

# The Future of Biofuels...It's Complicated

Scott Irwin



Green

# U.S. Ethanol Maker Eyes Low-Carbon Sugar as Its 'Moonshot'

By [Kim Chijman](#) +Follow

November 4, 2021, 12:24 PM CDT Updated on November 4, 2021, 5:28 PM CDT

- ▶ Market shrugs off Green Plains' loss amid 4th-quarter optimism
- ▶ Ethanol crush margins plunged 93% during July-September period

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Shares of Green Plains Inc. rebounded to a seven-week high after the U.S. ethanol maker touted progress in its attempt to transform into a powerhouse of high-value ingredients made from

November 14, 2021  
1:20 PM CST  
Last Updated 3 days ago

Energy

## Raizen, Shell to supply second-generation ethanol to Ferrari F-1 team

2 minute read

By Roberto Samora and Gram Stattery



# BIOFUEL GROUPS PUSH FOR 'STRONG' ETHANOL MANDATE, CITING CLIMATE AND GAS PRICES

By [Chuck Abbott](#)

11/17/2021

Amid reports the EPA might scale back the ethanol mandate, biofuel groups said on Tuesday there was no U.S. path to net-zero greenhouse gas emissions or lower prices at the fuel pump without homegrown ethanol. In testimony before Congress and in a letter to the White House, the trade groups called for "strong" RFS targets and speedy restoration of year-round sales of E15, a higher than traditional blend of ethanol and gasoline.

"Renewable fuels like ethanol remain the single most affordable and abundant source of low-carbon motor fuel on the planet – and are critical to meeting carbon

