

The Outlook for U.S. Biofuels

Renewable Diesel and FAME Biodiesel

by Scott Irwin



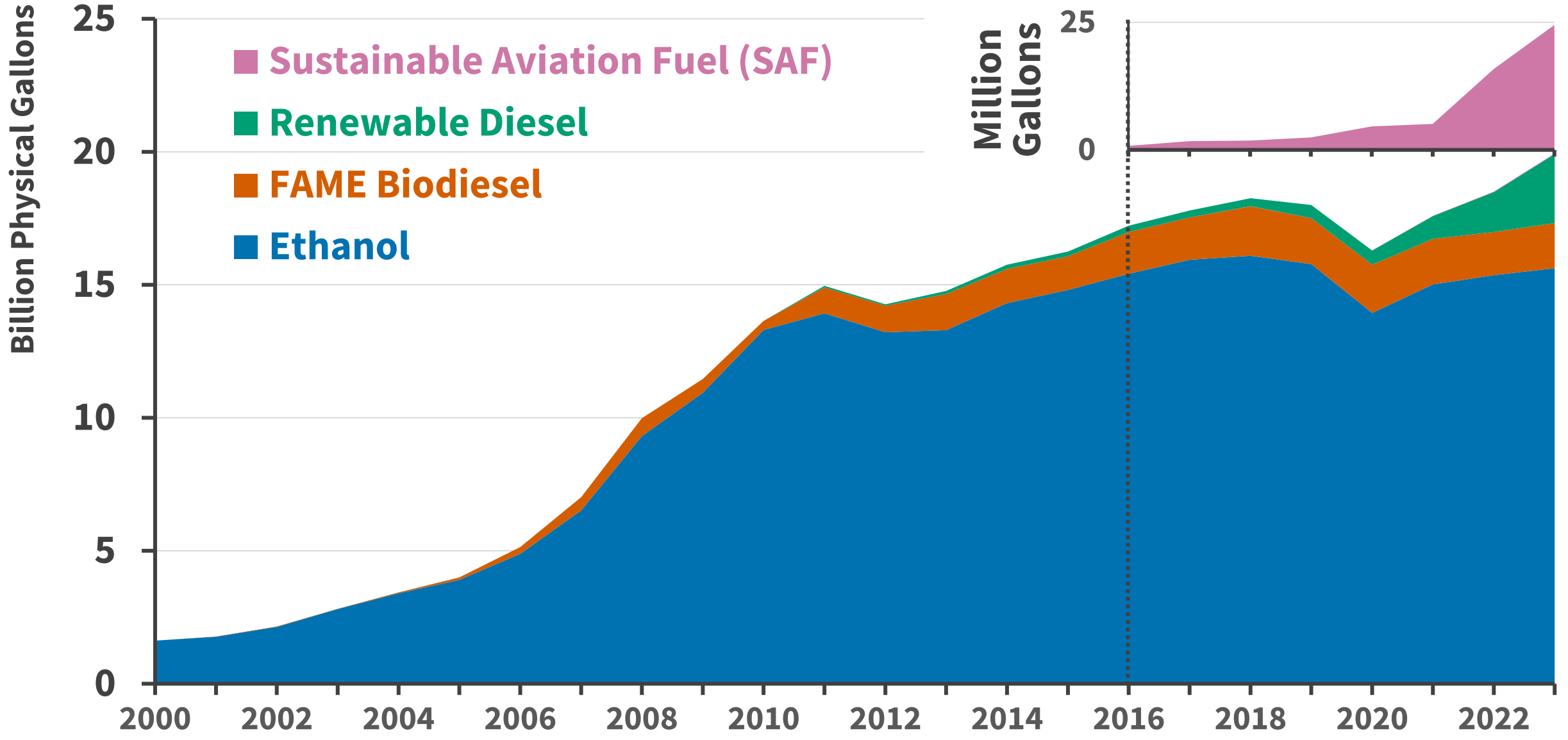
