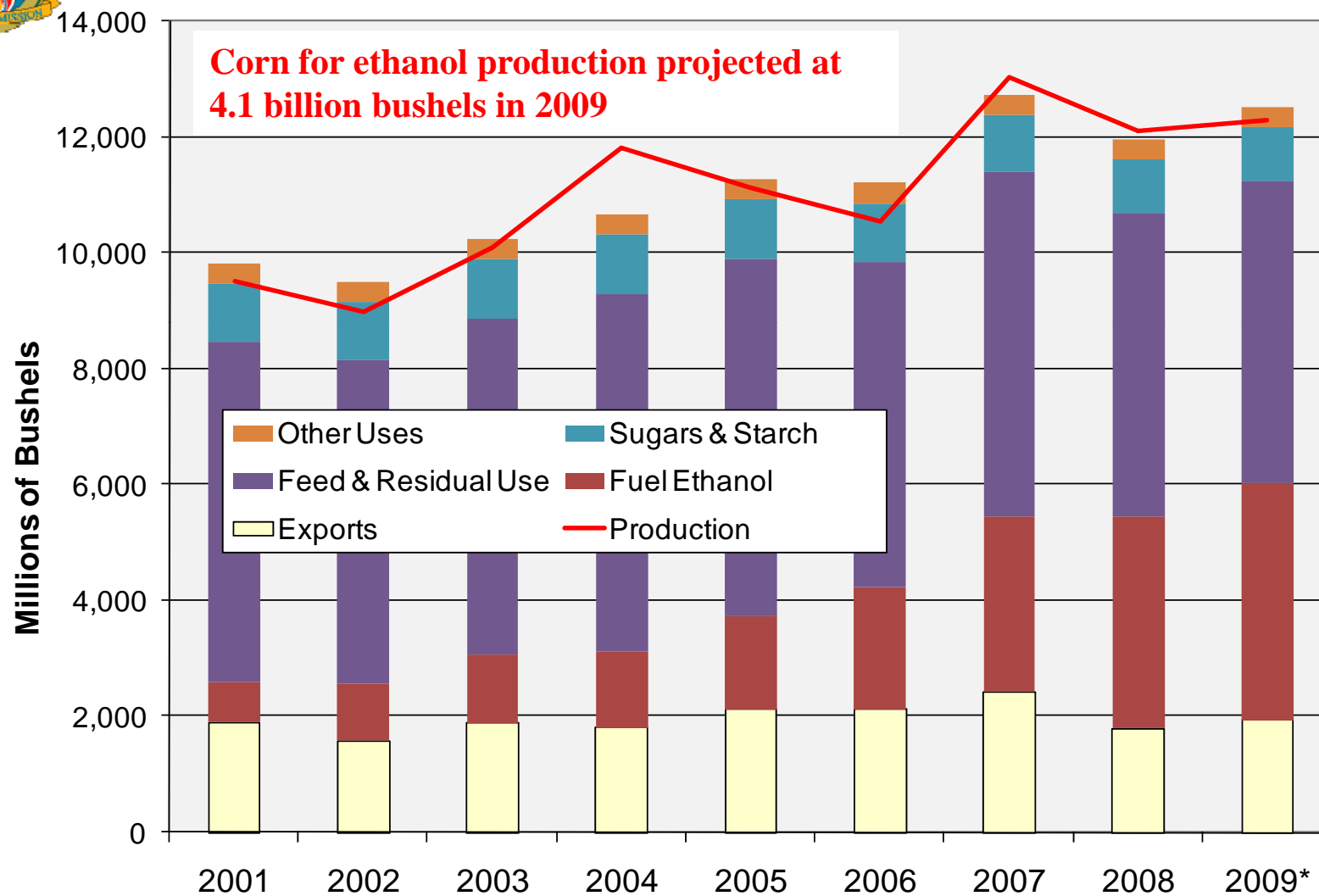
U.S. Percent of Corn Demand for Ethanol Use



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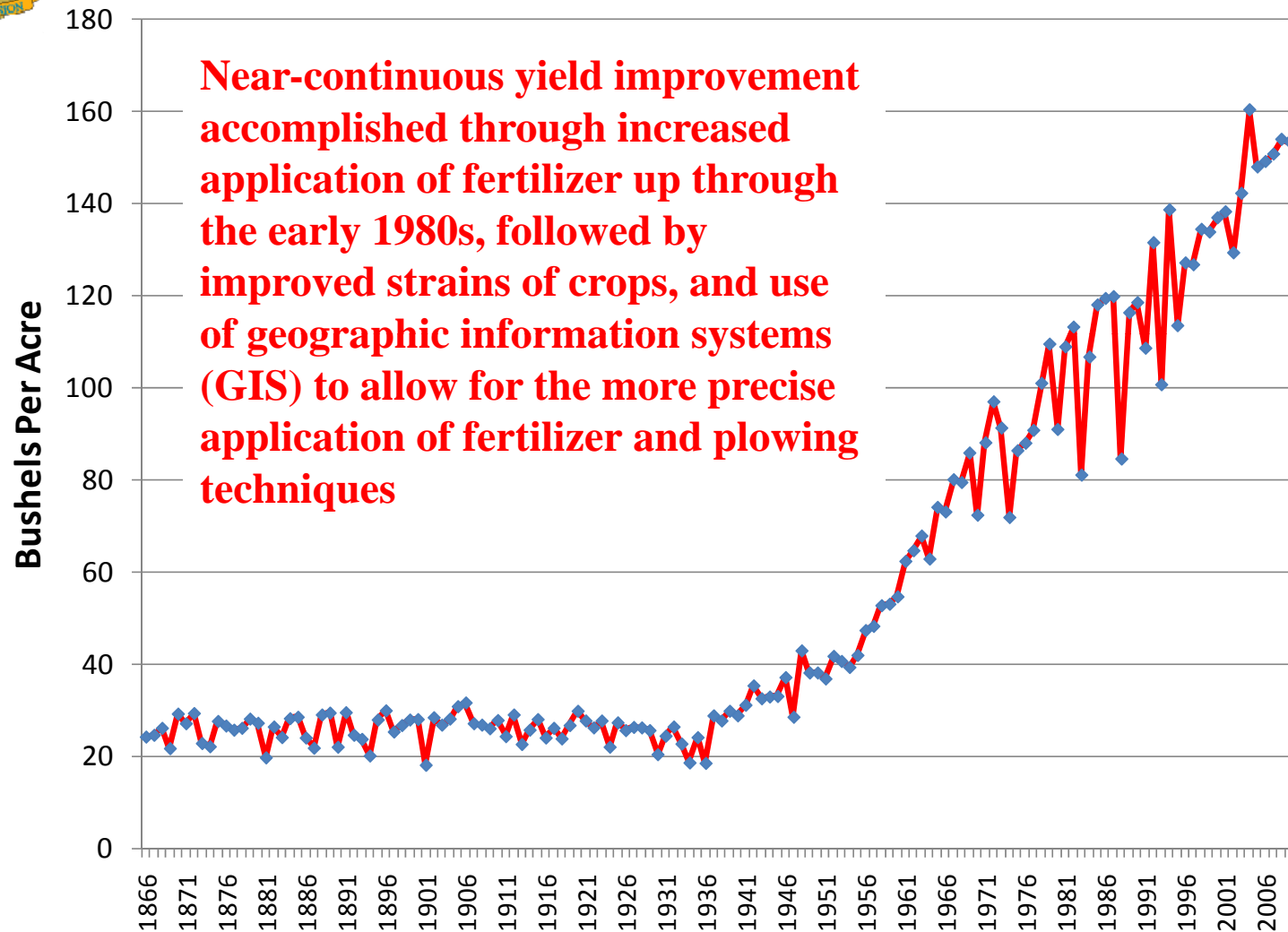
U.S. Corn Production & End Use



