

# The Outlook for U.S. Biofuels: Ethanol and SAF



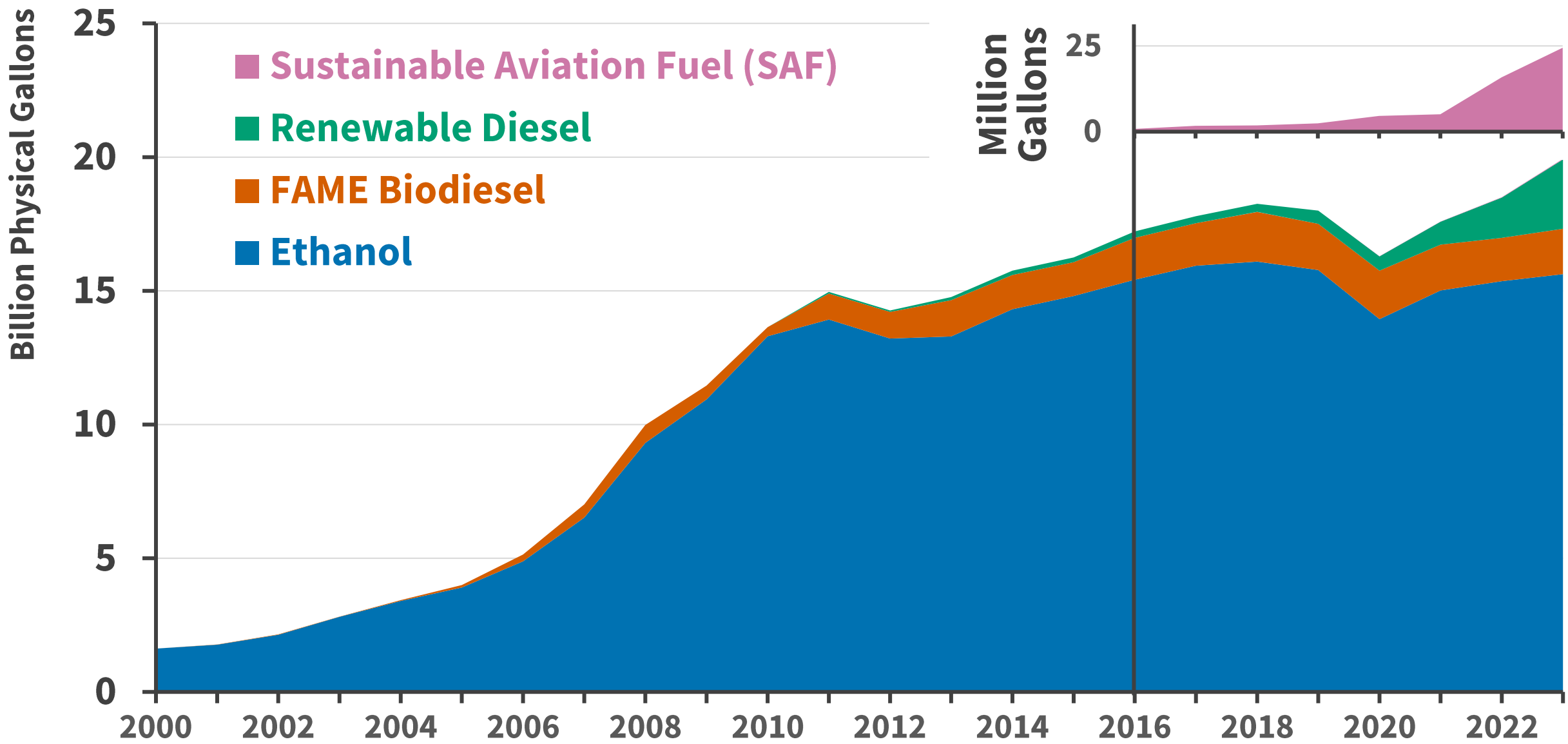
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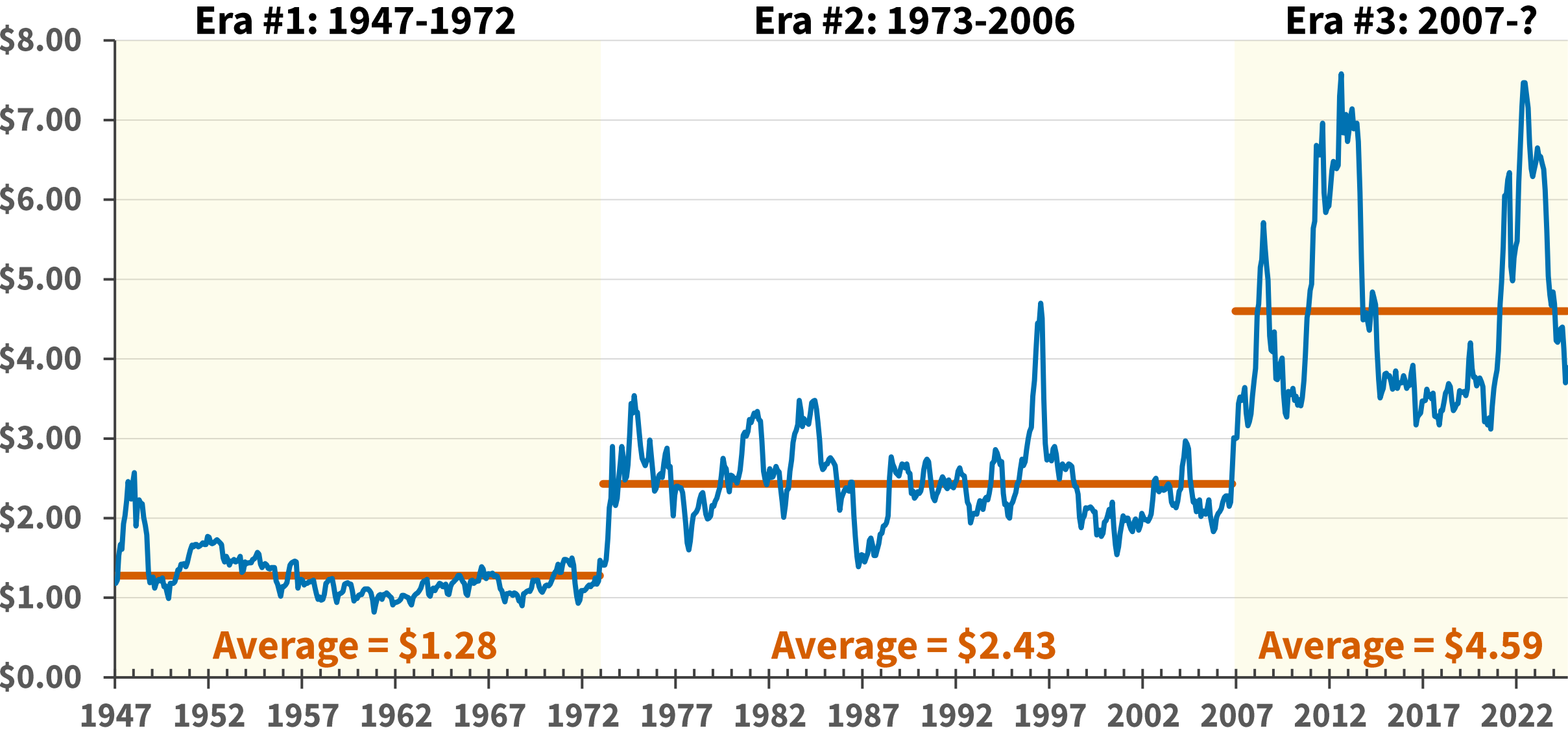
**Scott Irwin**  
**farmdoc**