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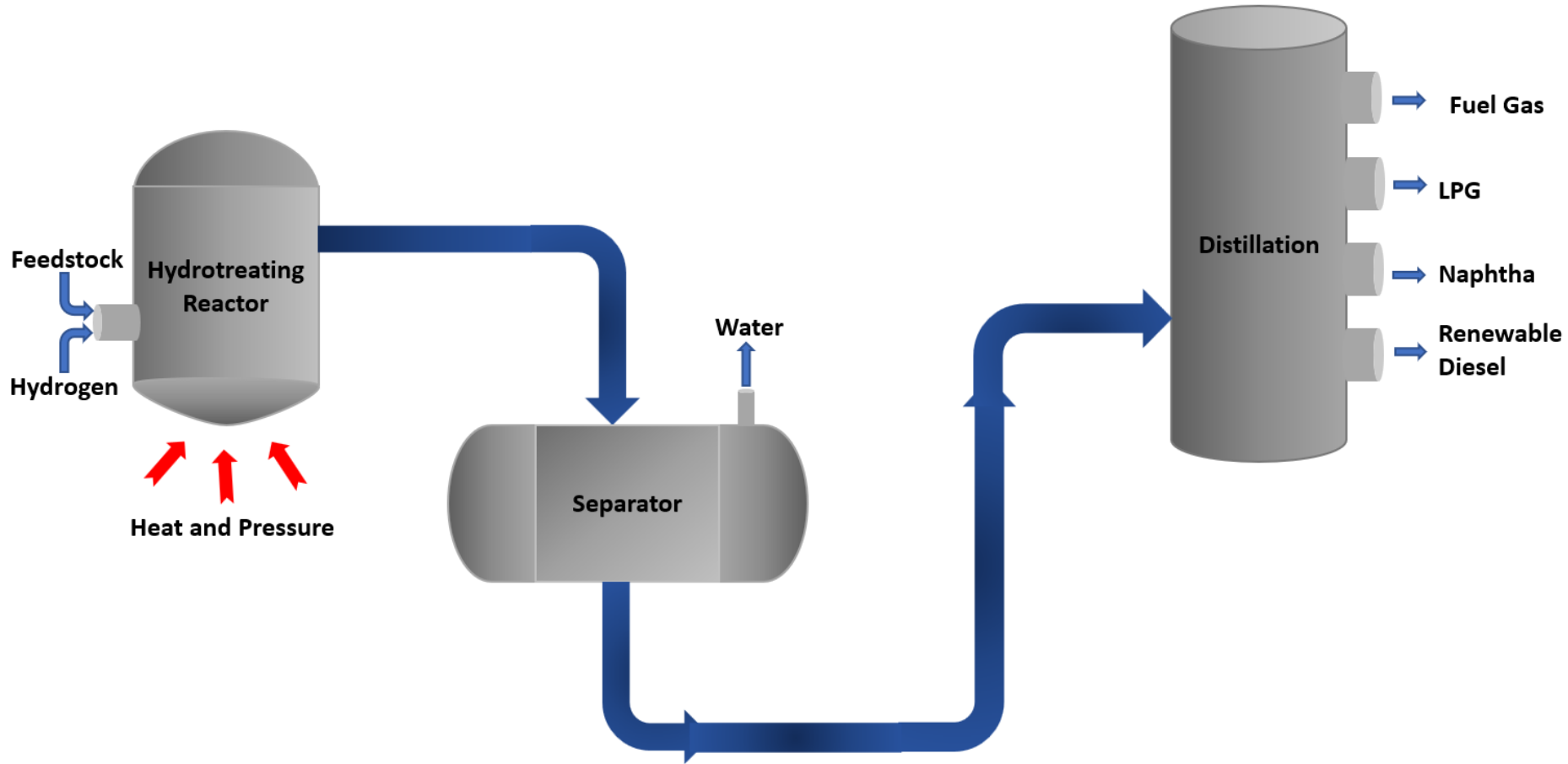