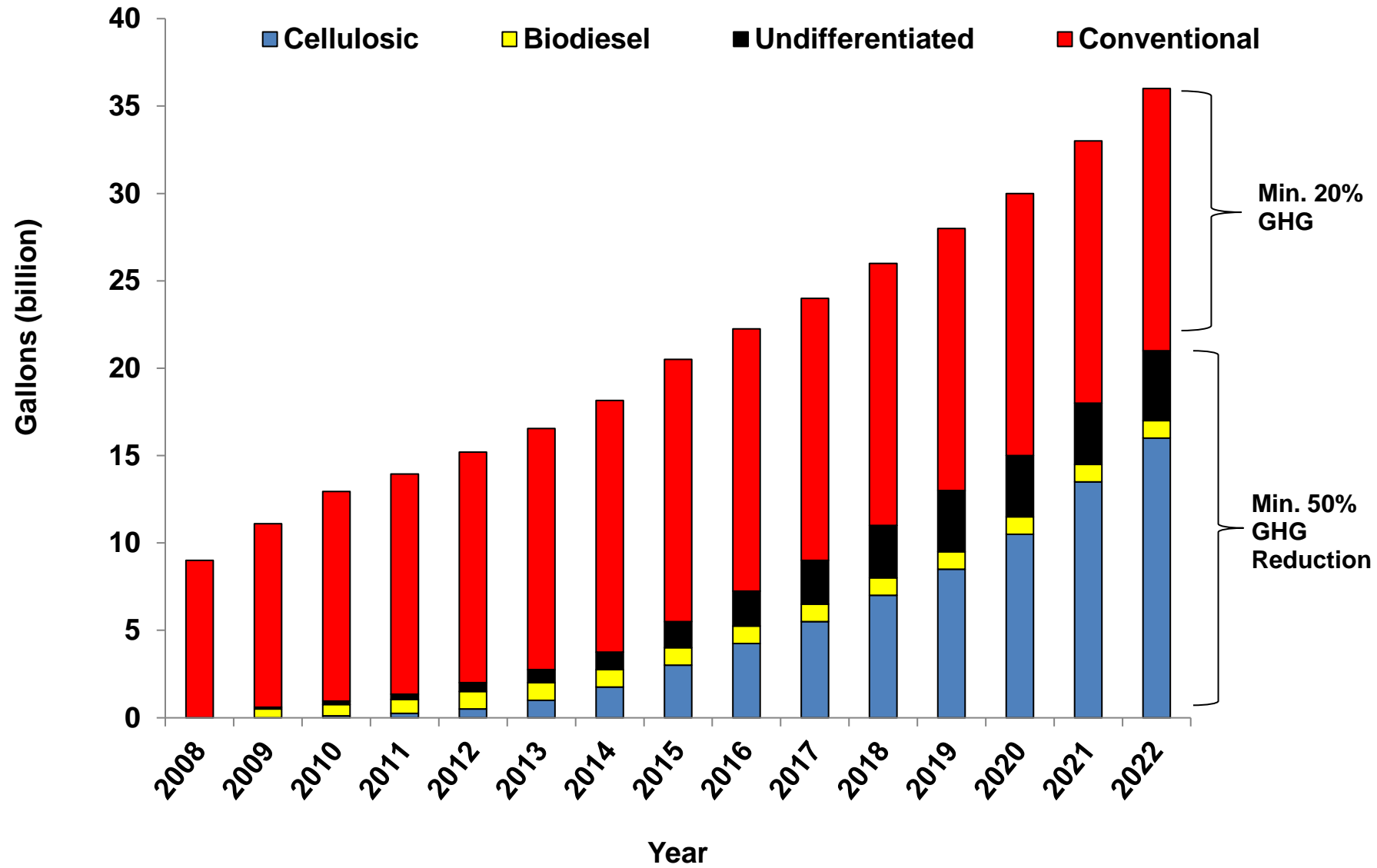


# Terminology

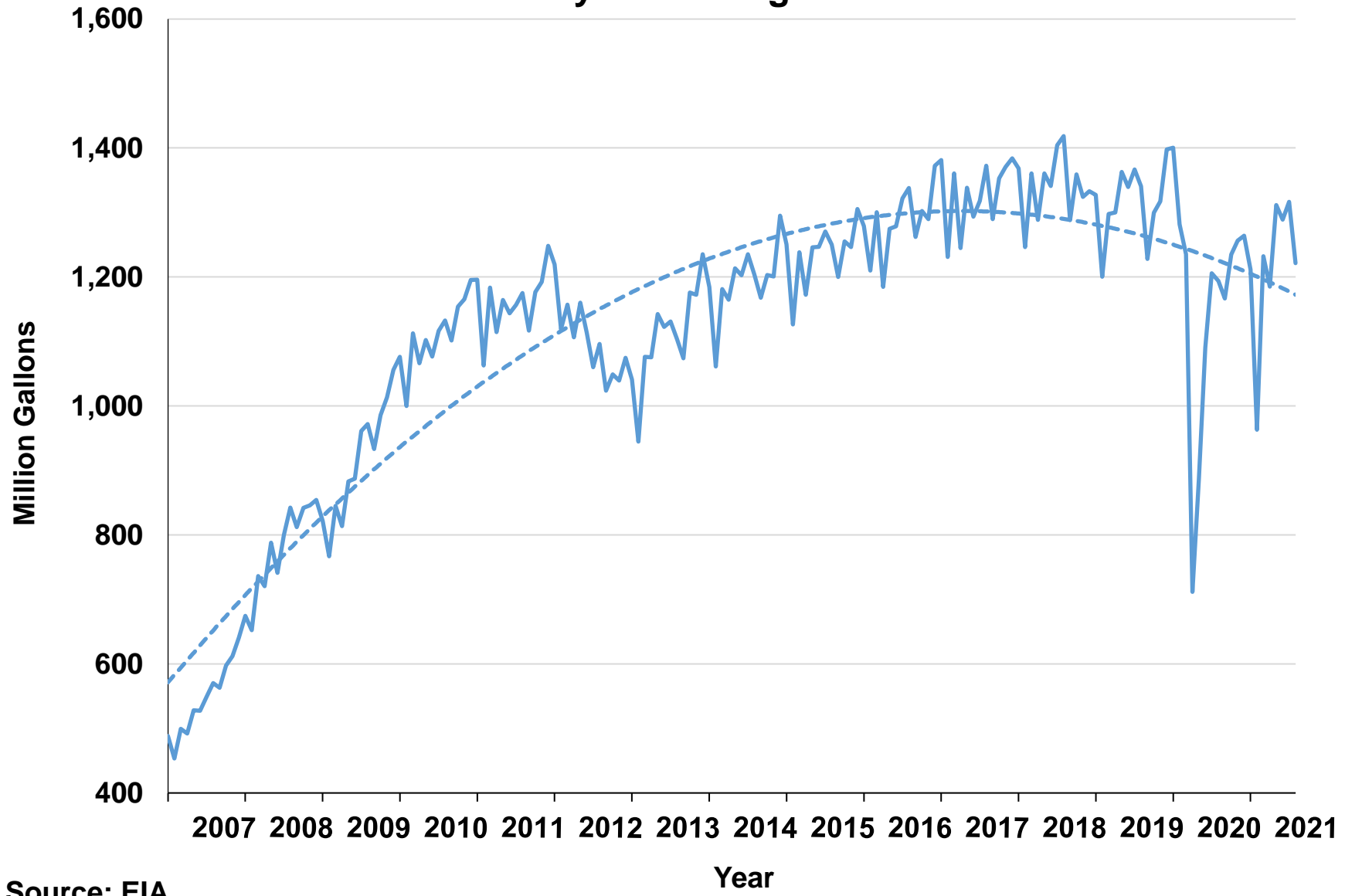
- ✓ ***Conventional Ethanol***: Made from a variety of starches, e.g., corn, sorghum, or sugar cane
- ✓ ***Cellulosic Ethanol***: Made from wide variety of fibers, e.g., corn stover, grasses, woody biomass
- ✓ ***Biomass-Based Diesel***: FAME Biodiesel and Renewable Diesel
- ✓ ***FAME Biodiesel***: Made from fats and vegetable oils using chemical reaction
- ✓ ***Renewable Diesel***: Made from fats and vegetable oils using heat, pressure, and chemical reaction
- ✓ ***Sustainable Aviation Fuel***: Made from fats and vegetable oils using heat, pressure, and chemical reaction



# Statutory U.S. Renewable Fuels Standards, 2008-2022



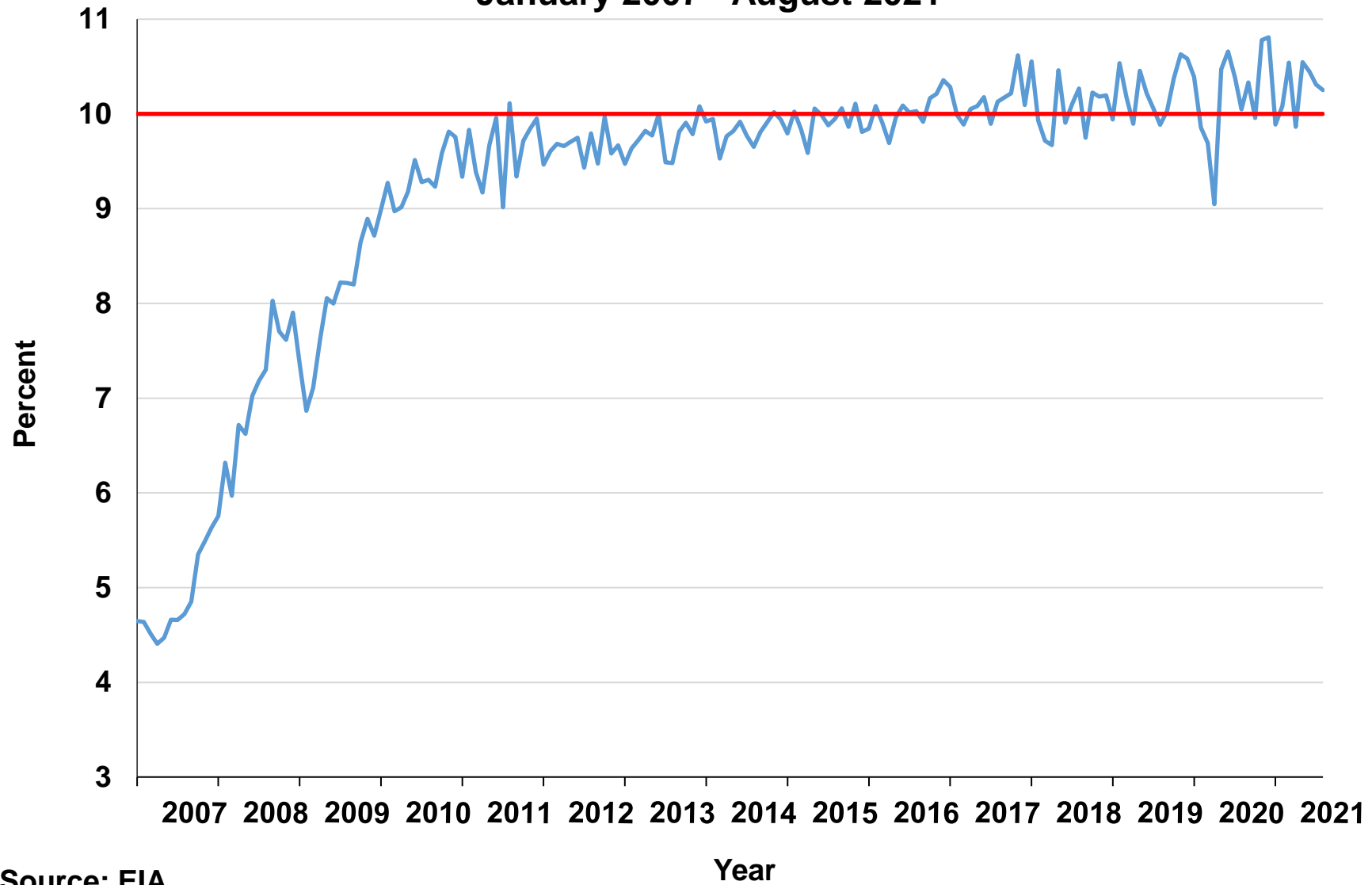
# Monthly U.S. Fuel Ethanol Production, January 2007 - August 2021