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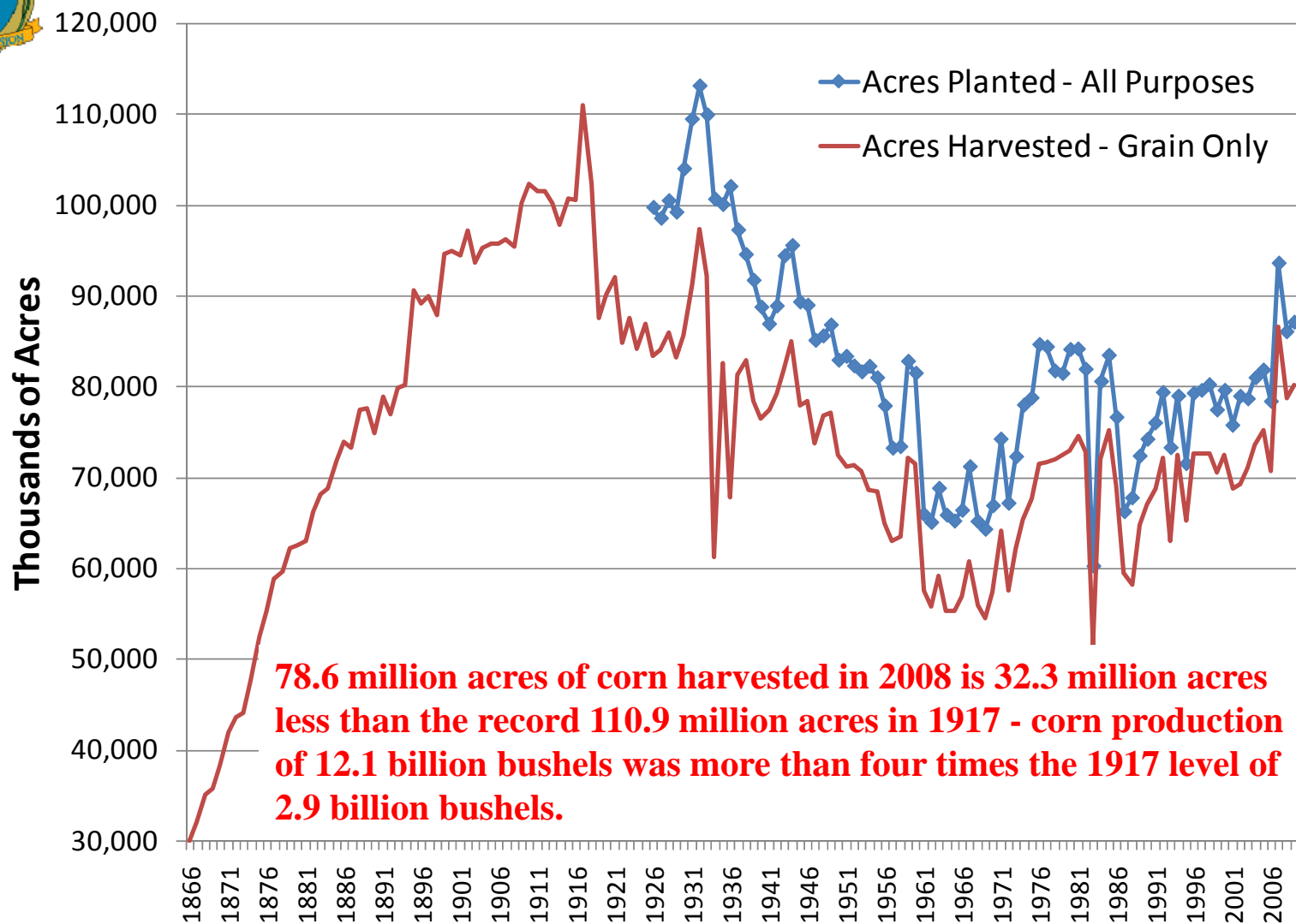
U.S. Annual Corn Yield