U.S. Biofuels Production, 2000 - 2023



HEFA (Hydrotreated Esters and Fatty Acids) Renewable Diesel Production Process

Waste
Fats
and
Veg Oil

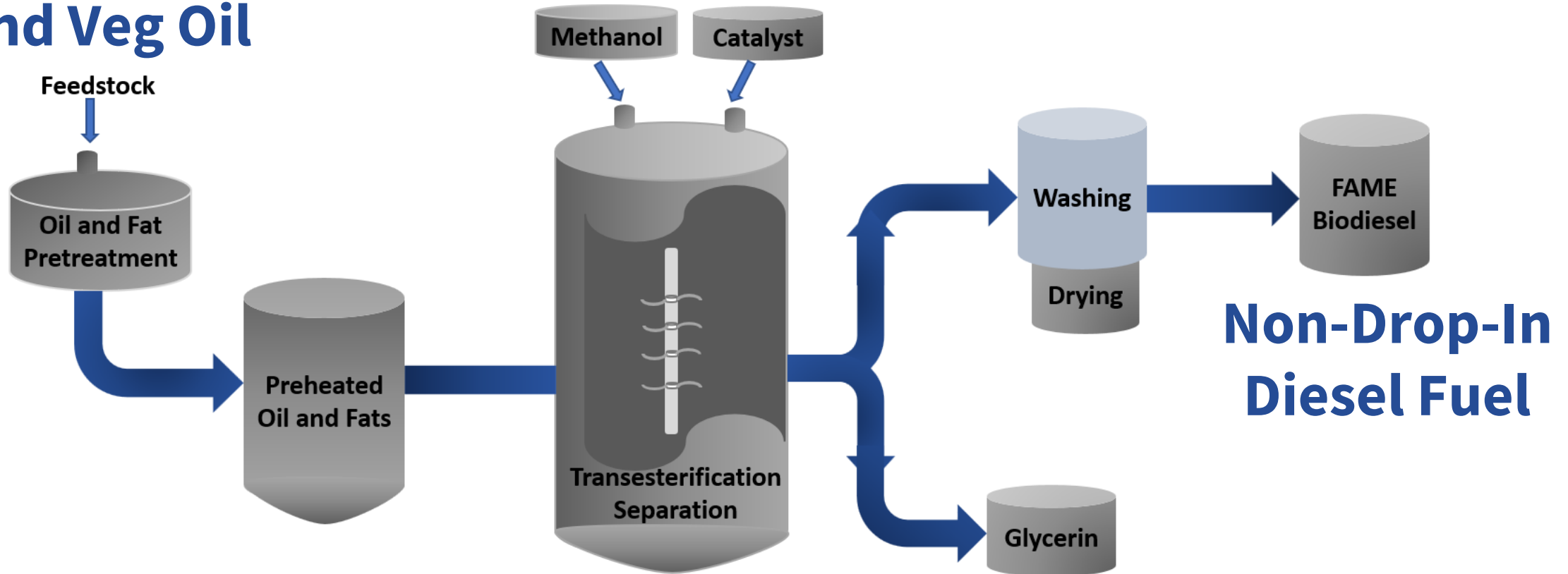


Drop-In
Diesel
Fuel