Source: EIA



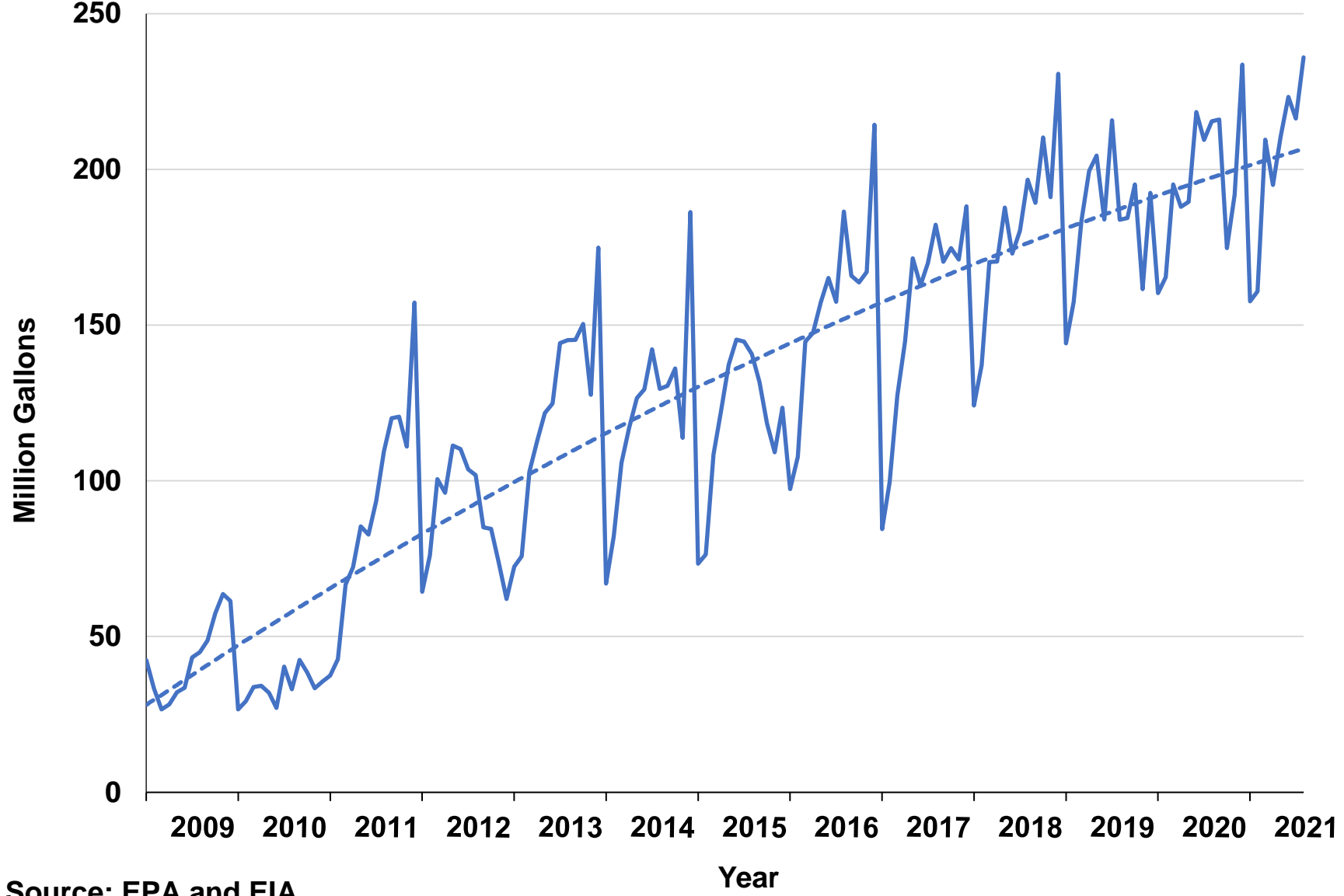
# Monthly Implied Domestic Consumption of Ethanol as a Percent of U.S. Finished Motor Gasoline Supplied, January 2007 - August 2021



Source: EIA



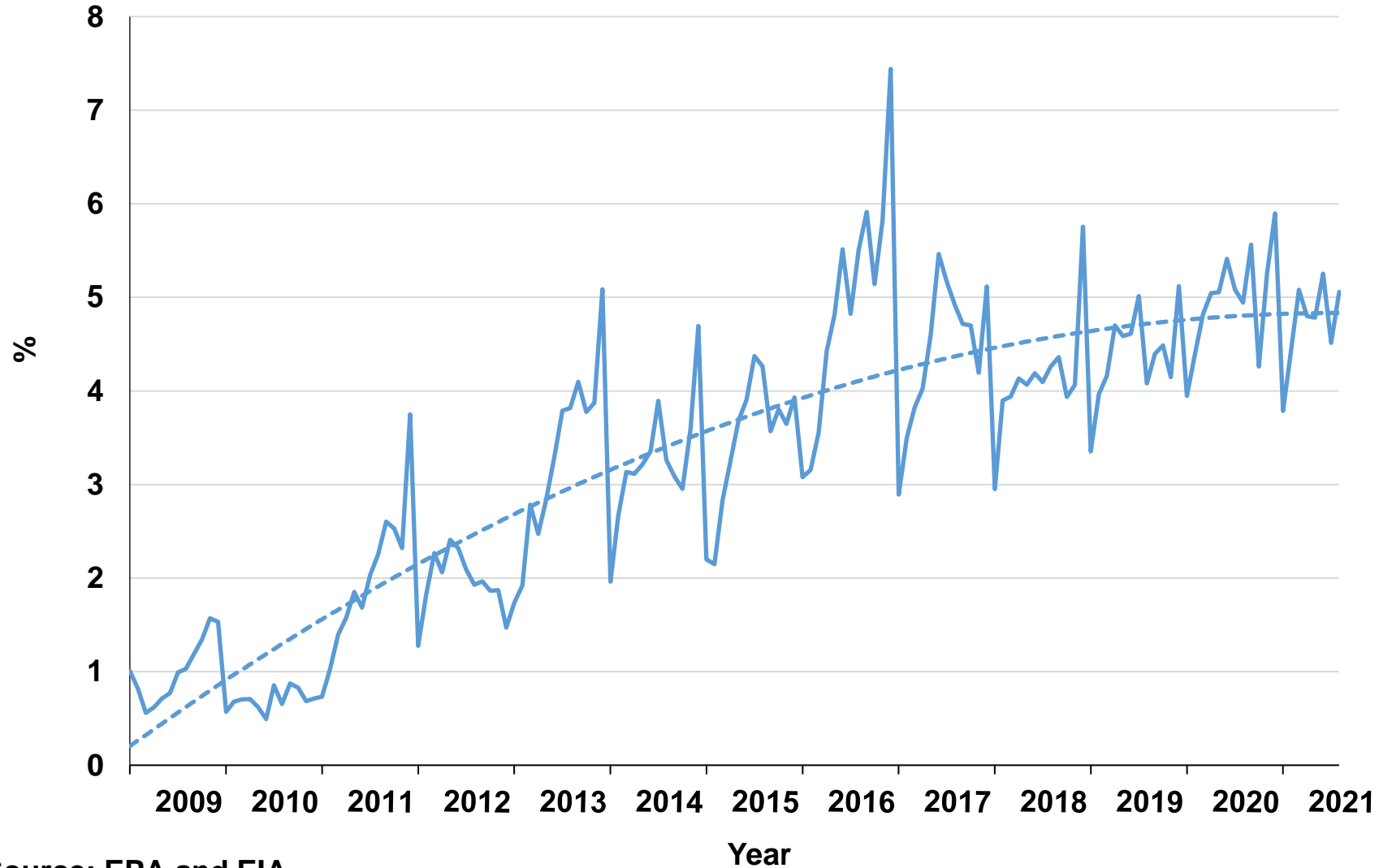
# Monthly U.S. Biomass-Based Diesel Production, January 2009 - August 2021