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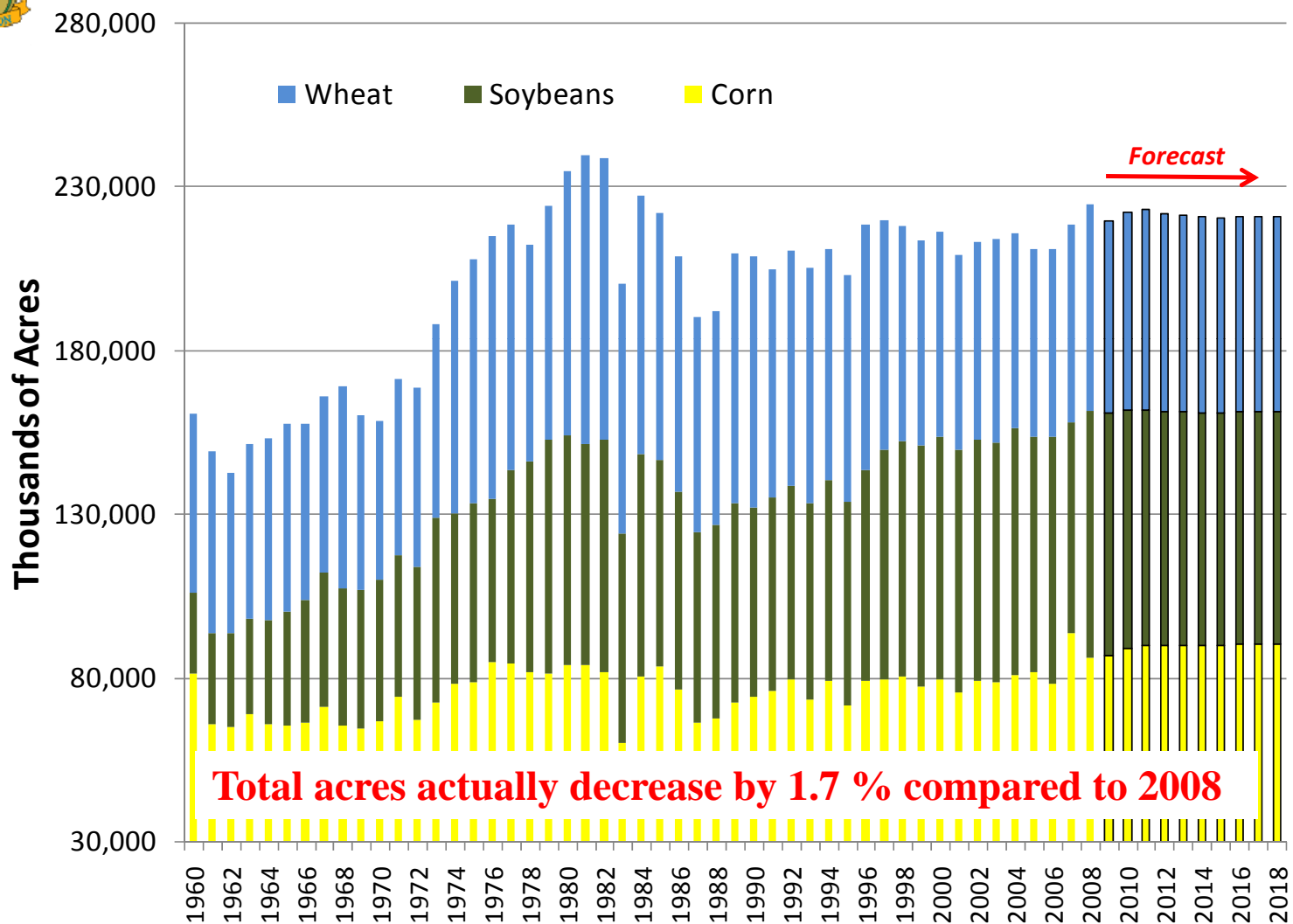
U.S. Acres of Corn Planted & Harvested



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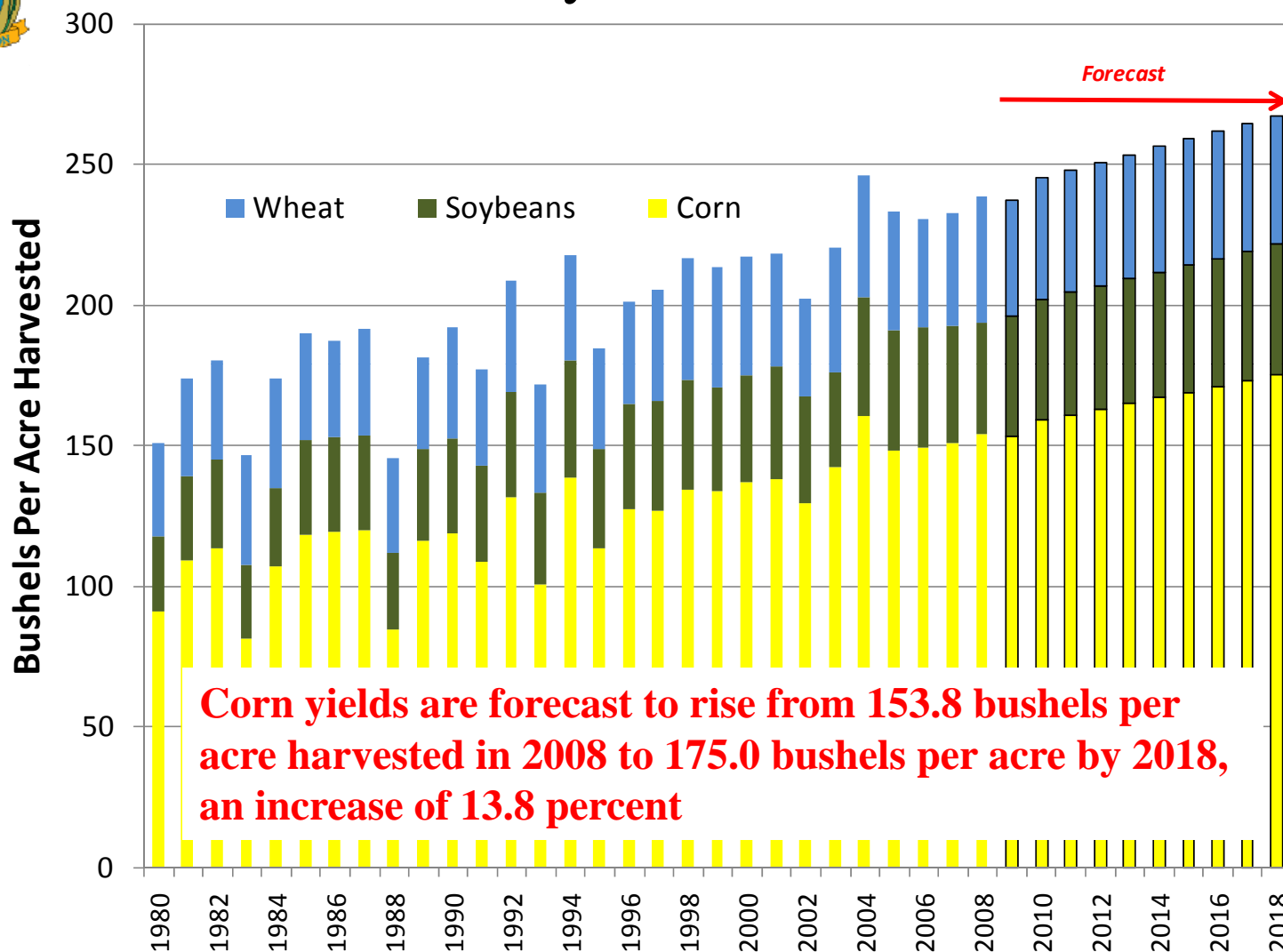
U.S. Corn, Soybean & Wheat Plantings