Petroleum Refining Technology

FAME (Fatty Acid Methyl Ester) Biodiesel Production Process

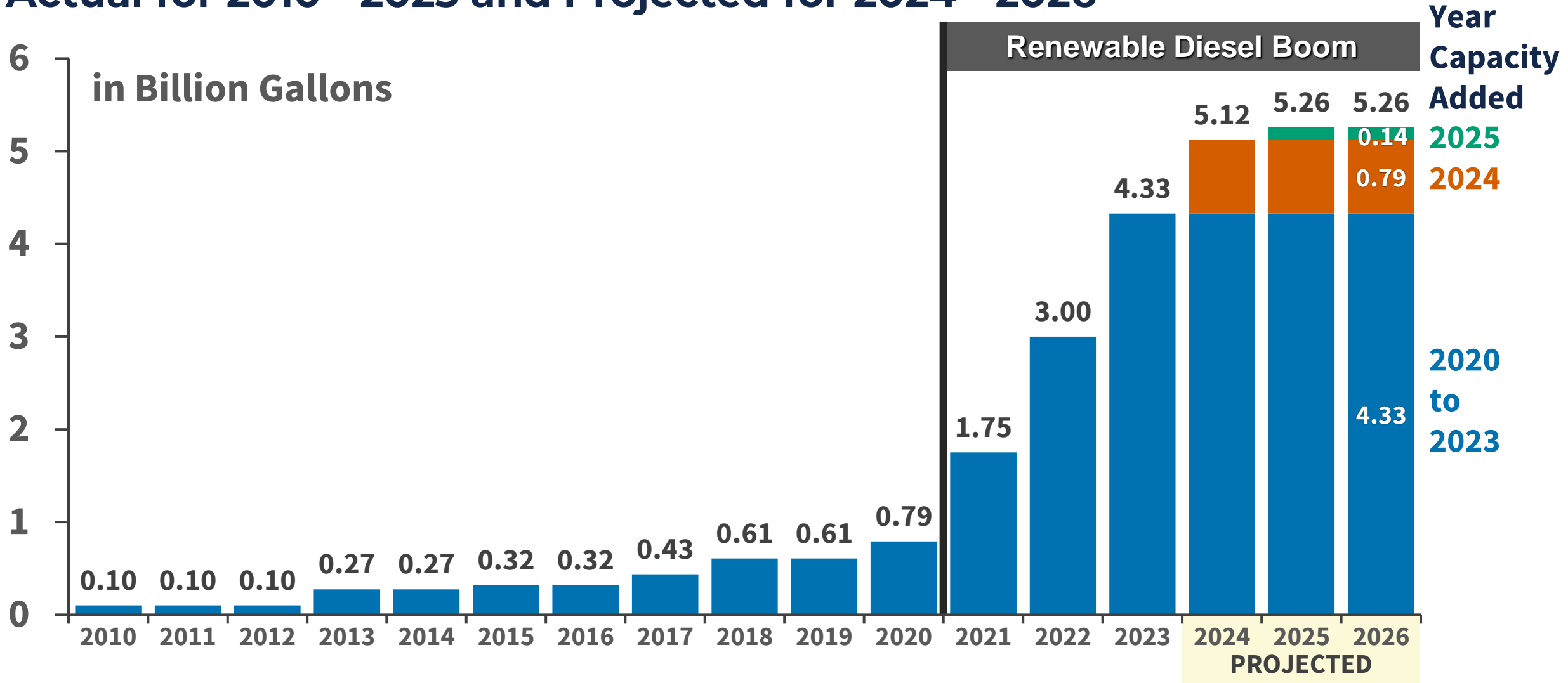
Waste Fats
and Veg Oil



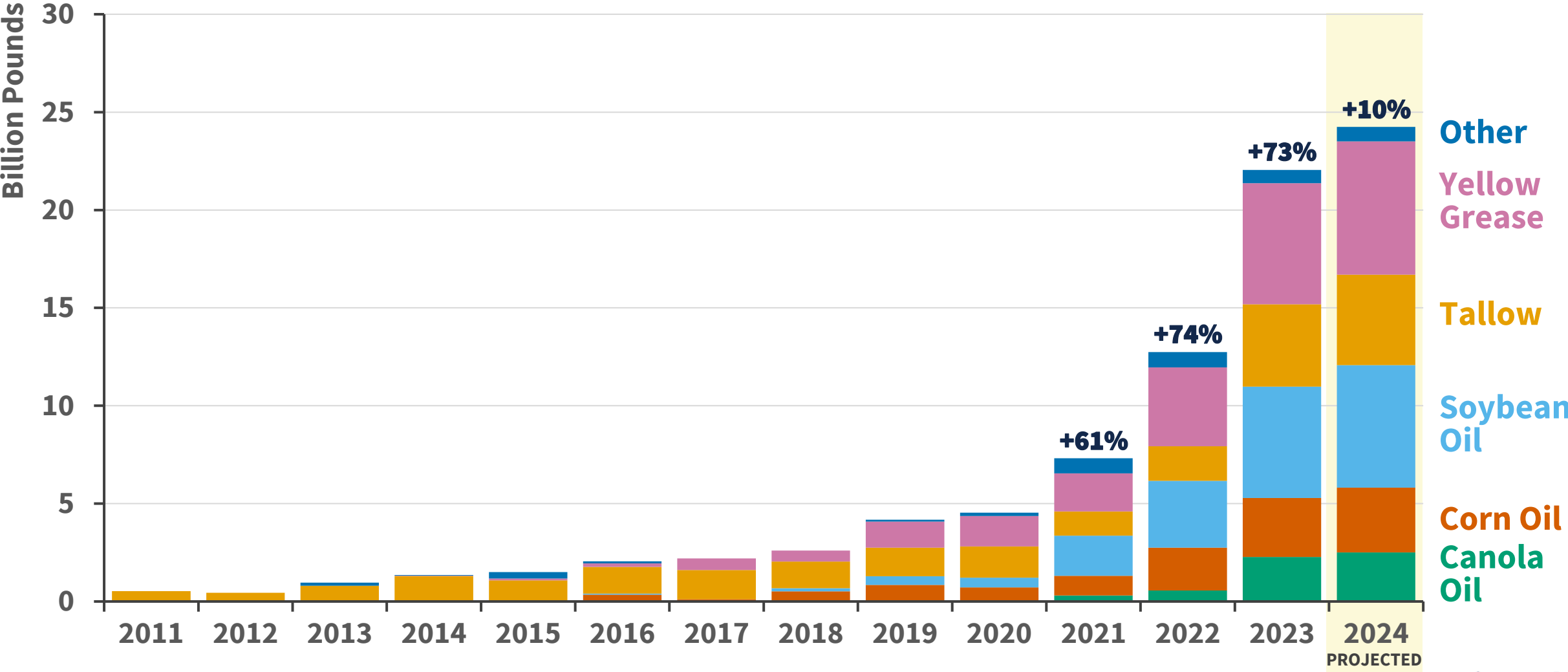