Source: EPA and EIA



# Monthly Biomass-Based Diesel Implied Domestic Consumption as a Percent of U.S. Distillate Fuel Oil Supplied (less than 15 ppm sulfur), January 2009 - August 2021

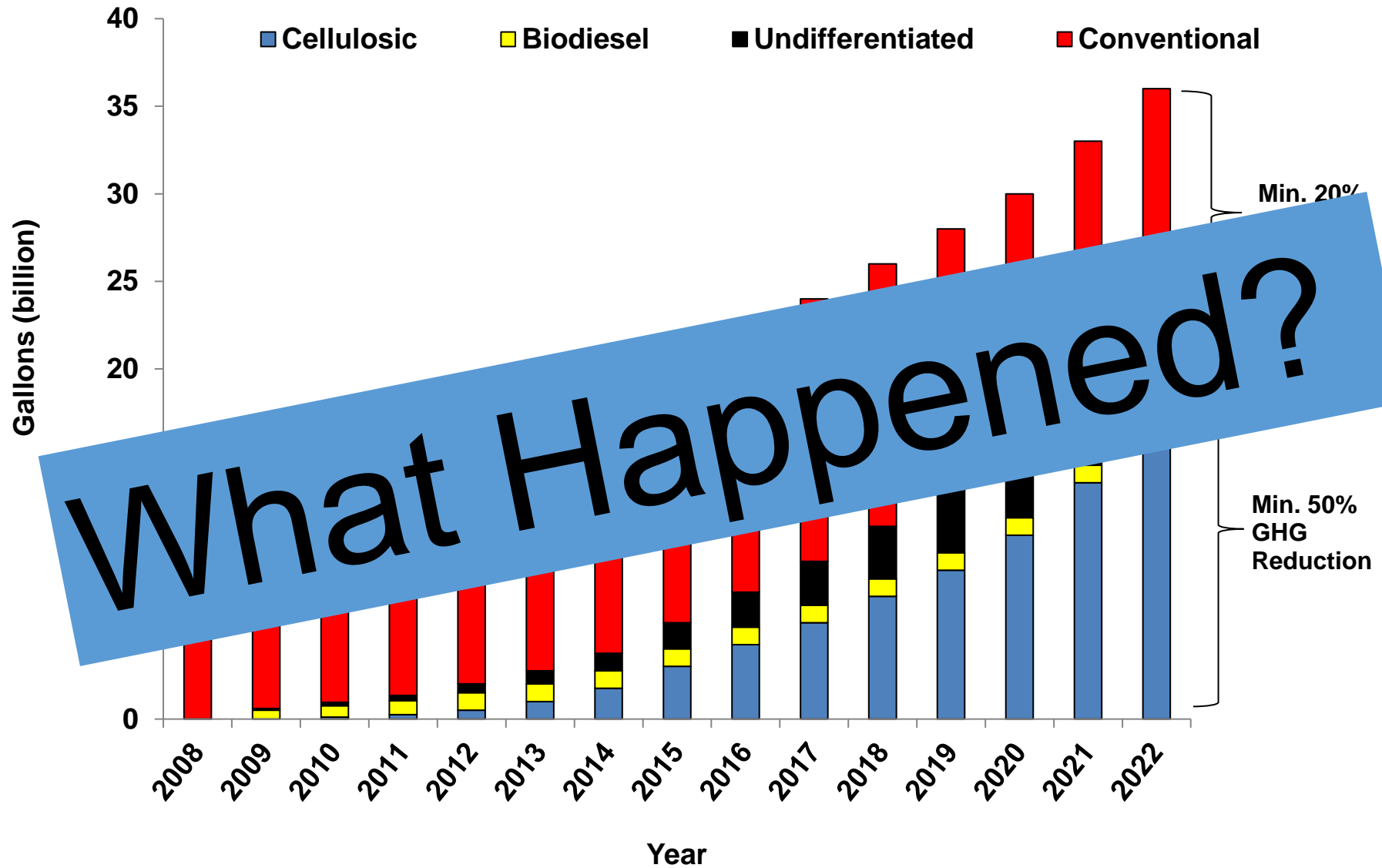


Source: EPA and EIA





# Statutory U.S. Renewable Fuels Standards, 2008-2022



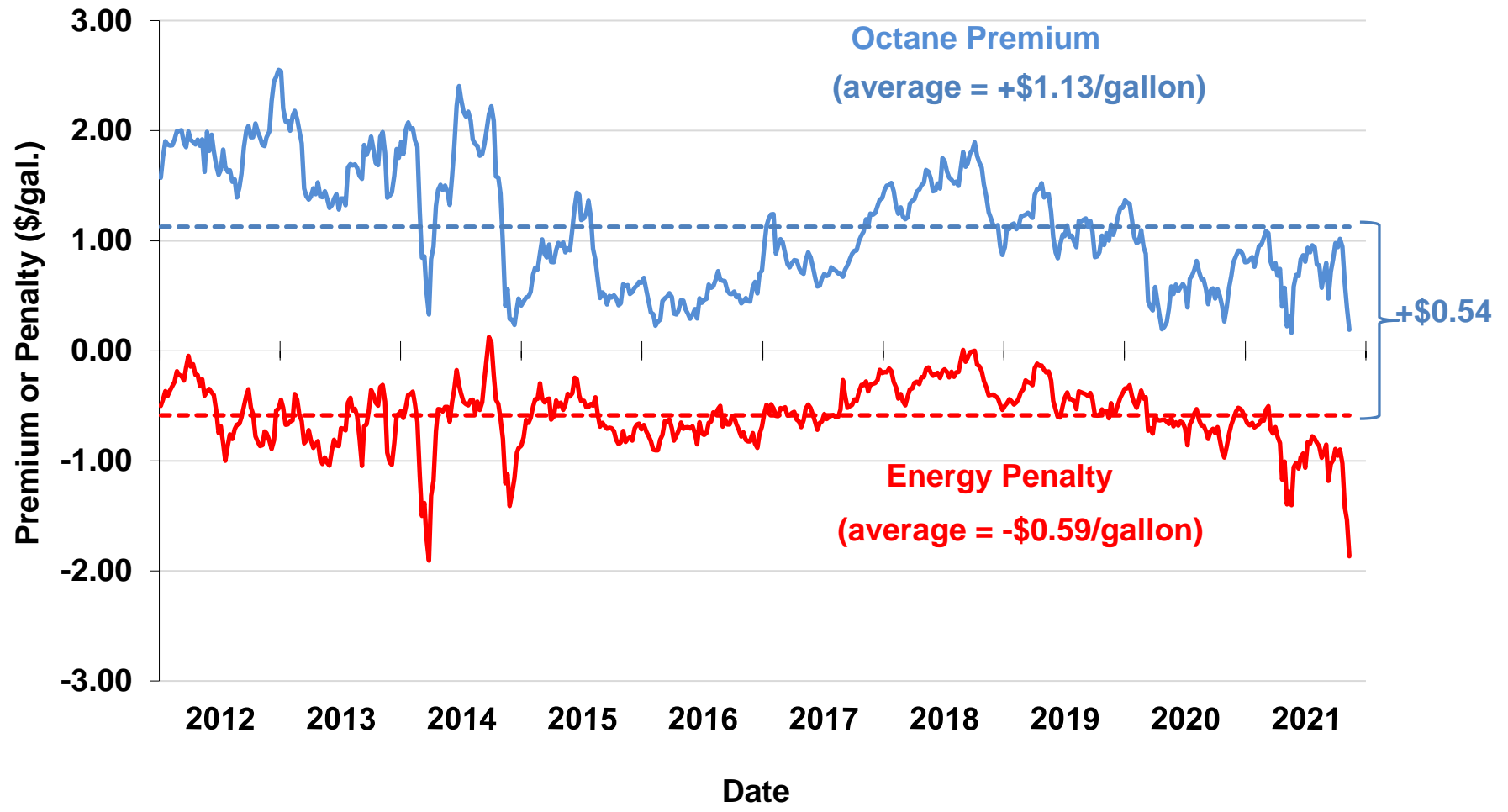
# The Political Battle Over Breaching the E10 Blend Wall