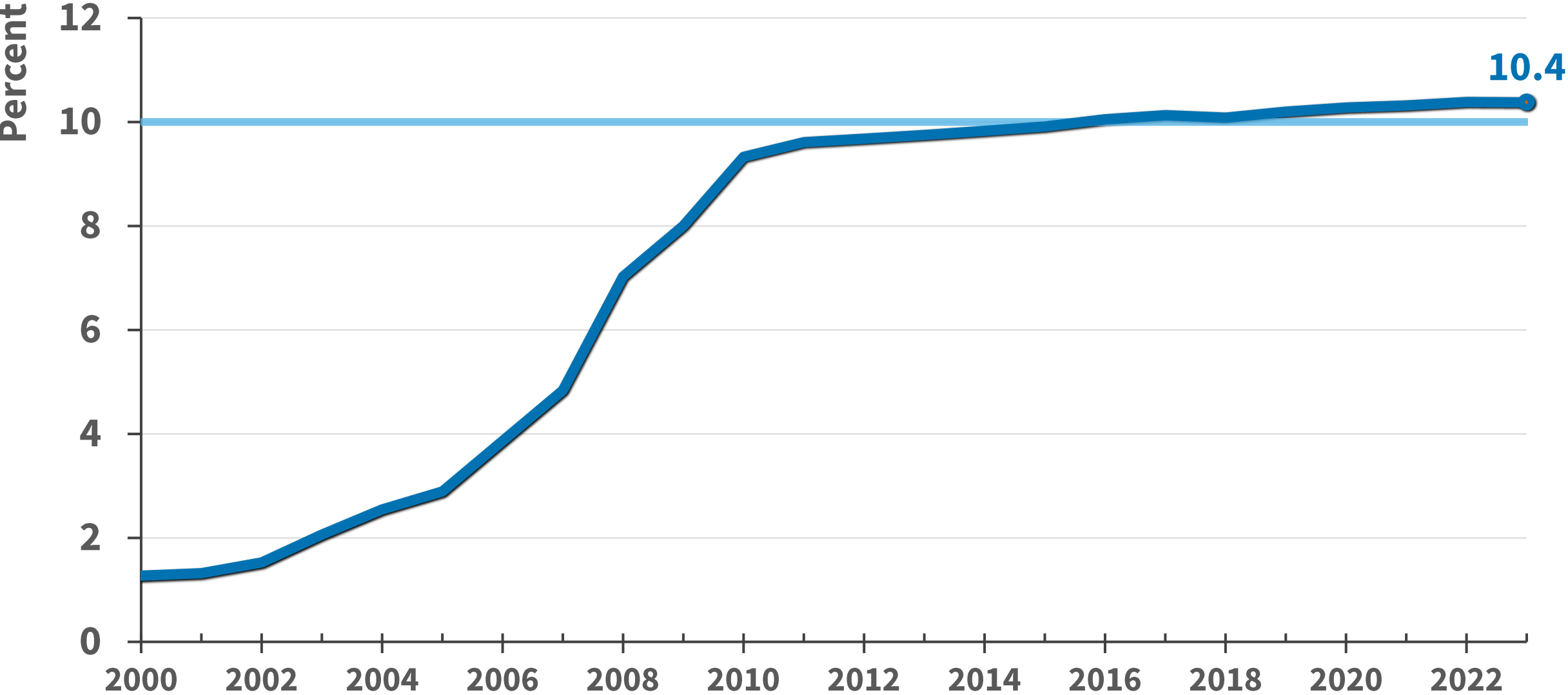
# U.S. Biofuels Production, 2000 - 2023



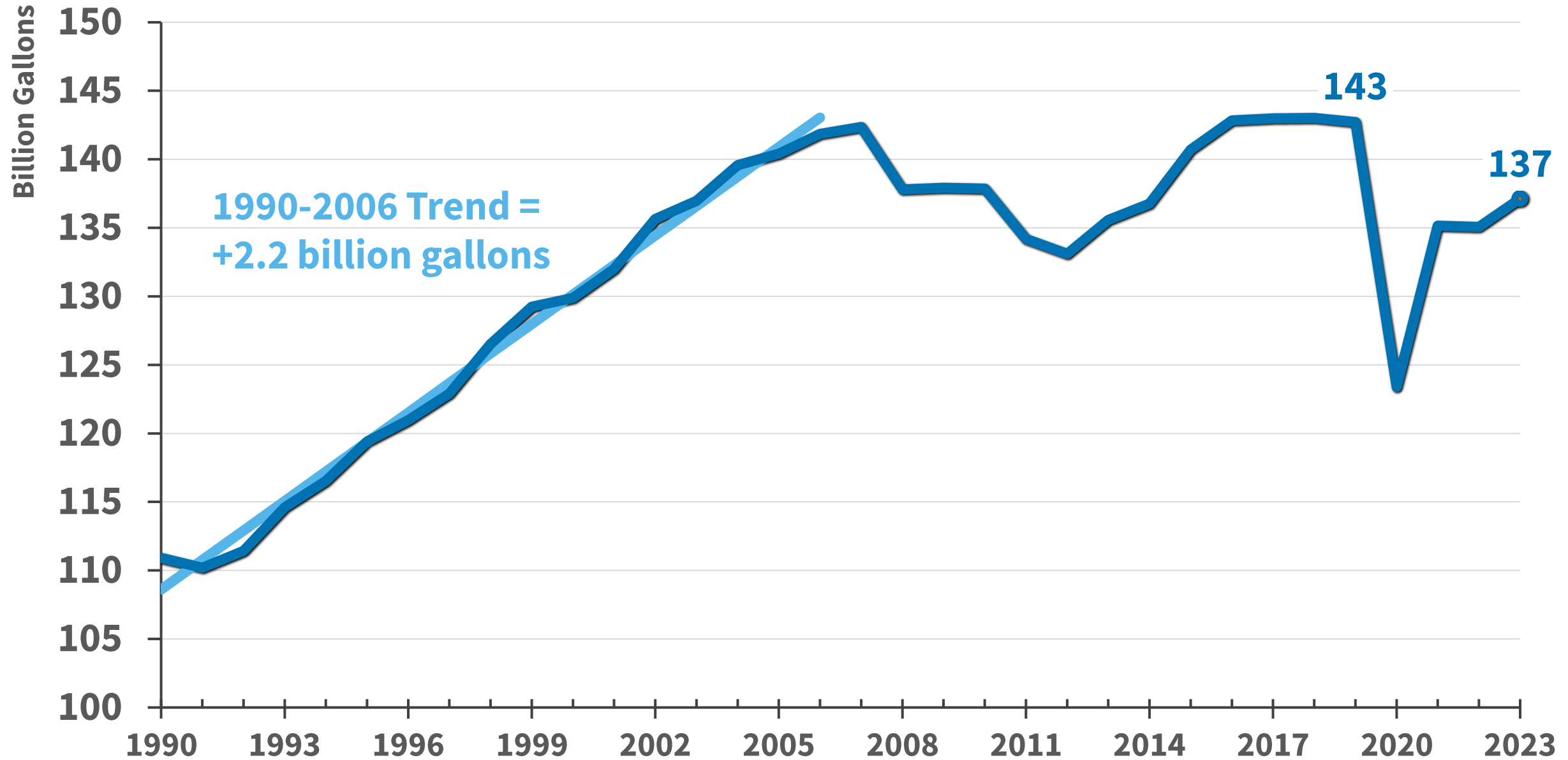
# Monthly Farm Price of Corn in Illinois, Jan 1947 - Sep 2024 in dollars per bushel



# Implied Domestic Consumption of Ethanol as a Percent of U.S. Finished Motor Gasoline Supplied, 2000 - 2023



# Annual U.S. Motor Gasoline Product Supplied, 1990 - 2023



BUSINESS > COMPANY NEWS



# Amazon's return-to-office mandate highlights festering tensions over remote work

Resume Builder said 87% of companies that went remote during the pandemic will be back in-office by 2025.



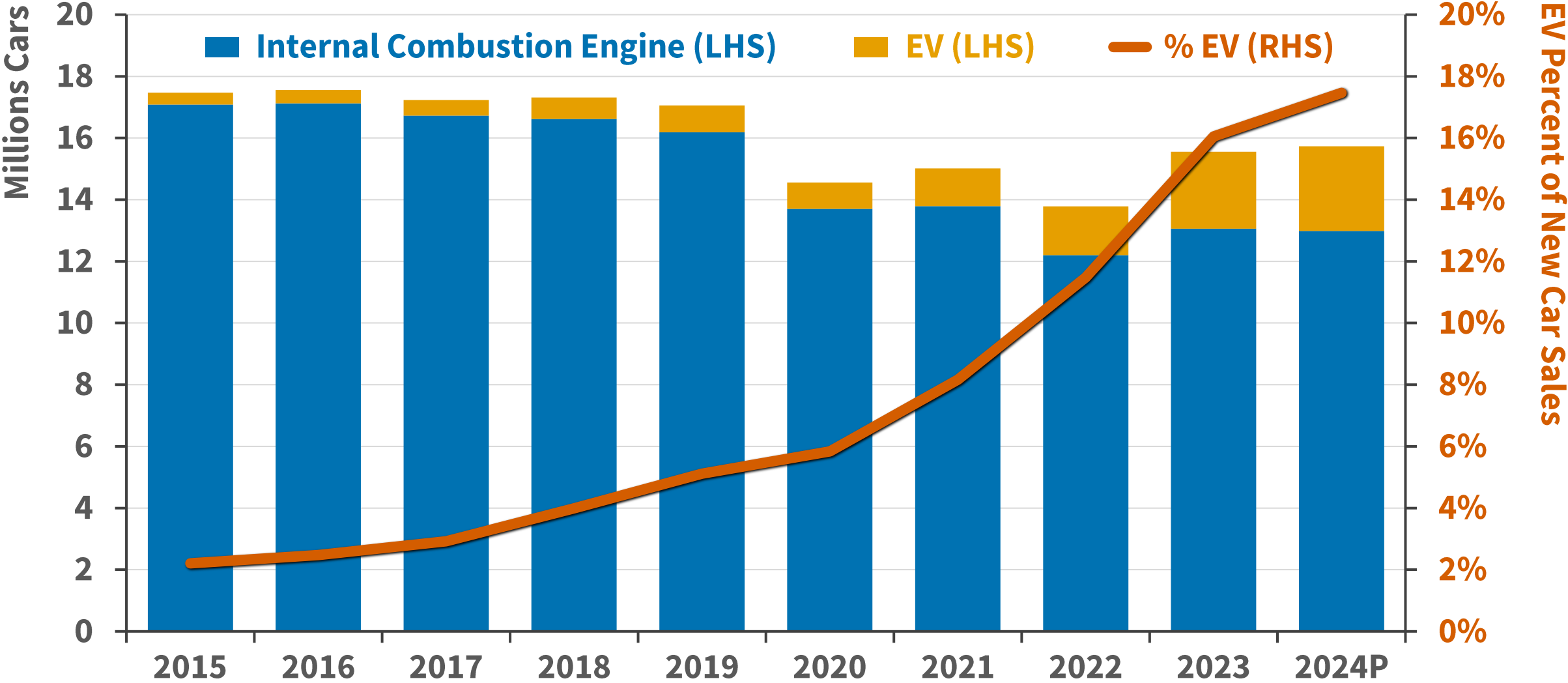
Photo by: Nam Y. Huh/AP

An Amazon truck makes deliveries.