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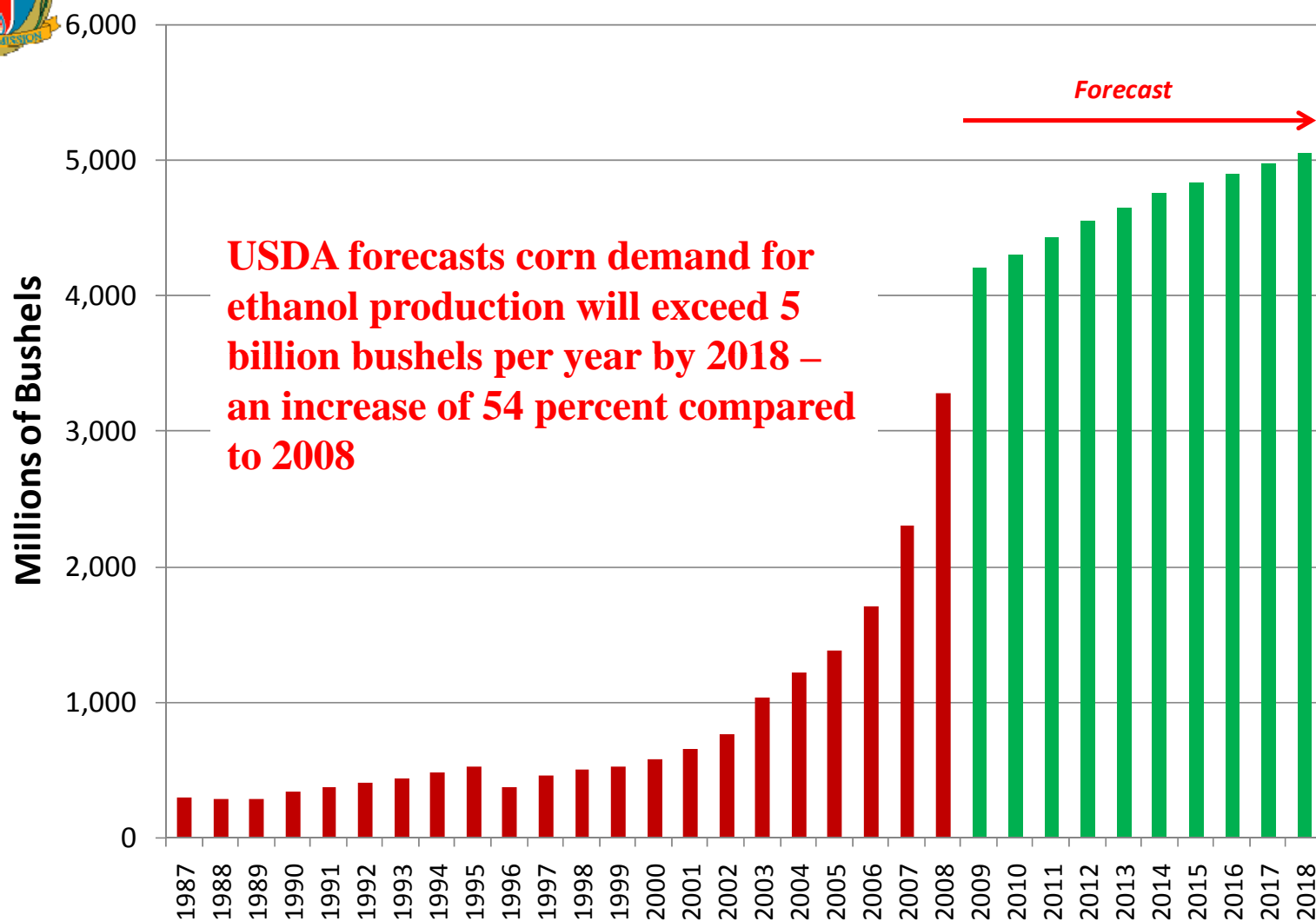


U.S. Corn, Soybean & Wheat Yields





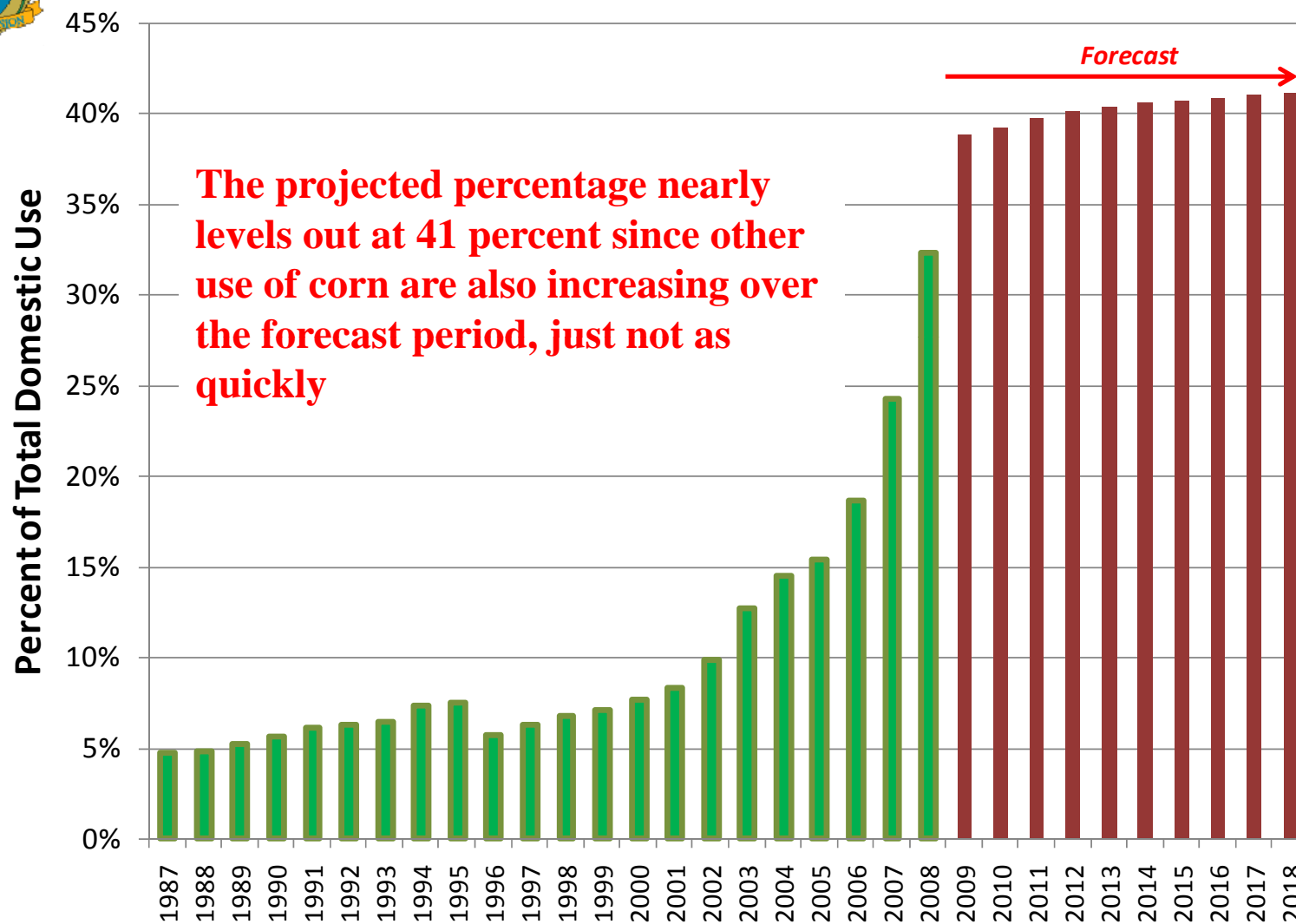
U.S. Corn Demand for Ethanol Use



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U.S. Percent of Corn Demand for Ethanol Use