Transesterification Technology

Annual Nameplate Production Capacity of HEFA Renewable Diesel Plants in the U.S.

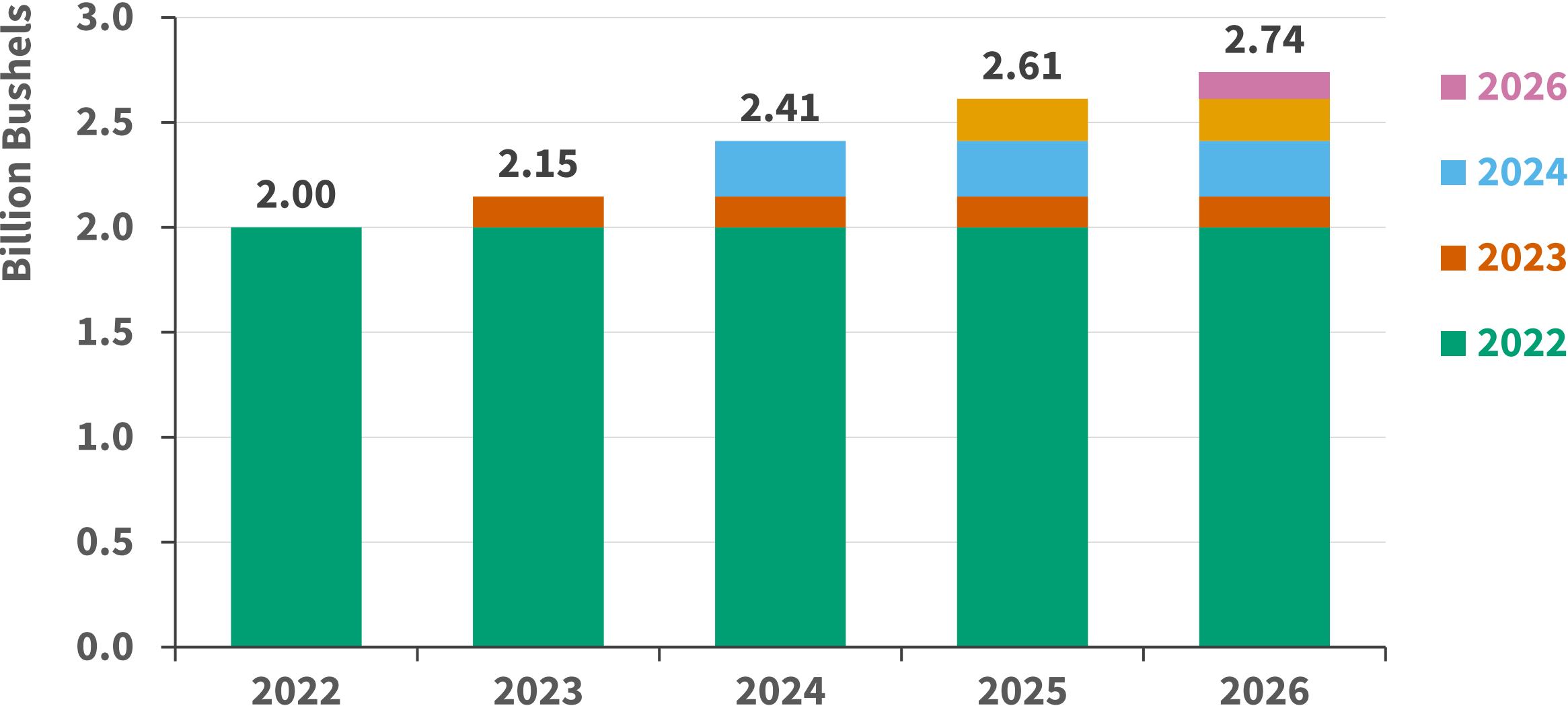
Actual for 2010 - 2023 and Projected for 2024 - 2026