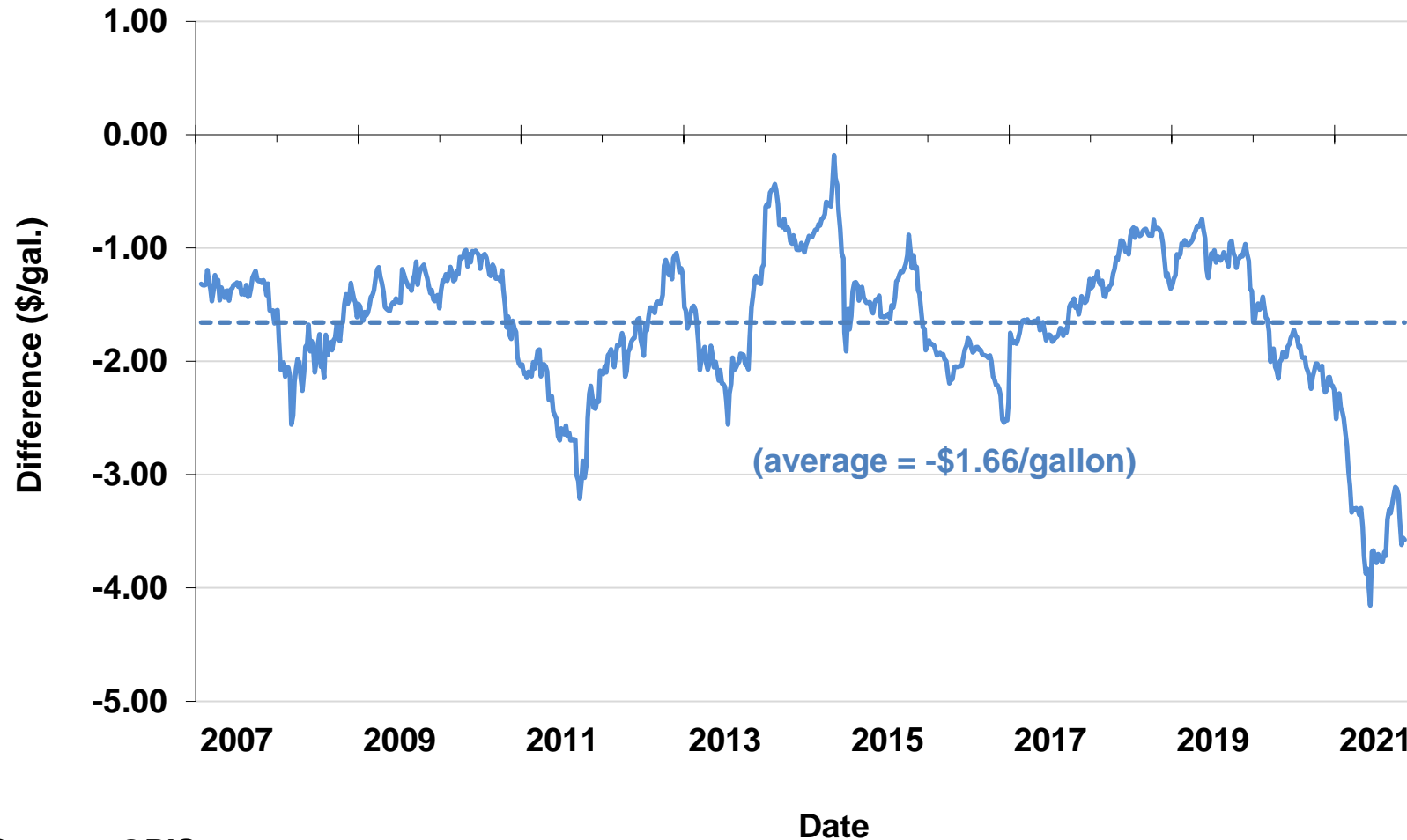
[https://si.wsj.net/public/resources/images/WO-AR519\\_WW1FIG\\_G\\_20140302182549.jpg](https://si.wsj.net/public/resources/images/WO-AR519_WW1FIG_G_20140302182549.jpg)



# Weekly (Thursday) Octane Premium and Energy Penalty for Ethanol at the U.S. Gulf, 01/05/2012 - 11/11/2021



# Weekly (Thursday) Energy-Adjusted Difference between Wholesale Ultra Low Sulfur Diesel (ULSD) and FAME Biodiesel at Chicago, 01/25/2007 - 11/11/2021