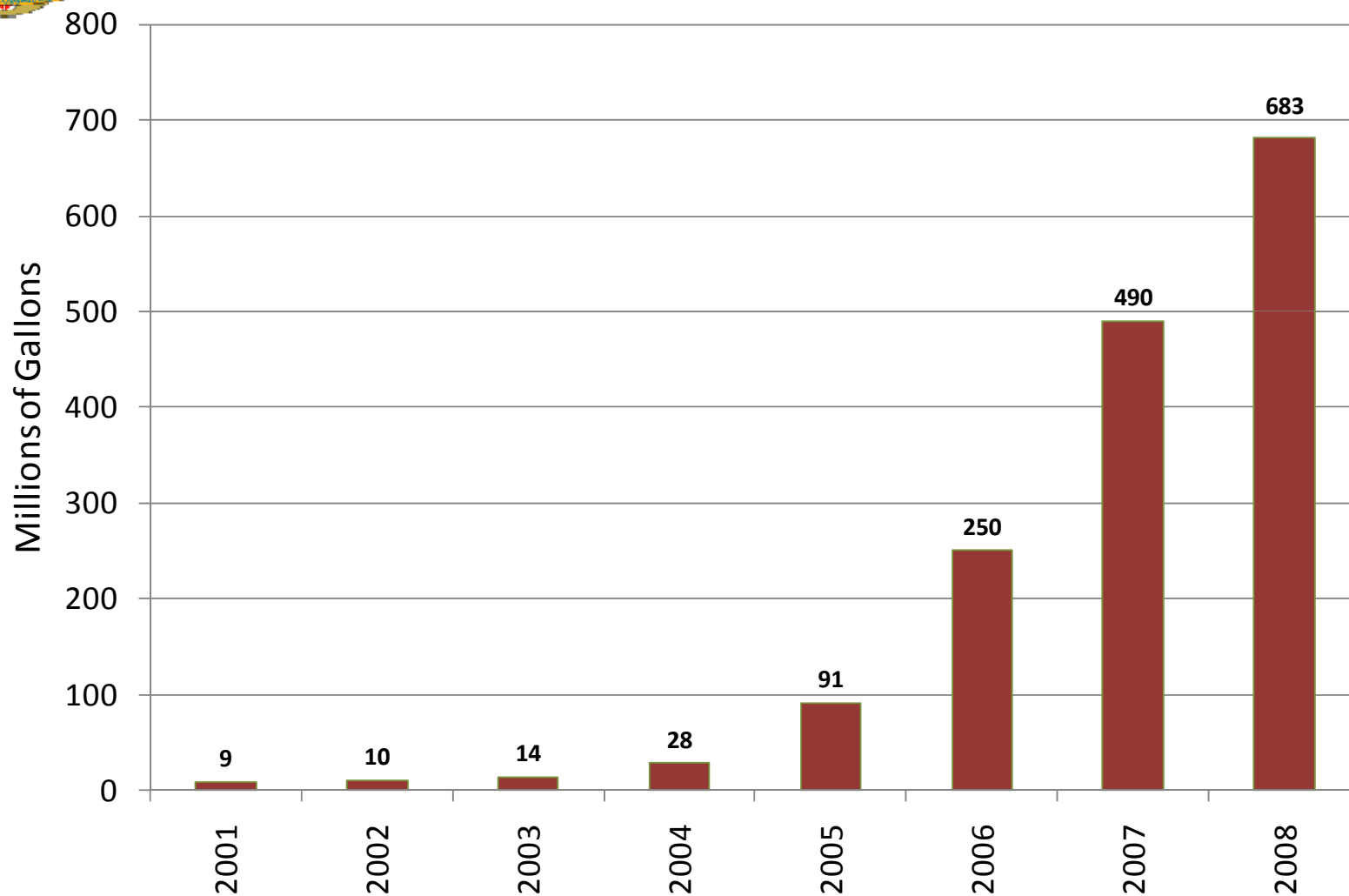
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Biodiesel