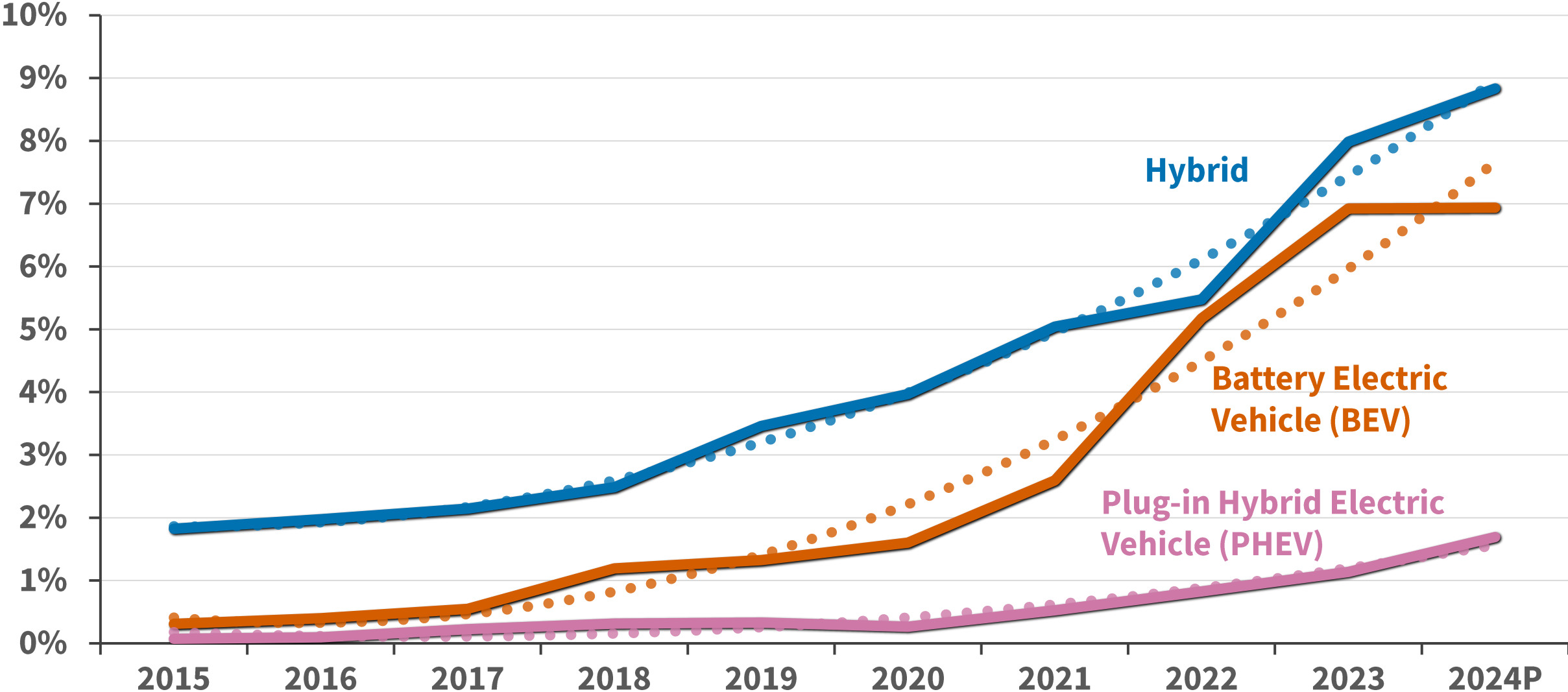


**Where Main Street  
Meets Wall Street**

# Light Duty Internal Combustion Engine and Electric Vehicle Sales in the U.S. (EV = BEV + Hybrid + PEHV), 2015 - 2024P

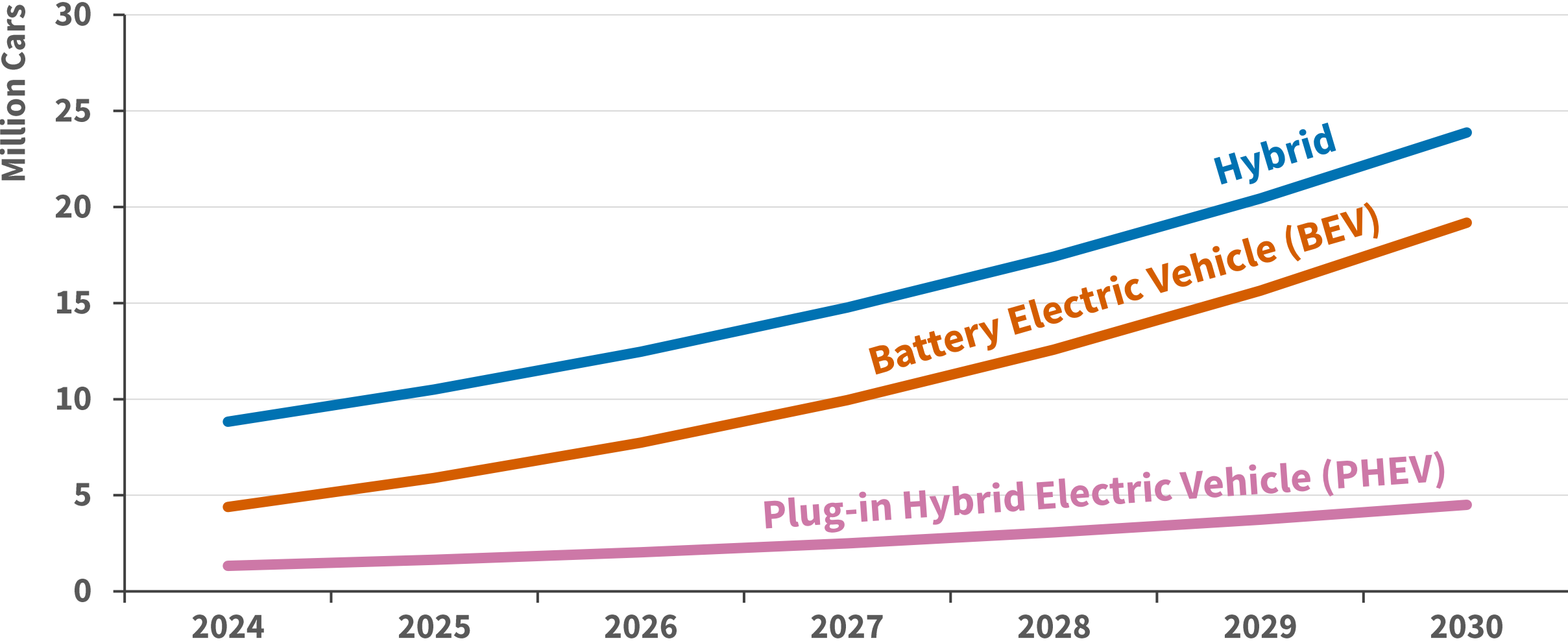


# Electric Vehicle (EV) Sales in the U.S. as a Percentage of Total Light Vehicle Sales, 2015 - 2024P

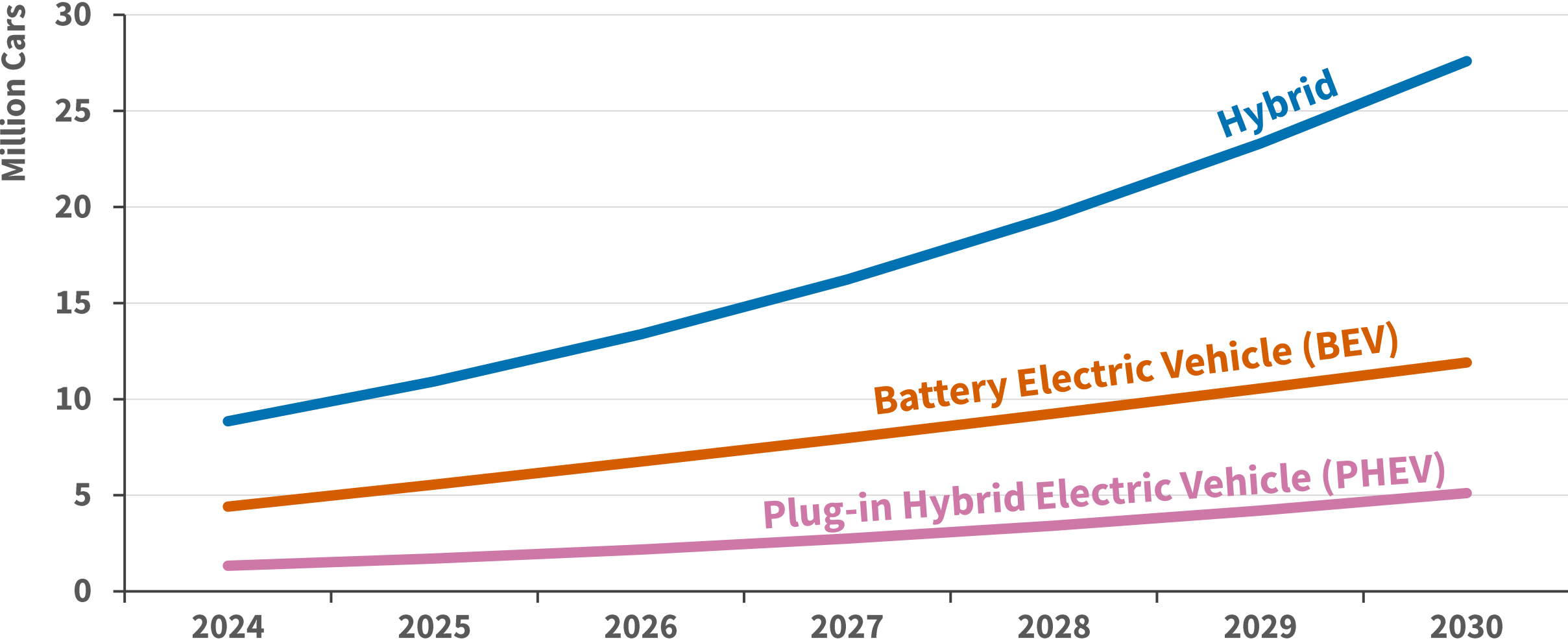




# Projected Number of Battery Electric Vehicles (BEV), Hybrid Vehicles, and Plug-In Hybrid Vehicles (PEHV) Based on Historical Trend Growth Rates, 2024 - 2030

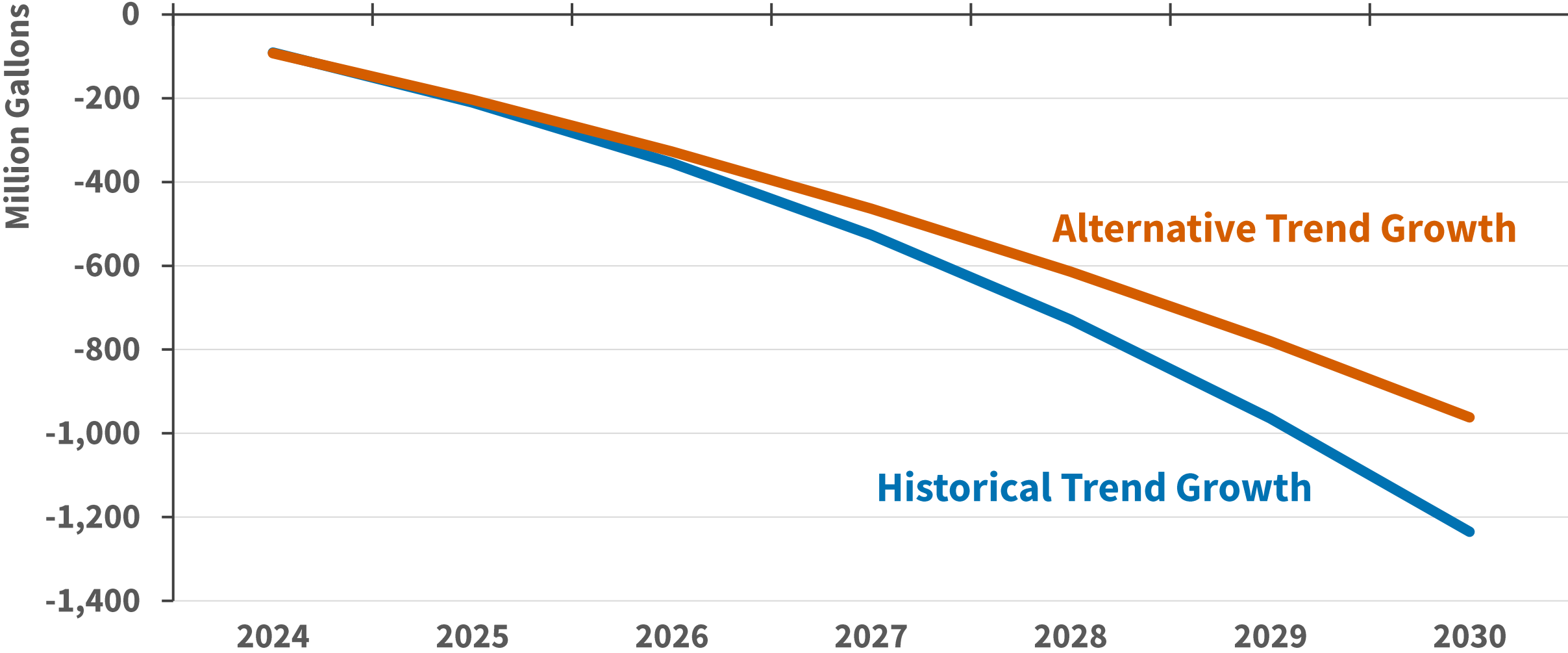


# Projected Number of Battery Electric Vehicles (BEV), Hybrid Vehicles, and Plug-In Hybrid Vehicles (PEHV) Based on ALTERNATIVE Trend Growth Rates, 2024 - 2030