Source: OPIS

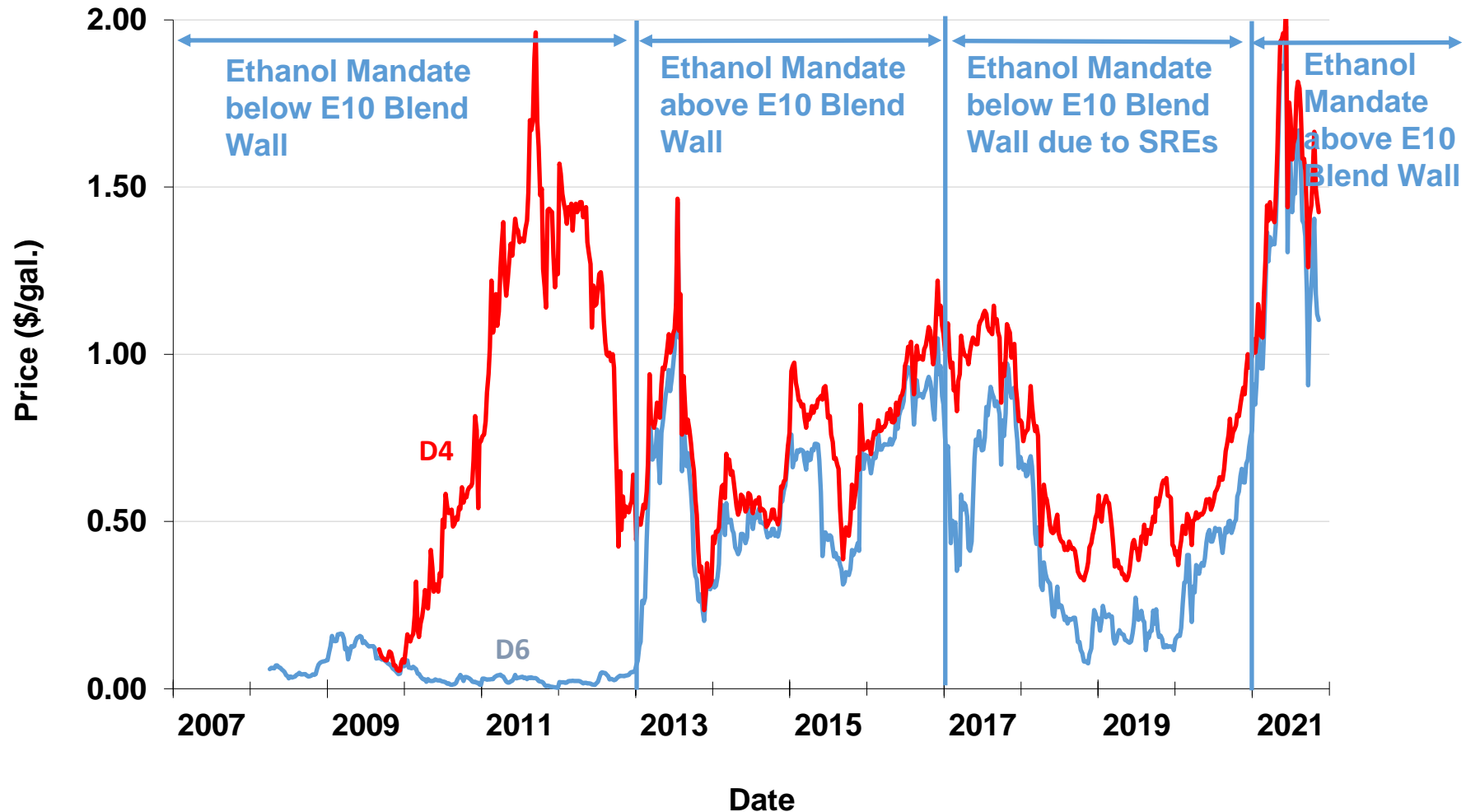


# RFS Compliance and the E10 Blend Wall

1. RFS compliance is demonstrated by turning in tradeable credits known as RINs (D6=Ethanol RIN; D4=biodiesel RIN)
2. Price of RINs reflect cost of filling different RFS mandates
3. Ethanol mandate < E10 blend wall: D6 RINs are cheap, reflecting ethanol's blending competitiveness
4. Ethanol mandate > E10 blend wall: gap must be filled with something else and that something else is biodiesel (safety valve)
5. Implication: biodiesel becomes marginal gallon for filling conventional "ethanol" mandate and D6 ethanol RINs rise to the price of much more expensive D4 biodiesel RINs
6. Refiners are outraged over high RIN costs



# Weekly (Thursday) D4 Biodiesel and D6 Ethanol RIN Prices, 04/03/2008 - 11/11/2021



Source: OPIS



# The Big 2023 Reset

1. Specific volumetric standards in the RFS statute end in 2022
2. This does not mean that the RFS sunsets in 2023
3. RFS volumes for 2023 and beyond were supposed to be established by late 2021
4. Required volumes of renewable fuels “shall be determined by the [U.S. Environmental Protection Agency] Administrator, in coordination with the Secretary of Energy and the Secretary of Agriculture...”
5. Does not mean EPA Administrator has free rein to set whatever volumes preferred
6. Only broad criteria are provided in the RFS statute



## D.C. Circuit of the U.S. Appeals Court in *Americans for Clean Energy*, July 28, 2017

*“By requiring upstream market participants such as refiners and importers to introduce increasing volumes of renewable fuel into the transportation fuel supply, Congress intended the Renewable Fuel Program to be a “market forcing policy” that would create “demand pressure” to increase consumption of renewable fuel.” (pp. 20-21)*



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*Coppess and Irwin (2020): North Star of the RFS*



# Outline of Political Compromise on the RFS Reset

1. Move to an E11 or E12 percentage ethanol standard for gasoline in the surface transportation fleet
2. Move to a B5 percentage standard for biomass-based diesel in the surface transportation fleet
3. Focus volume standards for growth of biofuels above these levels on decarbonizing the air transportation and maritime transportation sectors
4. Eliminate RINs and move the point of obligation to blenders