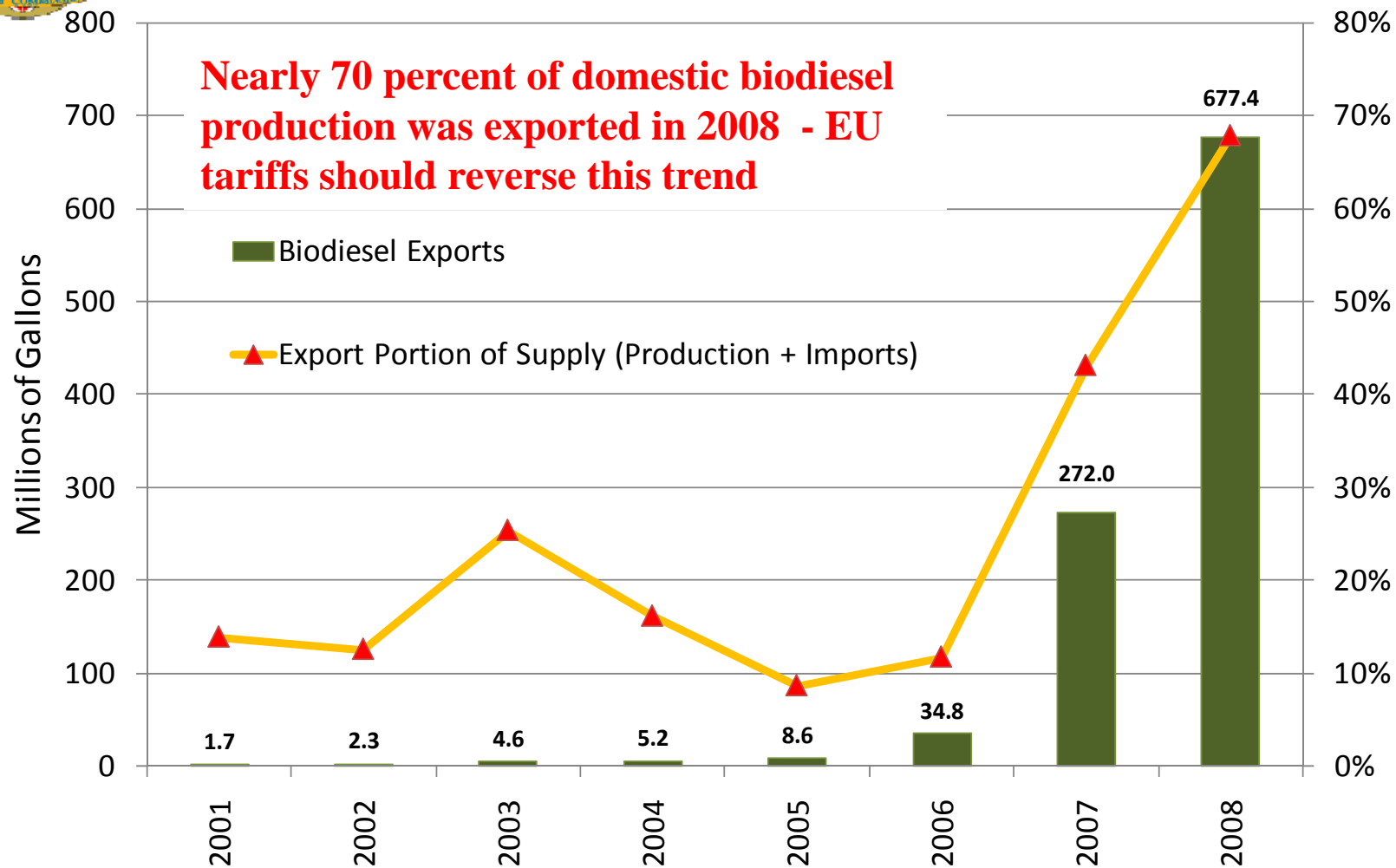
U.S. Biodiesel Production



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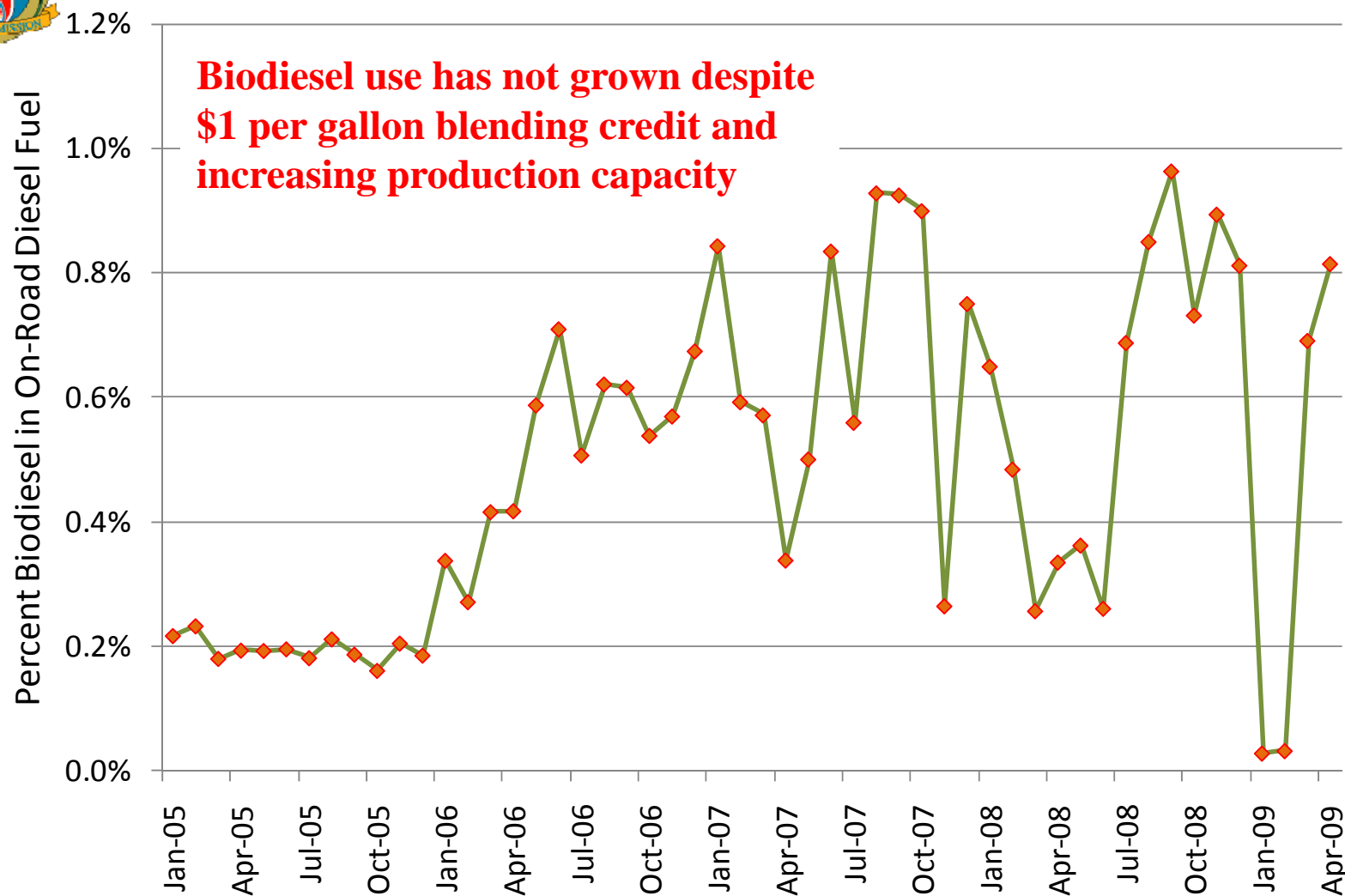
U.S. Biodiesel Exports & Percent of Supply