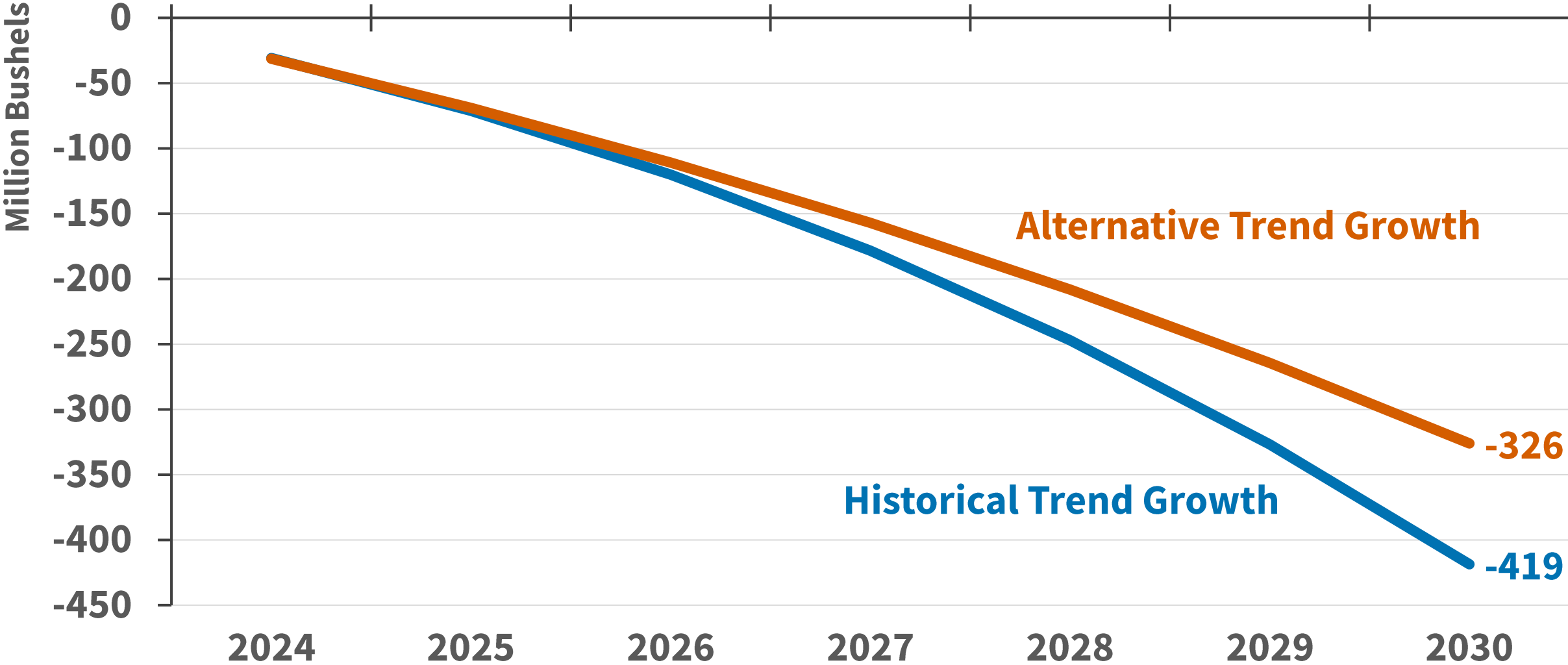


# Projected Decline in Ethanol Use Due to Adoption of Electric Vehicles (EVs) in the U.S. based on EV Growth Trends

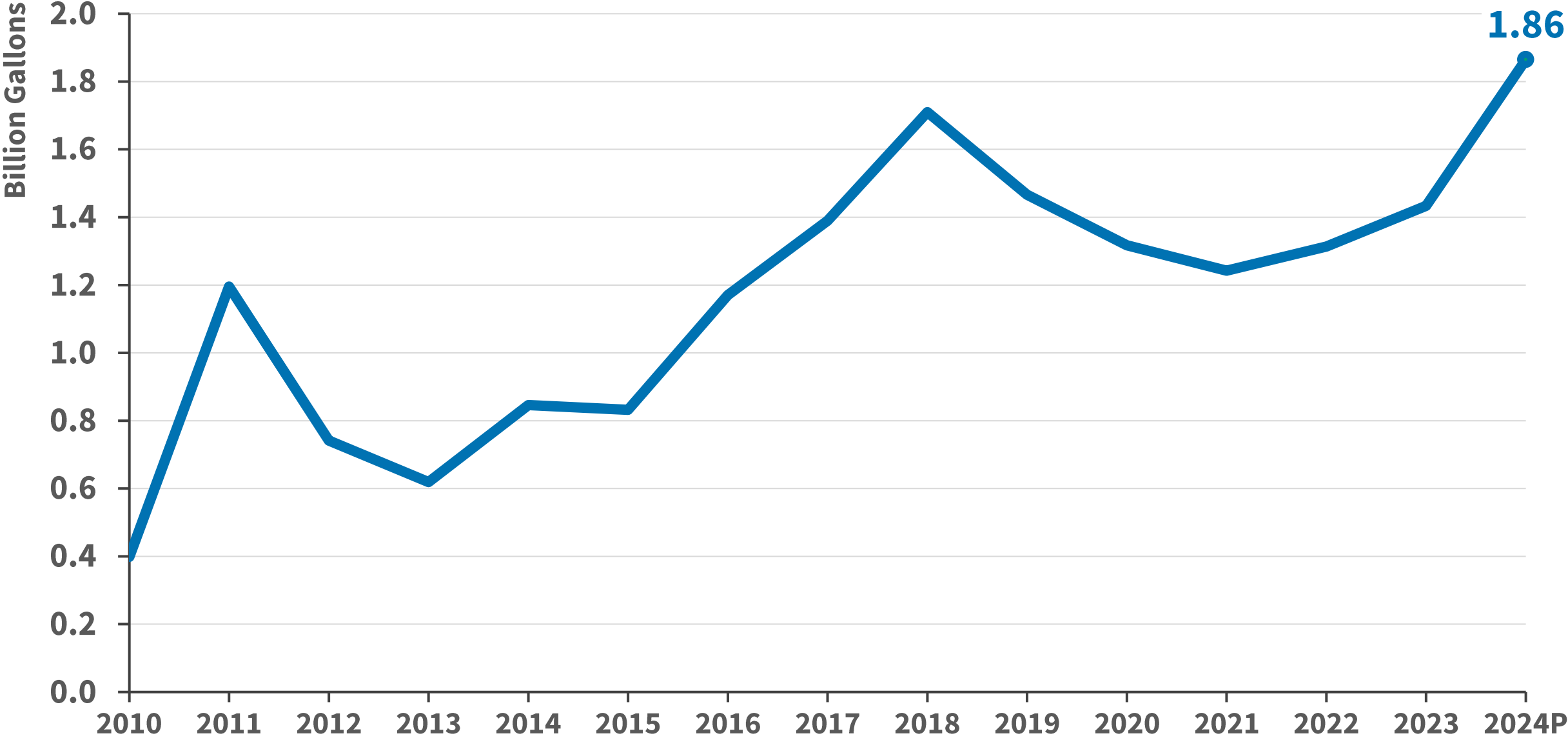
## 2024 - 2030



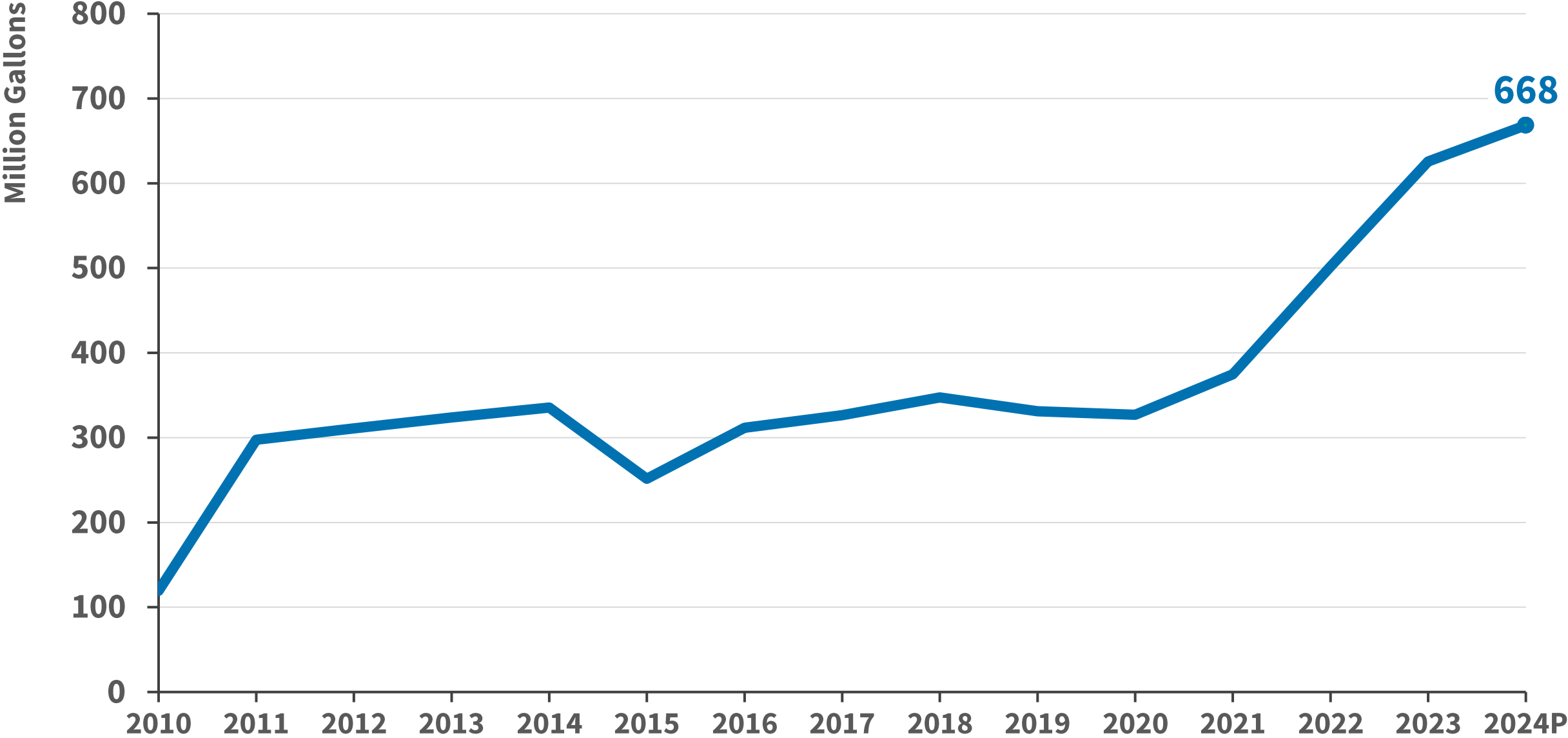
# Projected Decline in Corn Used to Produce Ethanol Due to Adoption of Electric Vehicles (EVs) in U.S. based on EV Growth Trends 2024 - 2030



# Annual U.S. Exports of Fuel Ethanol, 2010 - 2024P



# Annual U.S. Exports of Fuel Ethanol to Canada, 2010 - 2024P



# Japan and Ethanol

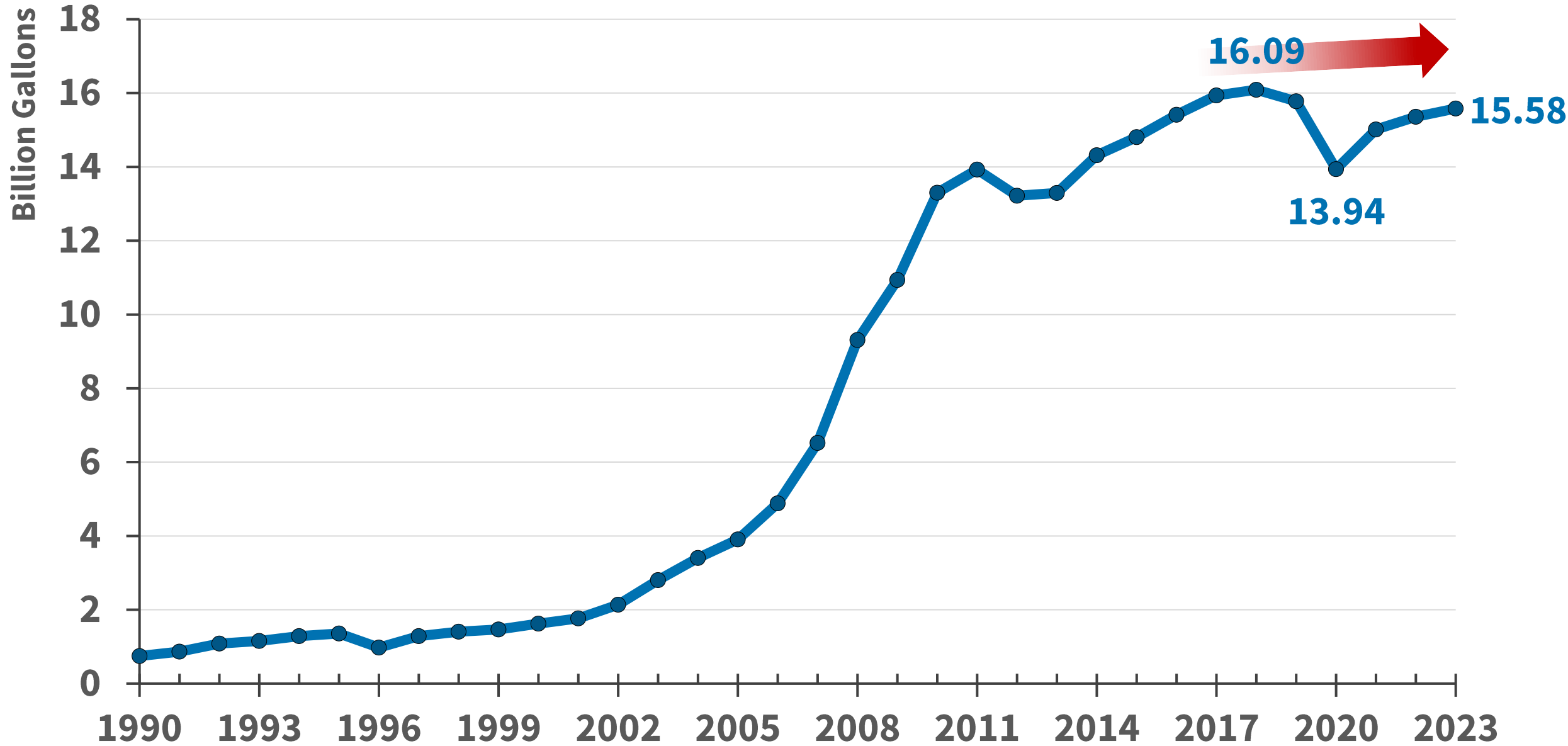


The Japanese government recently announced its intention for gasoline to be blended with 10 percent ethanol by 2030 and 20 percent ethanol by 2040. /

SOURCE: USGC

- 5<sup>th</sup> largest consumer of crude oil in the world
- In 2023, Japan consumed 11.8 billion gallons of gasoline
- Goal of 10% ethanol represents over a billion gallons of ethanol
- Infrastructure for E3 blend currently in place
- In 2023, imported virtually no ethanol from the U.S.