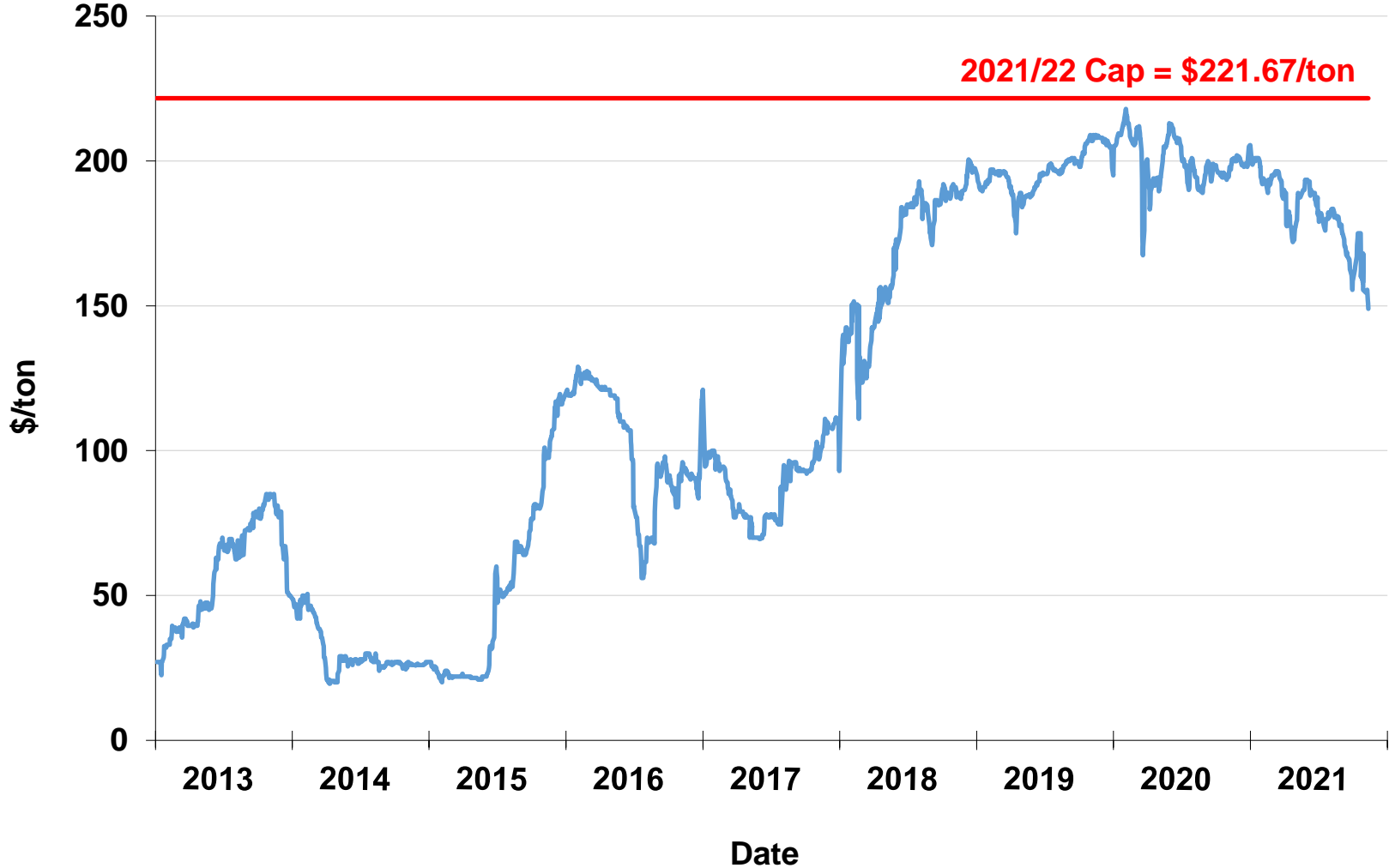


# The California Low Carbon Fuel Standard (LCFS): The Future?

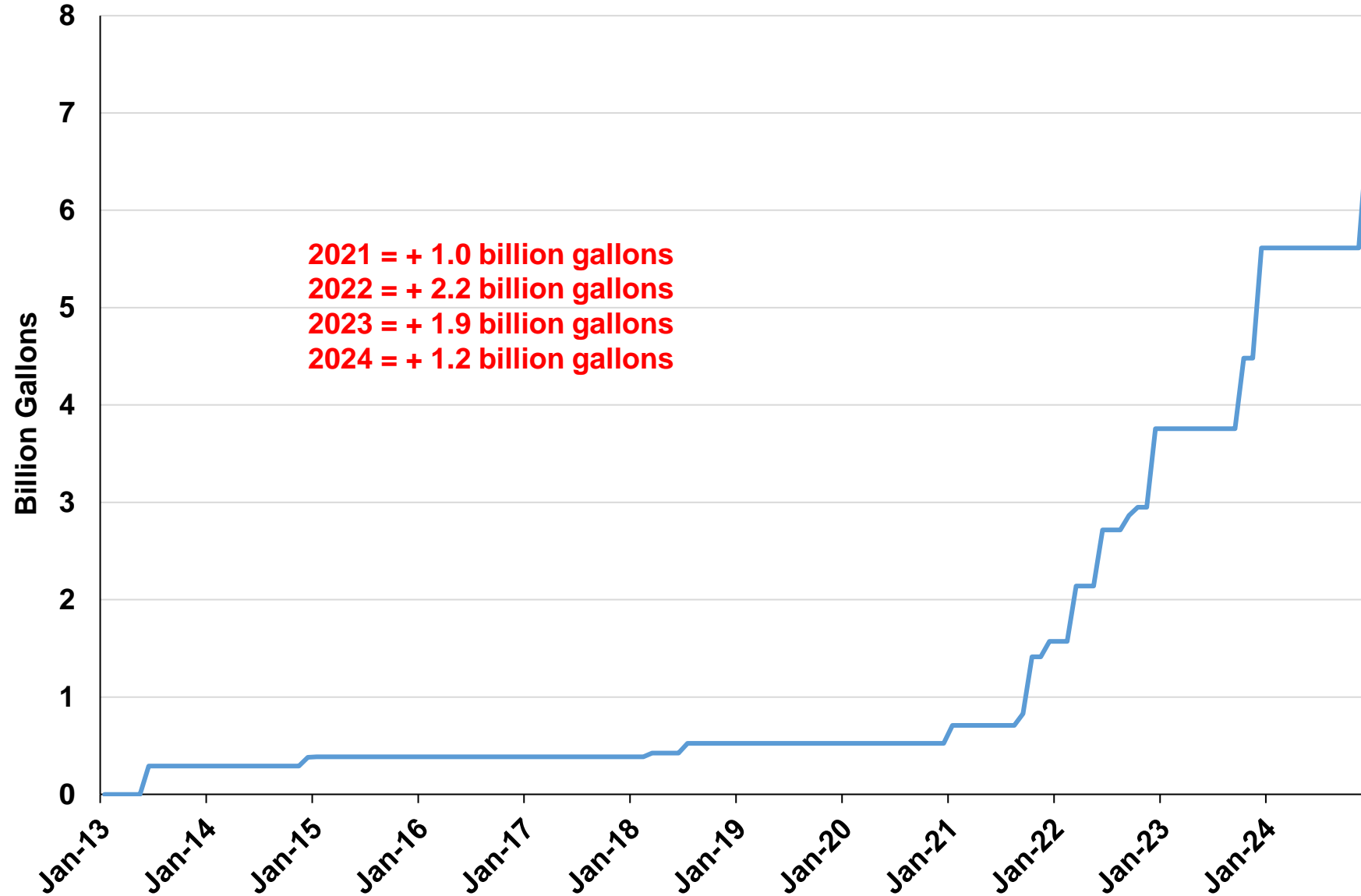
1. Target of 20% (25%) reduction in carbon intensity of transportation energy below 2010 levels by 2030 (2035)
2. All regulated fuel volumes assigned a carbon intensity (CI) score based on life-cycle greenhouse gas (CHG) emissions
3. Fuels with a CI above the target generate deficits and those below generate credits
4. Obligated parties (refiners, importers, or distributors) comply by reducing CI of fuels, generating credits internally, or purchasing credits in the secondary market