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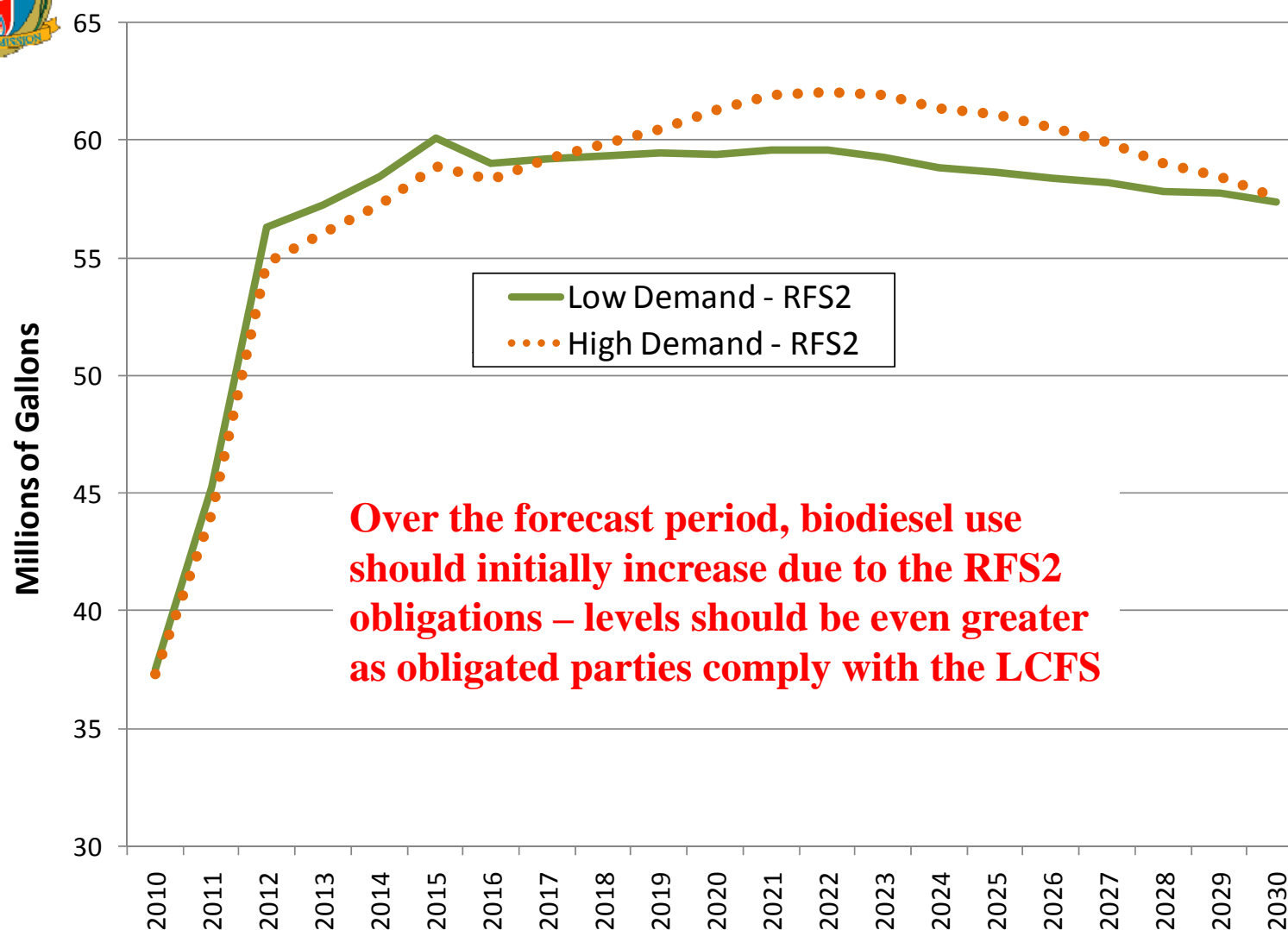
U.S. Biodiesel Blending Levels



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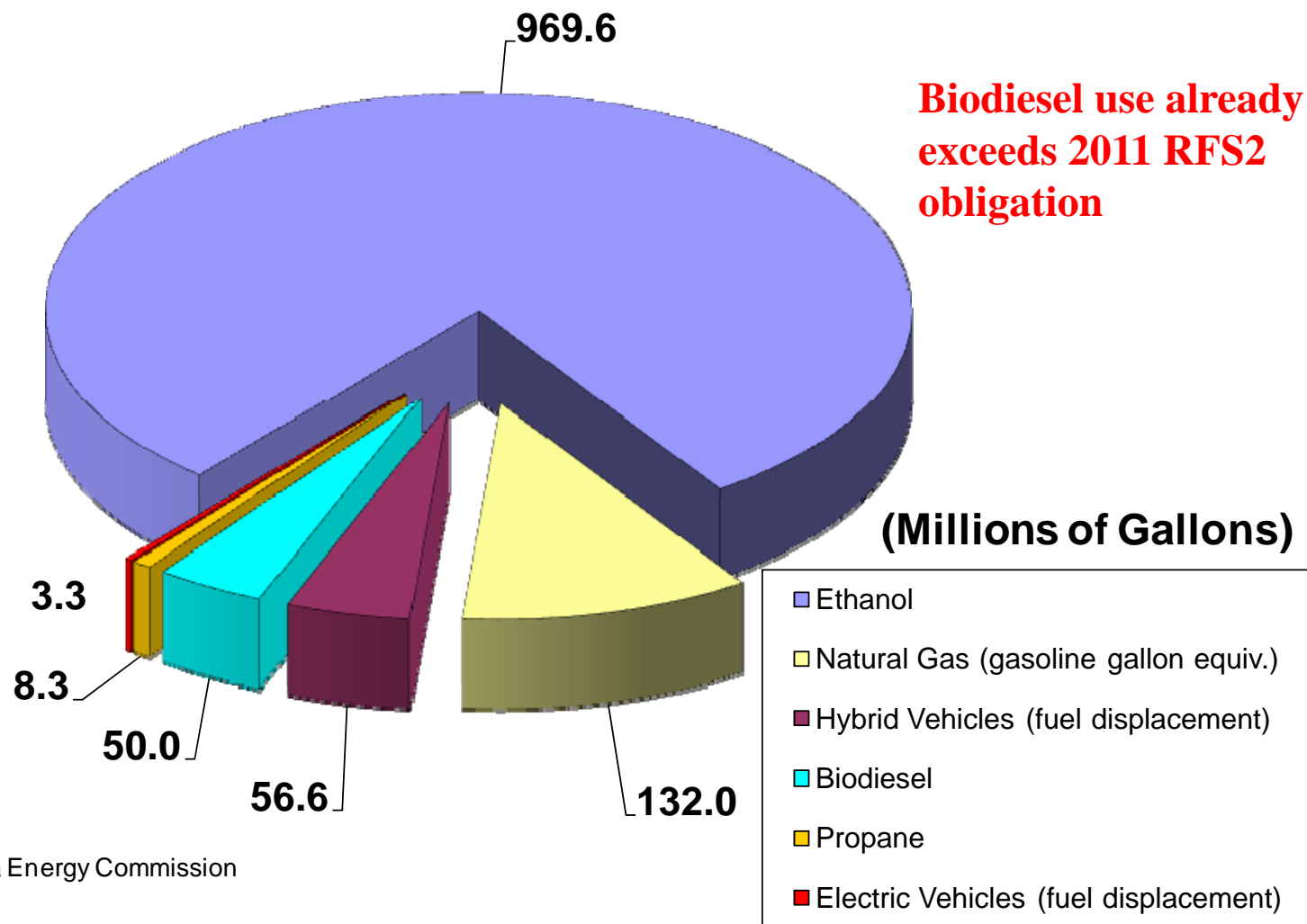
Californian Biodiesel Demand Forecast