# Annual U.S. Fuel Ethanol Production, 1990 - 2023





# Energy Policy Direction Under Trump 2.0

## Broad themes

- Fossil fuels in, electric vehicles out (except for Tesla 😊)
- Green light for domestic crude oil production
- Climate change policies reversed or put on the backburner
- Tariffs used to protect domestic production

# Energy Policy Direction Under Trump 2.0

## Positive implications for ethanol and corn

- Year round E15 RVP waiver possible
- Less demand loss due to EV adoption
- Roll back of CAFE standards

# Energy Policy Direction Under Trump 2.0

## Negative implications for ethanol and corn

- Revision/elimination of 2022 IRA Green New Deal tax incentives
- Merchant refiner push for relief in form of RFS small refinery waivers
- EPA may set conventional RVO at the E10 blend wall

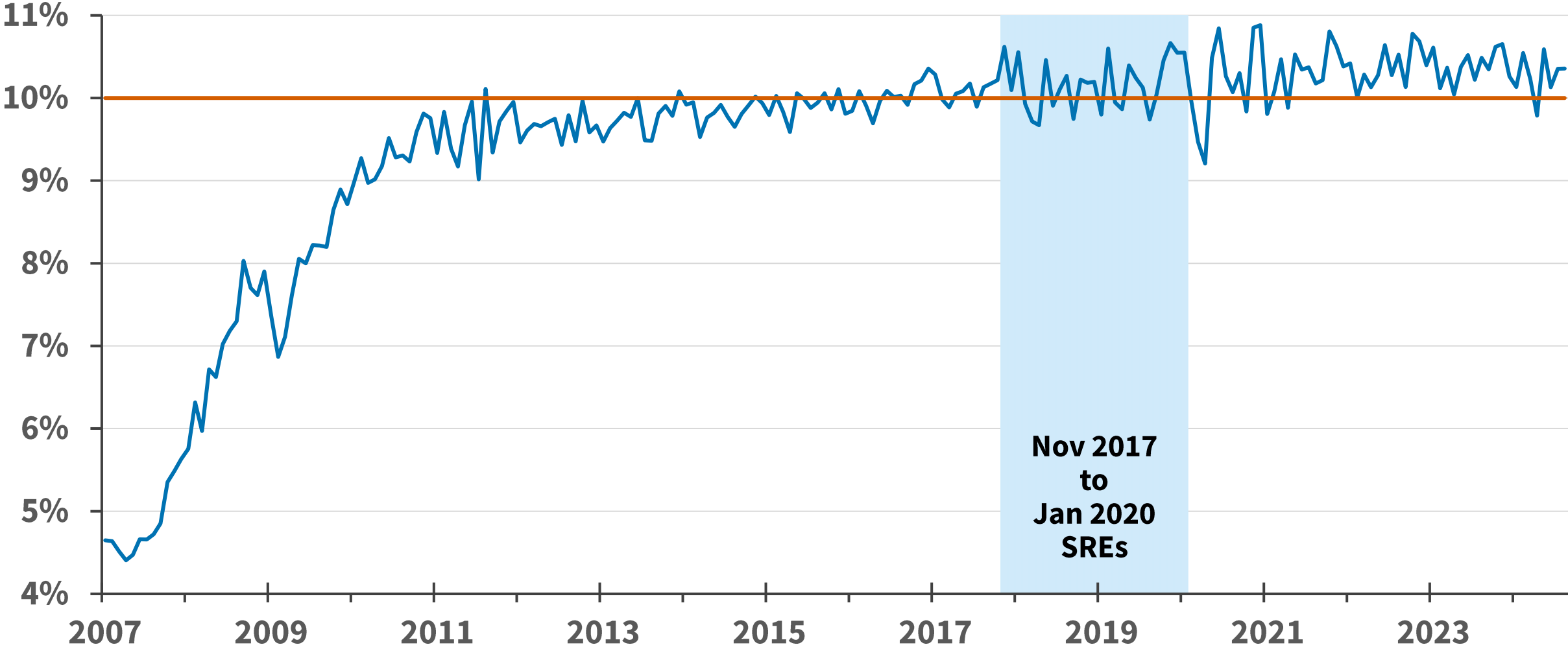
# Weekly (Thursday) D6 Ethanol RIN Prices in \$/gallon

April 4, 2008 - November 7, 2024



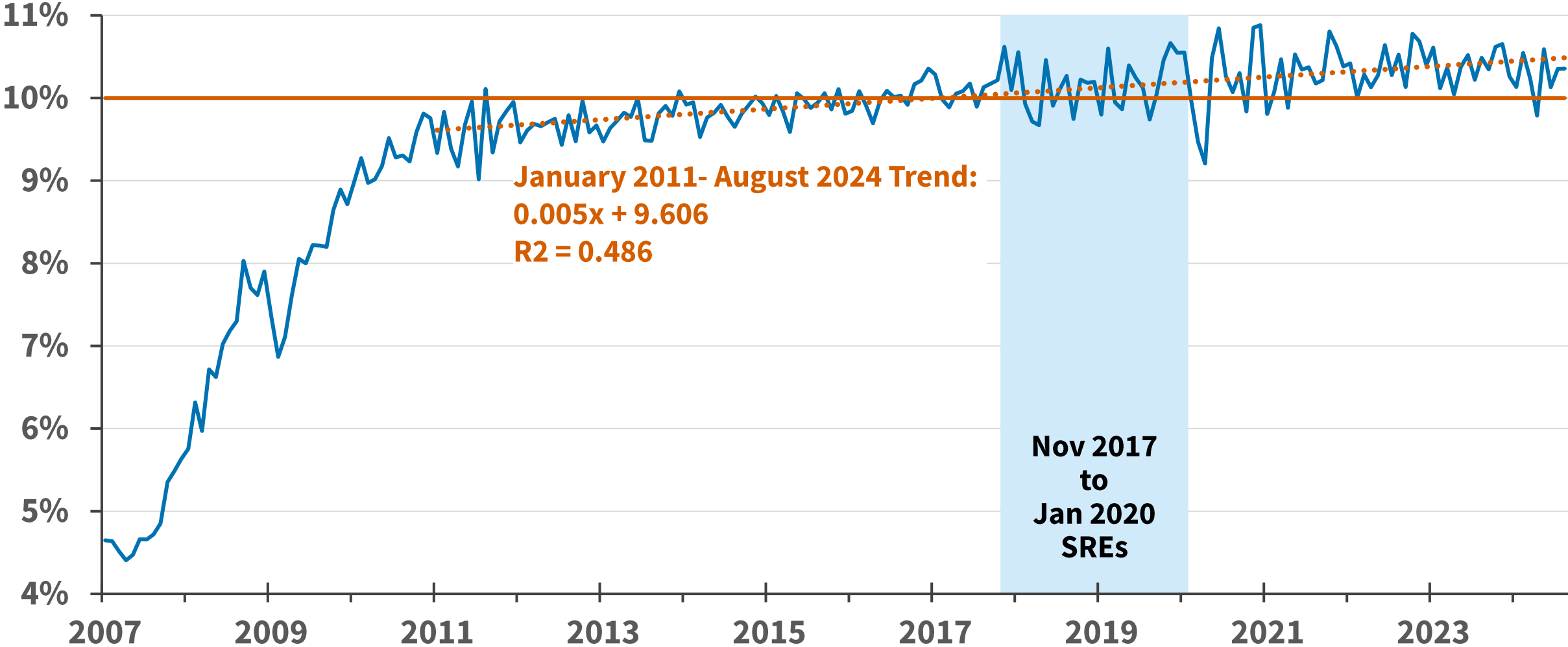
# Monthly Implied Domestic Consumption of Ethanol as a Percent of U.S. Finished Motor Gasoline Supplied