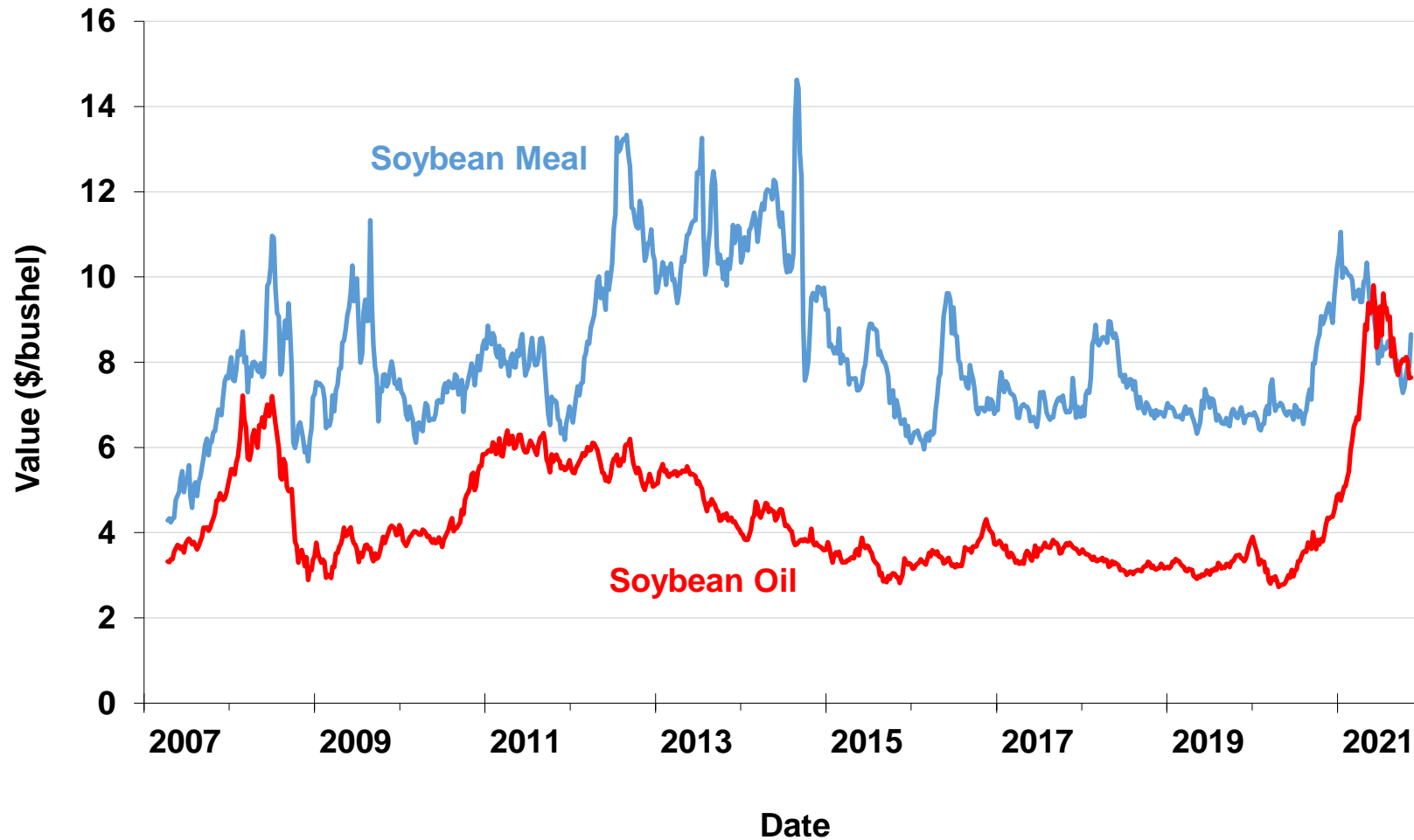
# Daily Price of Carbon Credit for the California Low Carbon Fuel Standard (LCFS), 1/4/2013 - 11/11/2021



# Actual and Projected North American Renewable Diesel Production Capacity, January 2013 - December 2024



# Weekly (Friday) Crush Value of Soybean Meal and Soybean Oil at Iowa Plants, 01/26/2007 - 11/12/2021



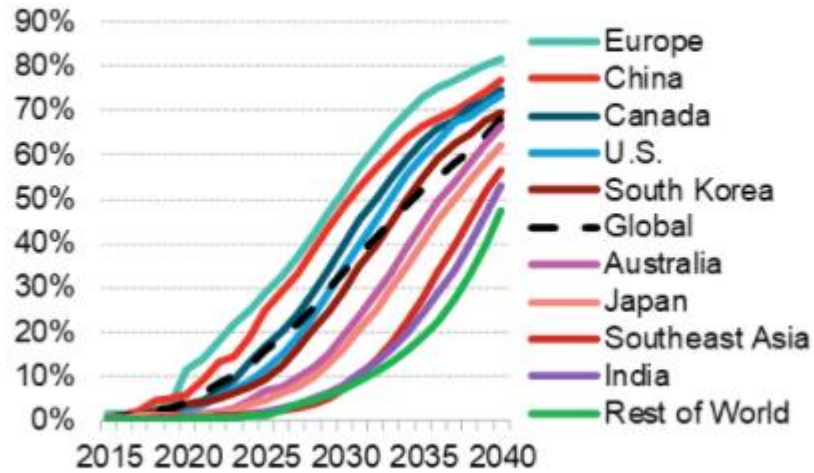


<https://www.tesla.com/models>



### Figure 5

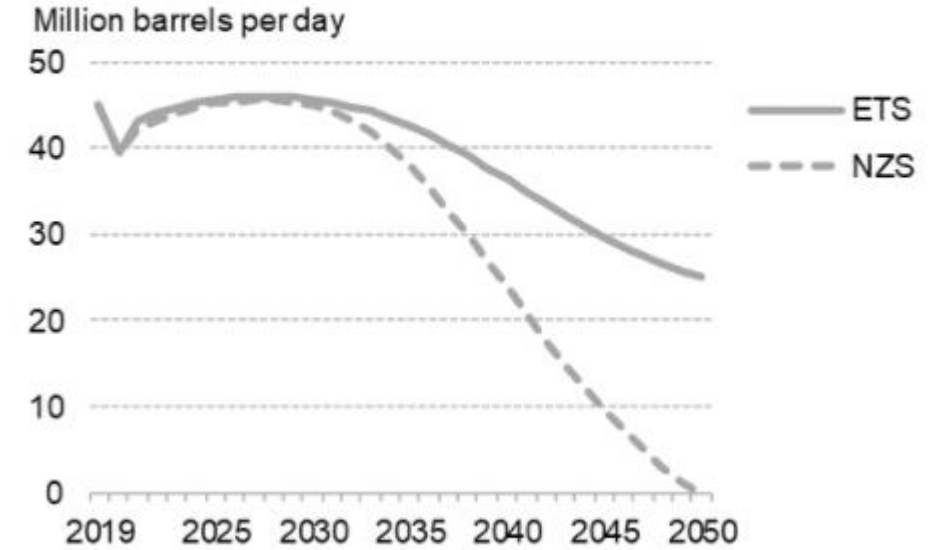
#### EV share of new passenger vehicle sales outlook by market - Economic Transition Scenario



Source: BNEF. Note: EVs include battery-electric and plug-in hybrid electric vehicles. Battery-electric vehicles represent 88% of total electric vehicle sales in 2030. Europe includes the EU, the U.K. and EFTA countries.

### Figure 16

#### Oil demand from road transport by scenario



Source: BNEF. Note: 'ETS' is Economic Transition Scenario and 'NZS' is Net-Zero Scenario.

<https://about.bnef.com/electric-vehicle-outlook/>





# Closing Thoughts

1. Future of biofuels is inherently political
2. No free lunches regarding climate policies
3. Public tolerance for costly climate policies is uncertain
4. Biofuels will play a role in the global energy future, but it will be a bumpy ride