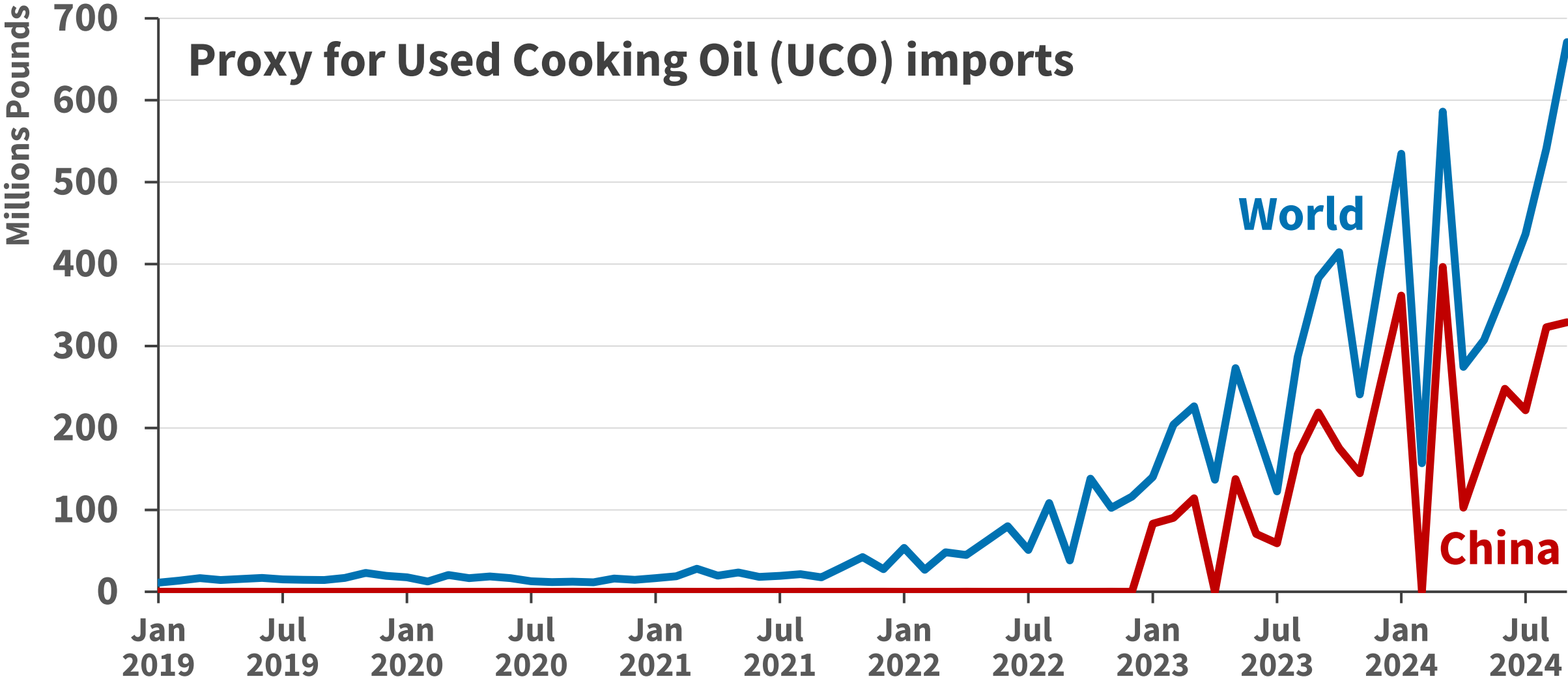
Composition of Feedstock Usage for Annual Production of U.S. Renewable Diesel by Volume and Major Feedstock Type, 2011 - 2023 Actual and 2024 Projected