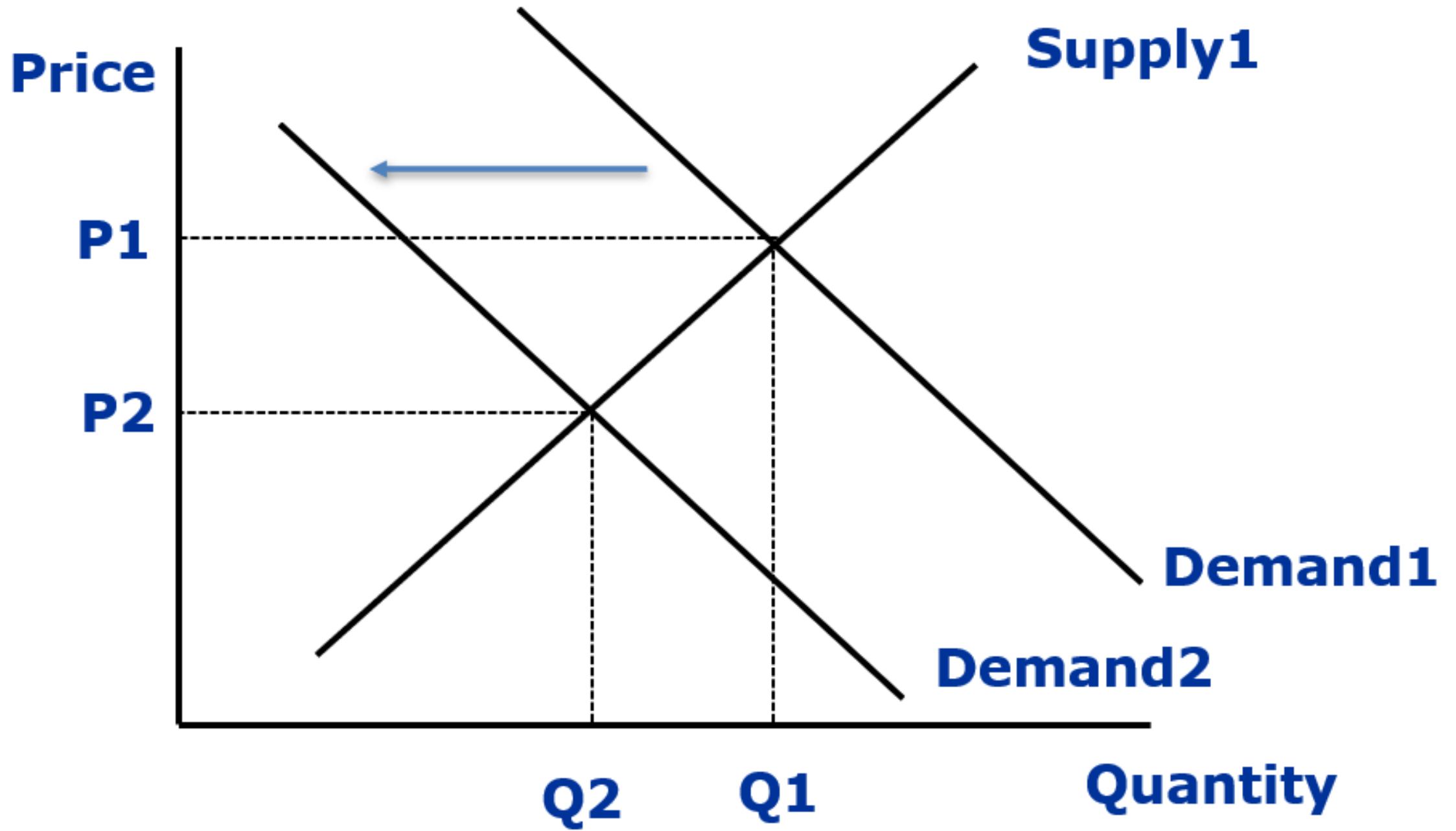
## January 2007 - August 2024

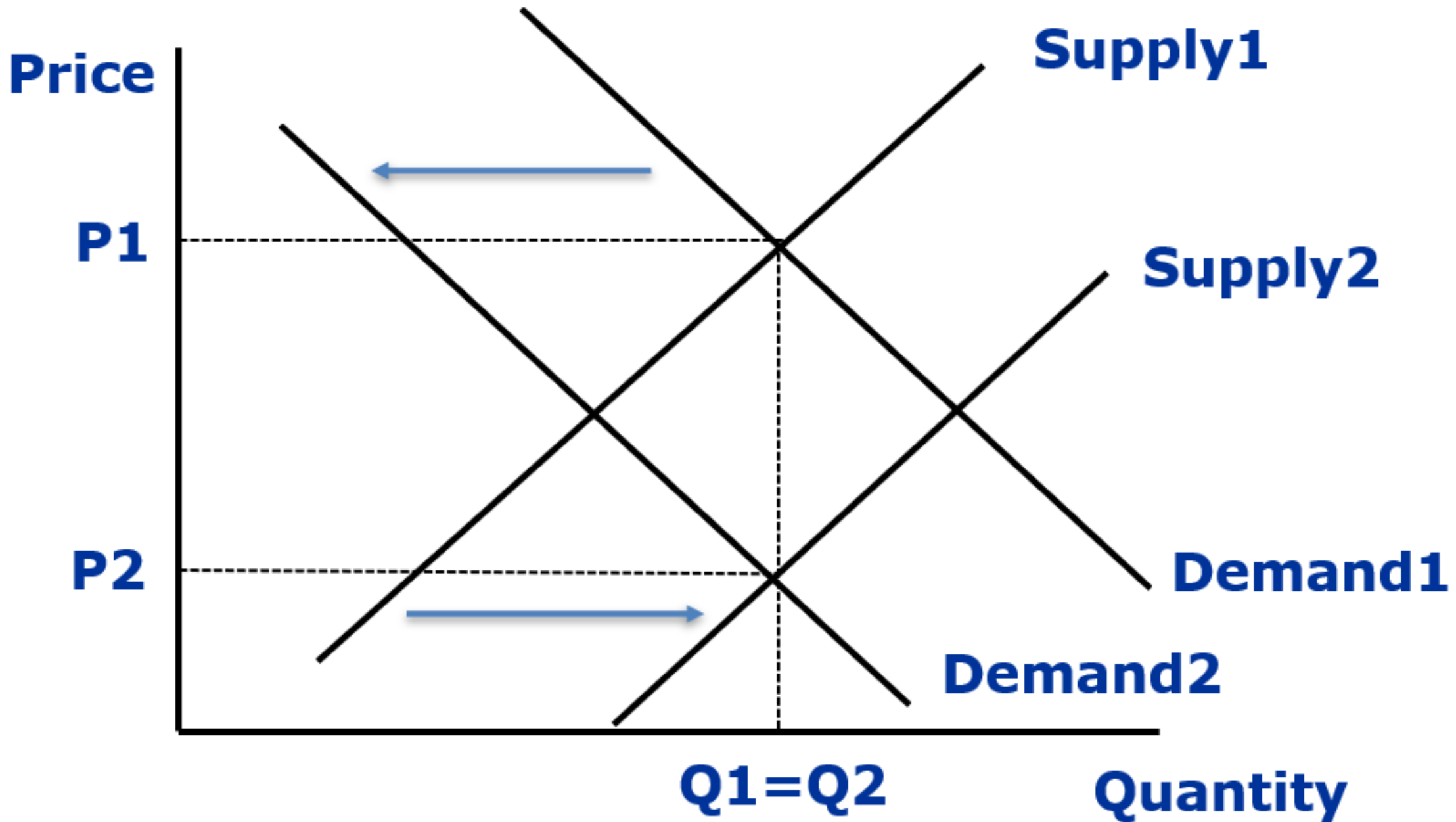


# Monthly Implied Domestic Consumption of Ethanol as a Percent of U.S. Finished Motor Gasoline Supplied

## January 2007 - August 2024

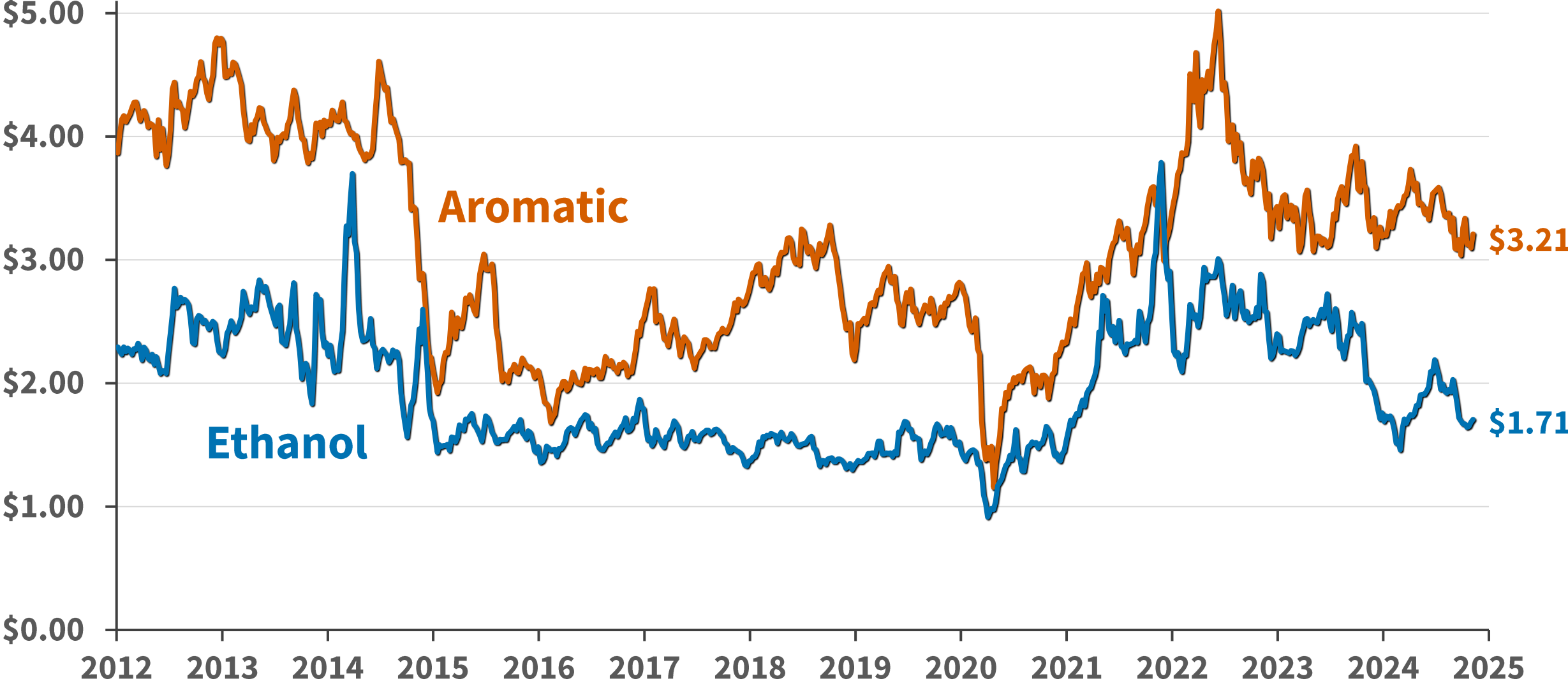








# Weekly (Thursday) Wholesale Average Aromatic and Ethanol Price in \$/gallon at the U.S. Gulf, 01/05/2012 - 11/07/2024



Daily Blog

## Can I Kick It? - 'Hydrogen-Rich' Gasoline Might Provide a Boost for Refiners, But Challenges Remain

Thursday, 10/31/2024

Published by: George Hoekstra

Oxygen-containing gasoline additives called oxygenates, including ethanol, have provided an octane boost to the U.S. gasoline pool since 2000. This has allowed refineries to reduce the octane of refinery-produced gasoline, which increases their gasoline production capacity and efficiency while simultaneously helping achieve the goals for cleaner, lower-carbon fuels derived from domestic renewable feedstocks. A new approach to gasoline formulation promises to take this “sharing” of the octane load much further to exploit the unique octane-enhancing qualities of ethanol, although there are some real-world challenges to wider implementation. In today’s RBN blog, we explain what’s behind the concept of “hydrogen-rich” gasoline.

# **HEFA Sustainable Aviation Fuel (SAF) Production Technology**

**HEFA renewable diesel refineries can be converted to make SAF**

- **Requires substantial additional investment**
- **Less SAF made than renewable diesel per unit of feedstock**

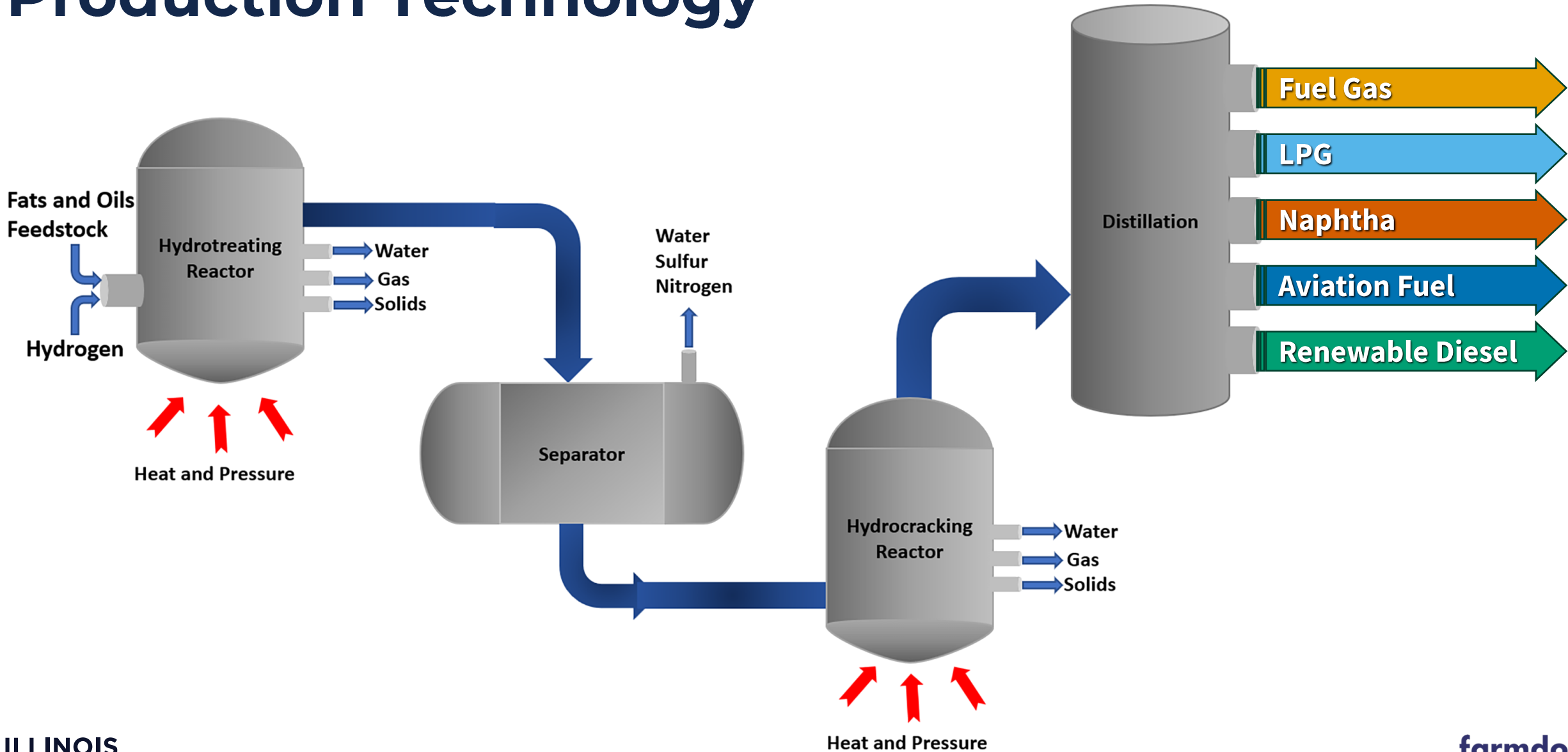
**Virtually all SAF currently produced in the U.S.  
or imported is made using HEFA technology**