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California Alternative Fuel Use – 2008



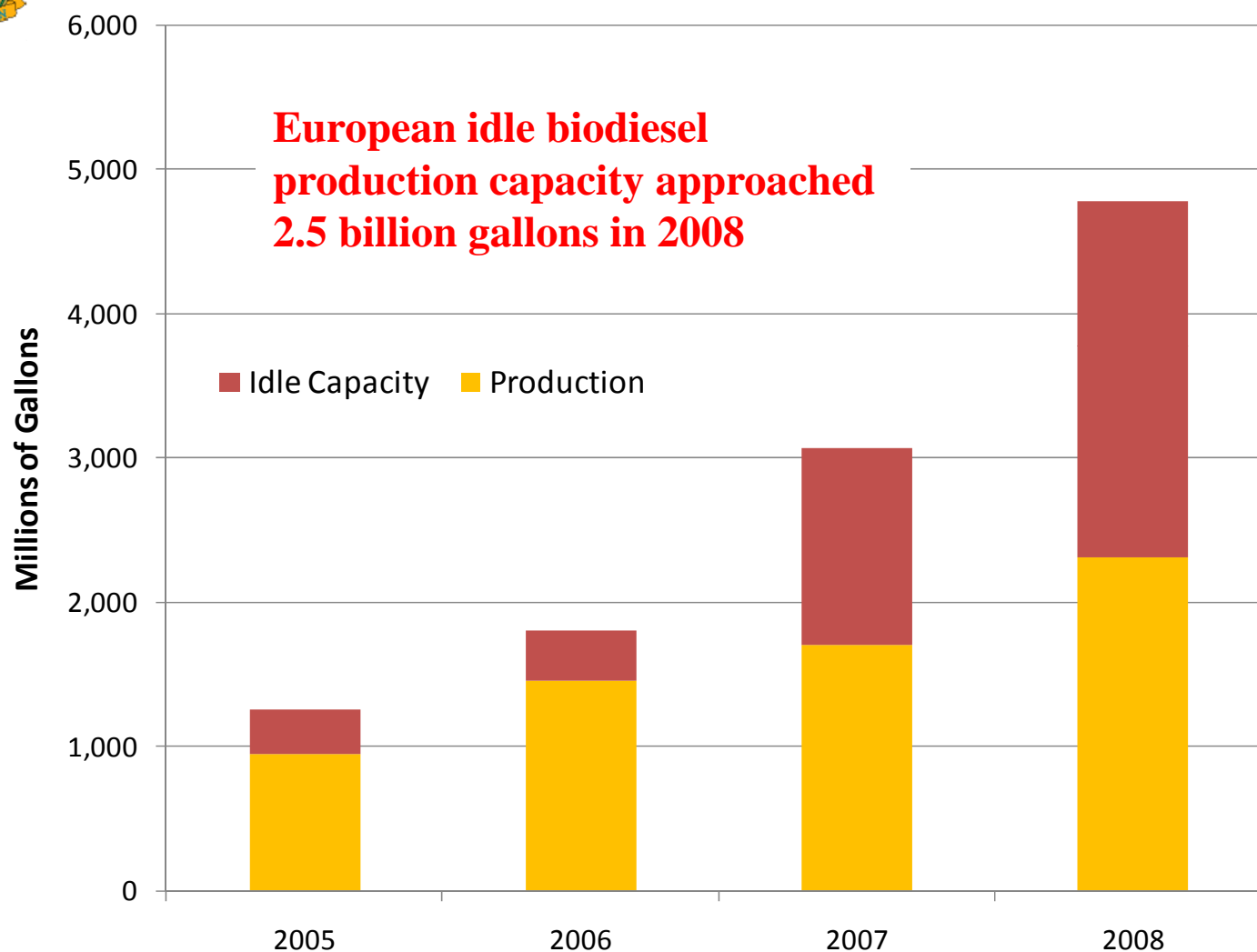


Biodiesel - Supply Outlook

- RFS2 regulations call for a minimum use of 1.0 billion gallons per year of biomass-based diesel fuel by 2012
- As of July 2009, there was more than 2.3 billion gallons of biodiesel production capacity for all operating U.S. facilities, along with another 595 million gallons per year of idle production capacity, and another 289 million gallons per year capacity under construction
- It appears as though there may be sufficient domestic sources of biodiesel production facilities to meet the RFS2 requirements for several years
- In addition, Europe alone had nearly 2.5 billion gallons per year of idle biodiesel capacity during 2008



Europe Biodiesel Production & Idle Capacity



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Biodiesel - LCFS Uncertainties

- The LCFS is expected to result in greater use of diesel blending components that have lower carbon intensities
- It is uncertain at this point what types and blending concentrations of biodiesel may be necessary to comply with the LCFS, awaiting publication of new pathways
- If California biodiesel demand levels exceed 10 or even 20 percent of total diesel fuel used in the transportation sector, volumes could easily surpass 400 to 800 million gallons per year by 2022
- Even under these circumstances, excess domestic and international biodiesel supply sources should be adequate to handle significantly greater biodiesel use in California



Biodiesel – Infrastructure Issues

- Biodiesel is able to mostly utilize the existing retail distribution structure at concentrations of 5 percent or less
- Unlike E85, little to no retail infrastructure modifications necessary to distribute B5
- The biodiesel wholesale infrastructure is currently inadequate to accommodate widespread blending of biodiesel even at concentrations as low as B5
- However, with sufficient lead time (12 to 24 months), modifications could be undertaken and completed to enable an expansion of biodiesel use



Biodiesel – Retail UST Issues

- USTs have not received independent testing organization approvals for biodiesel blends greater than 5 percent (B5) and up to 20 percent (B20)
- California State Water Resources Control Board issued emergency regulations that took effect on June 1, 2009 that allowed for a 36-month variance from this UST requirement
- Assuming biodiesel fuel blends in California do not exceed the B20 level over the foreseeable future, retail station modifications should be negligible to accommodate such increased concentrations



Additional Questions?