# **Ethanol Sustainable Aviation Fuel (SAF) Production Technology**

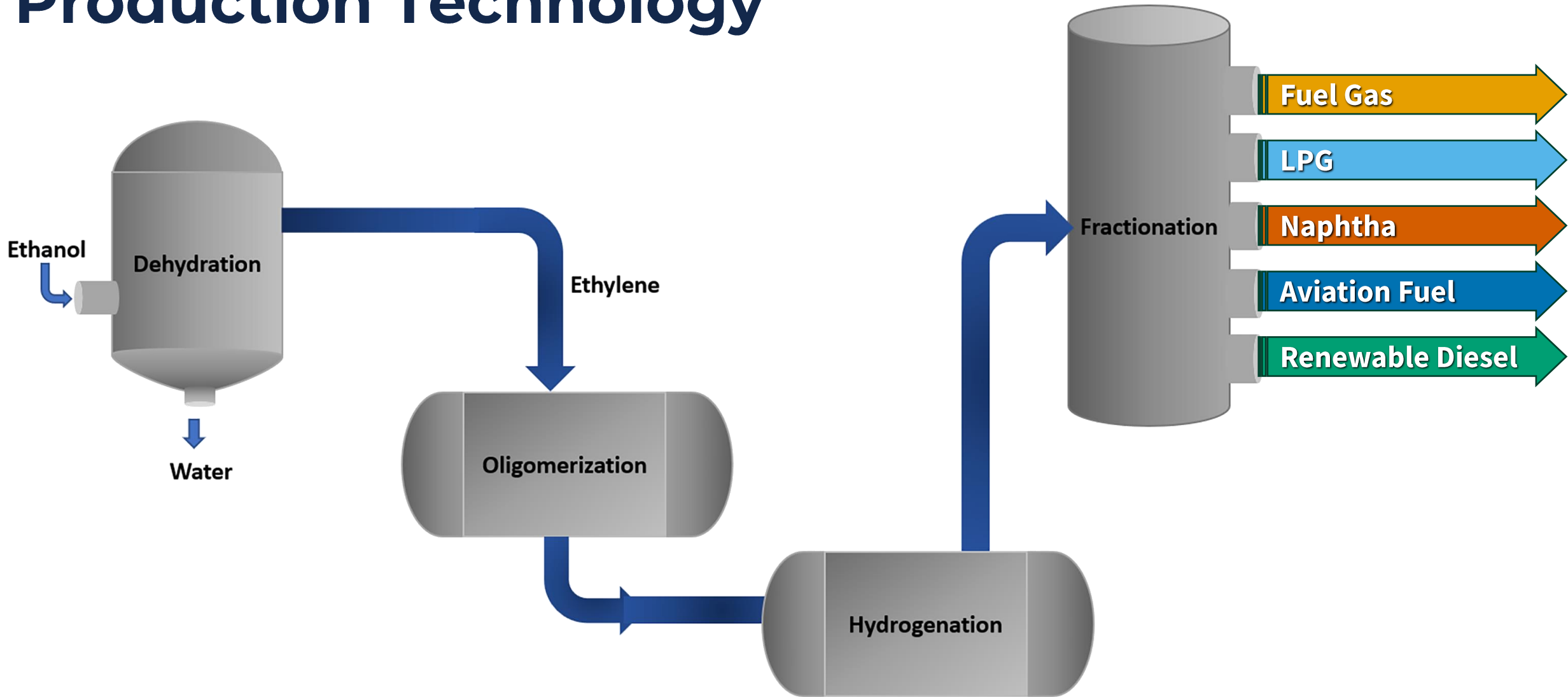
**Ethanol-to-jet fuel (ETJ) technology still in development phase**

- **Only one small ETJ pilot plant currently operating in the U.S.**
- **One commercial scaled plant may begin construction in 2026**

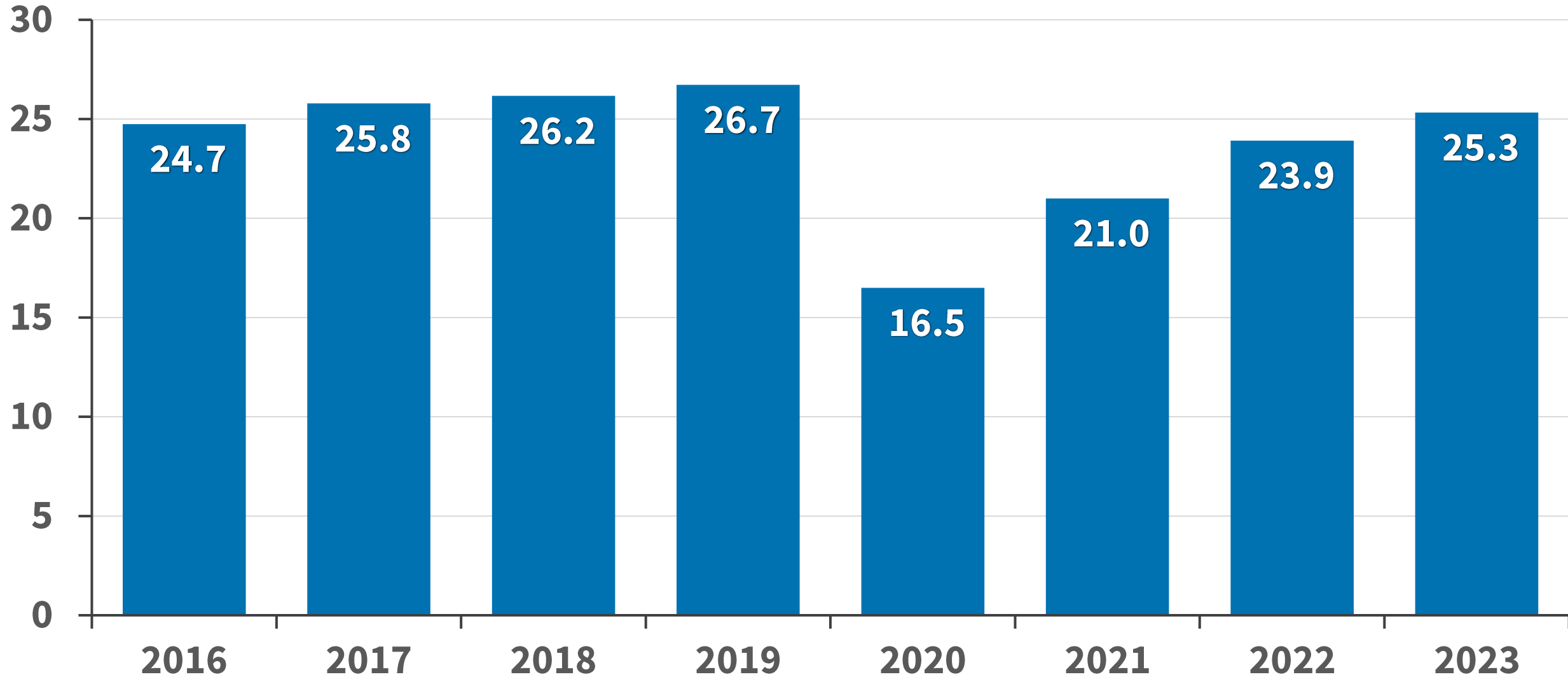
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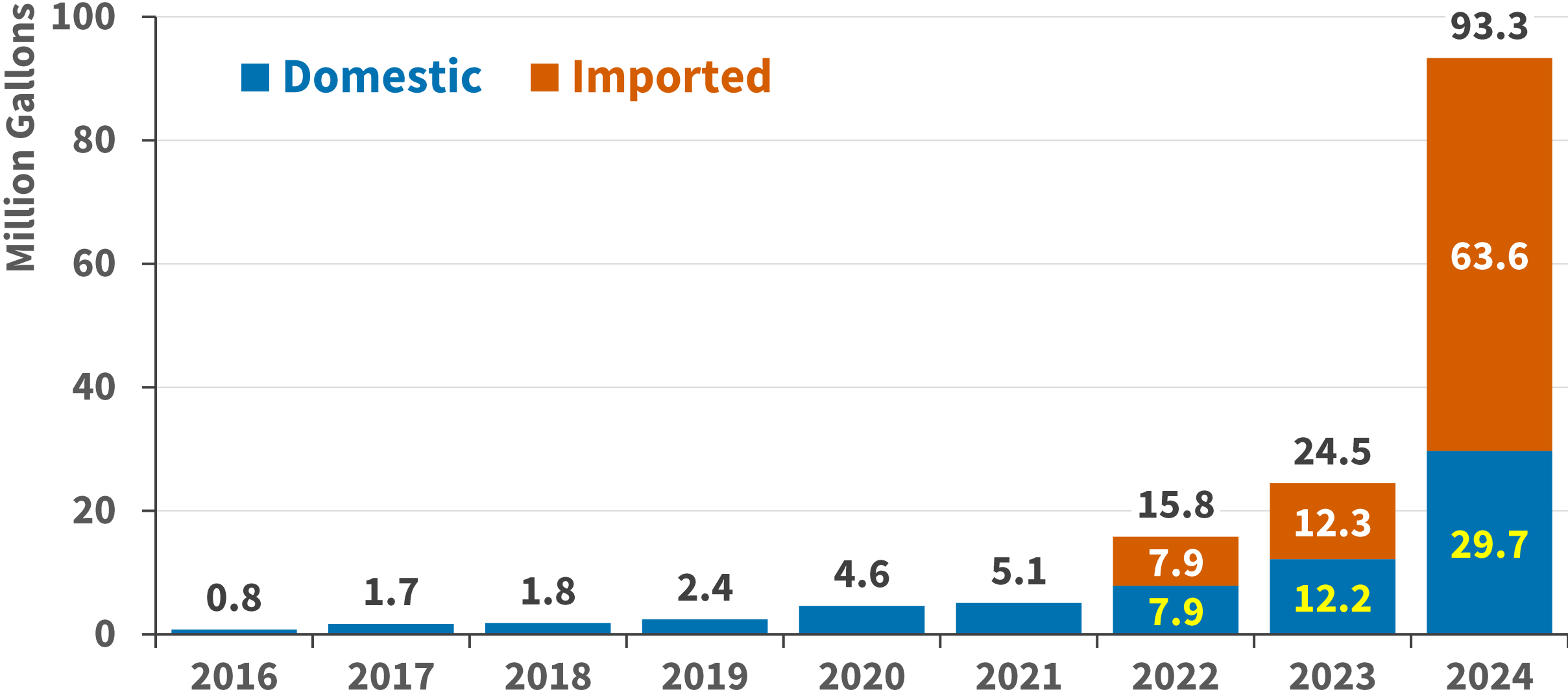
# Ethanol Sustainable Aviation Fuel (SAF) Production Technology



# Annual U.S. Kerosene-Type Jet Fuel Supplied in billion gallons from 2016 to 2023

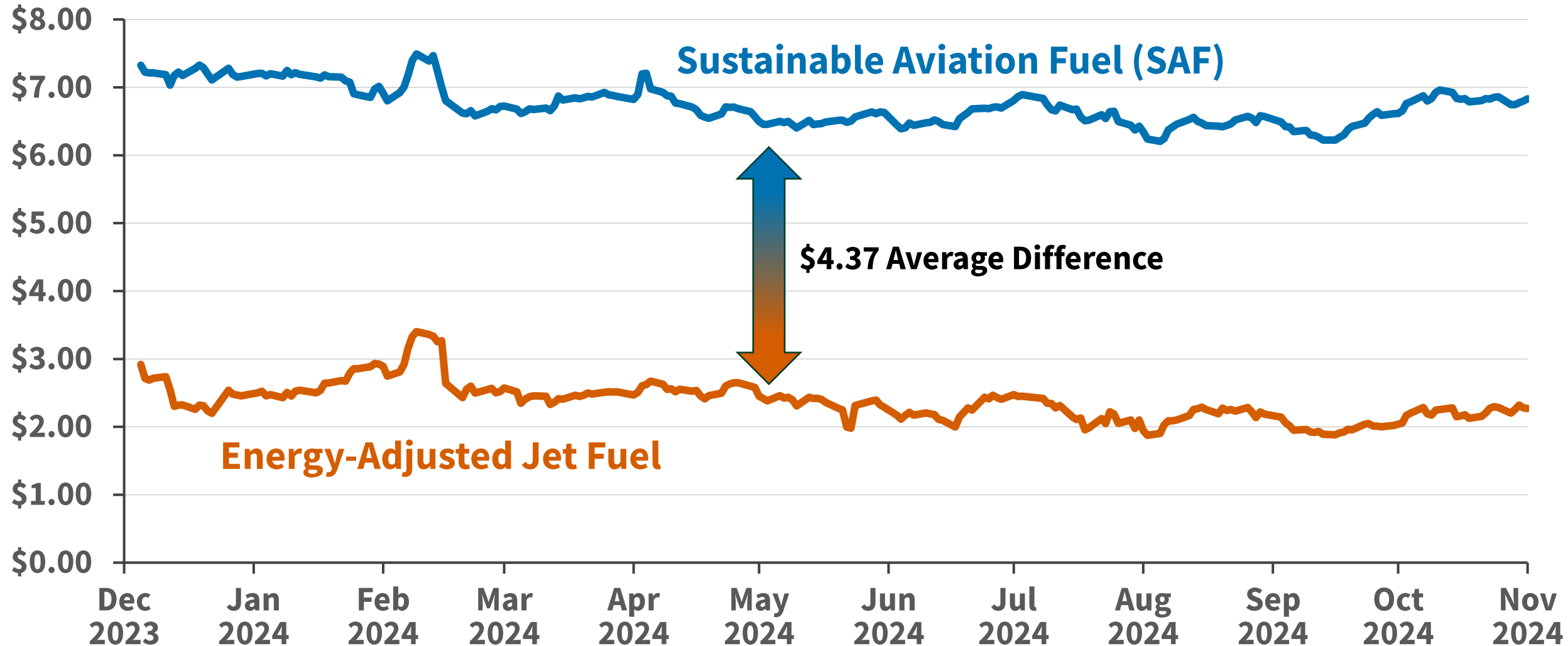


# D4 Jet Fuel RIN Generation, 2016 - 2024 through September 2024



# Daily Sustainable Aviation Fuel (SAF) and Petroleum Jet Fuel Prices in \$/gallon Delivered to Los Angeles

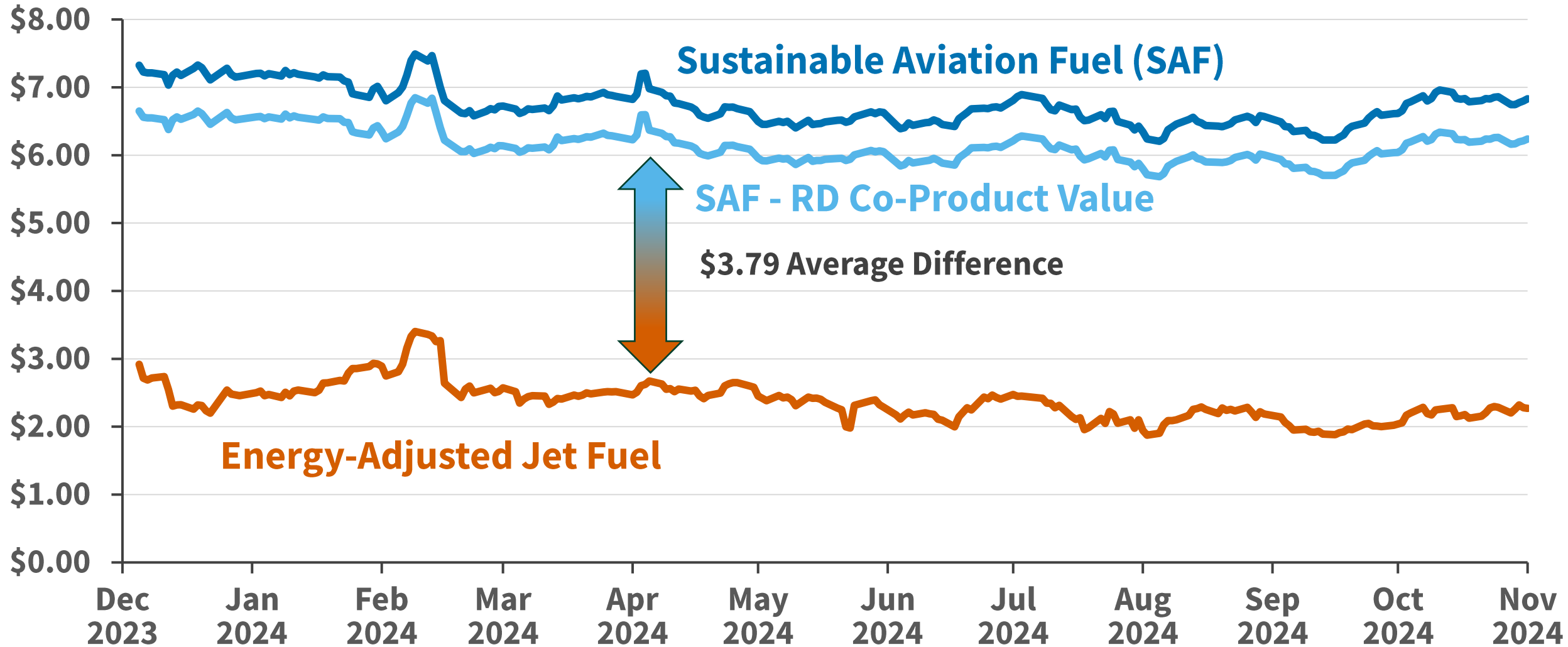
December 5, 2023 - November 1, 2024





# Daily Sustainable Aviation Fuel (SAF) and Petroleum Jet Fuel Prices in \$/gallon Delivered to Los Angeles

December 5, 2023 - November 1, 2024



# The Policy Stack for SAF

## 1. 40B Federal Tax Credit

up to \$1.75 per gallon based on CI score for 2023-24

## 2. 45Z Federal Tax Credit

up to \$1.75 per gallon based on CI score over 2025-2027

## 3. U.S. Renewable Fuel Standard (RFS)

SAF generates 1.6 D4 RIN credits

# The Policy Stack for SAF

## 4. State Low Carbon Fuel Standards (LCFS)

variable credits for SAF based on CI score for supplying low carbon fuel into fuel market (California, Oregon, Washington, and New Mexico)

## 5. State SAF Tax Credits:

Nebraska, Minnesota, Illinois

(e.g., Illinois = \$1.50 per gallon 2023-2032)

## 6. Voluntary Carbon Offset Credits

“green premium”

# Is the Policy Stack for SAF High Enough?

## California Averages for 2024 through November 1

### Gap:

(SAF price - RD co-product value) - Jet fuel price     **\$3.76**

### Policy Stack:

40B tax credit for 45 CI:  $\$1.25 + (50-45) \times \$0.01 =$      **\$1.30**

+ RFS D4 RIN credit:     **\$0.95**

+ California LCFS credit     **\$0.42**

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**\$2.67**

**Difference:     \$1.09**

# Is the Policy Stack for SAF High Enough?

## Hypothetical Averages for Illinois in 2024

### Gap:

(SAF price - RD co-product value) - Jet fuel price      **\$3.76**

### Policy Stack:

40B tax credit for 45 CI:  $\$1.25 + (50-45) \times \$0.01 =$       **\$1.30**

+ RFS D4 RIN credit:      **\$0.95**

+ Illinois SAF credit      **\$1.50**

---

**\$3.75**

**Difference:      \$0.01**

# Conclusions

## 1. Ethanol outlook is cautiously optimistic

- Return to the office and increased commuting positive for E10 demand
- BEV domestic demand loss not as threatening post-election
- Strong export demand
- Potential for E15 expansion

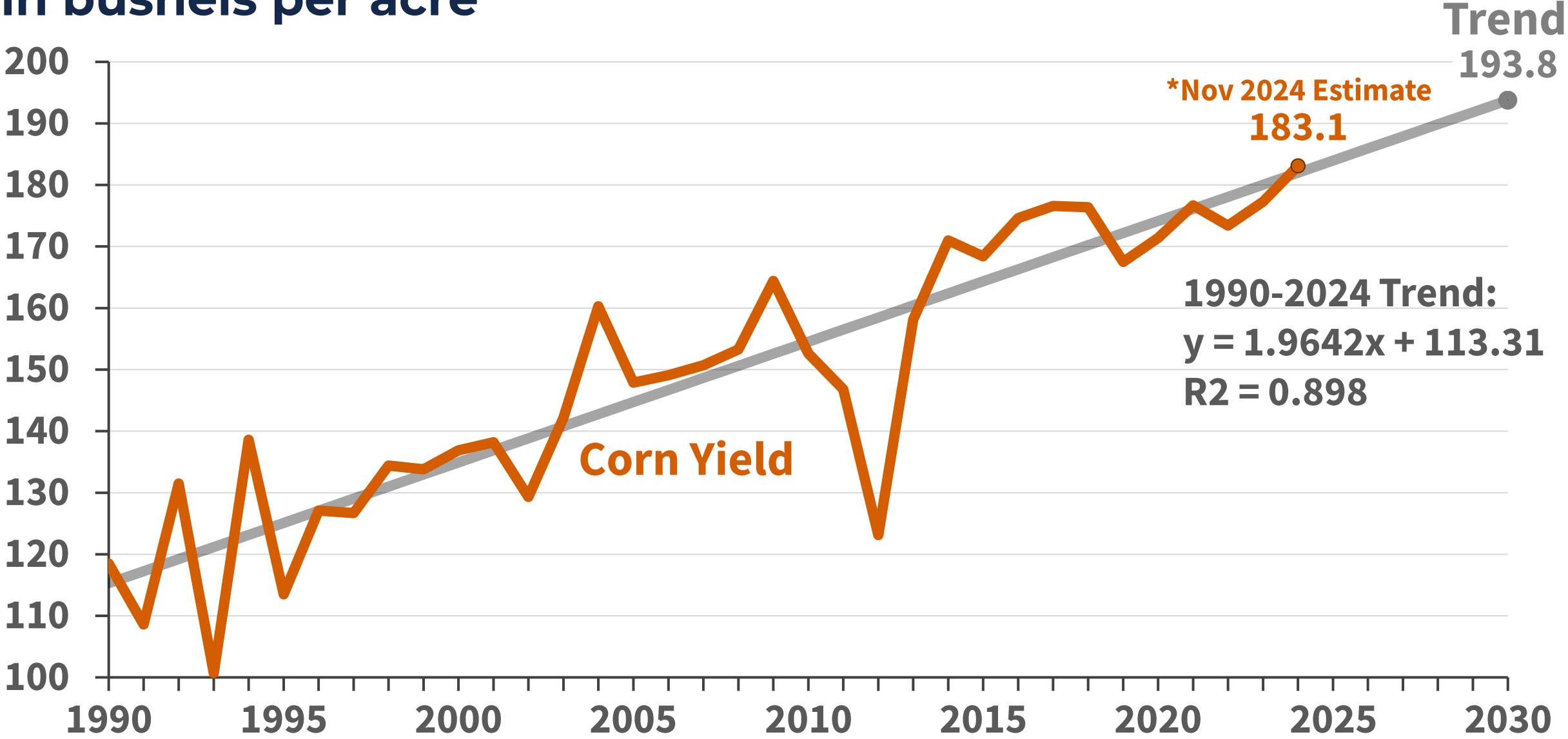
# Conclusions

## 2. SAF outlook is uncertain

- Policy stack was large enough to incentivize some production pre-election
- 45Z tax credit is critical to future incentives and possibly could be on the chopping block post-election
- Without a mandate meeting the “grand challenge” of 3 billion gallons of SAF by 2030 may be difficult

# U.S. Average Corn Yield, 1990 - 2024\*

in bushels per acre





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