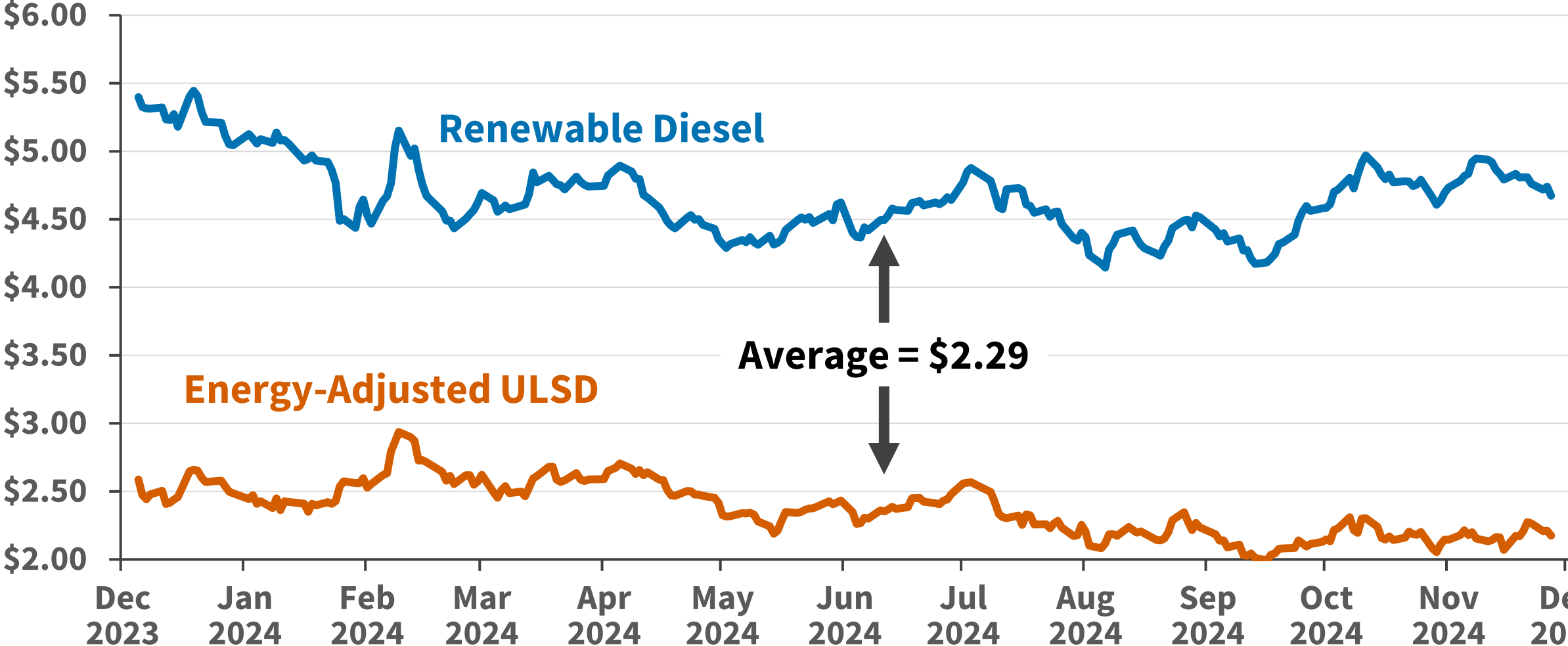
Current and Expected U.S. Soybean Crush Capacity 2022 - 2026



Monthly U.S. Imports of Animal And Vegetable Fats And Oils And Their Fractions, Boiled, Oxidized, Dehydrated, Sulfurized, Etc. Or Otherwise Chemically Modified, January 2019 - September 2024



Daily Renewable Diesel and Energy-Adjusted Ultra Low Sulfur Diesel (ULSD) Prices in Los Angeles in \$/gallon from 12/05/2023 to 11/25/2024



Source: OPIS

The Policy Stack for Renewable Diesel

1. U.S. Renewable Fuel Standard (RFS)

minimum volumetric mandates for biomass-based diesel (renewable diesel and FAME biodiesel)

2. U.S. Blenders Tax Credit (BTC)

\$1 per gallon credit for each gallon of renewable diesel and FAME biodiesel blended with diesel

3. U.S. Import Tariffs

duties on major U.S. import competitors of 54 to 70% per gallon of FAME biodiesel

The Policy Stack for Renewable Diesel

4. State FAME Biodiesel Blend Mandates

variety of programs

(e.g., Illinois, Minnesota, Iowa)

5. State Low Carbon Fuel Standards (LCFS)

variable credits for supplying

low carbon fuel into fuel market

(California, Oregon, Washington)

Renewable Diesel and FAME Biodiesel Fill Three Buckets in the RFS



Biodiesel Mandate



**Undifferentiated Advanced
Excess of the
Advanced Mandate
above the Biodiesel Mandate**

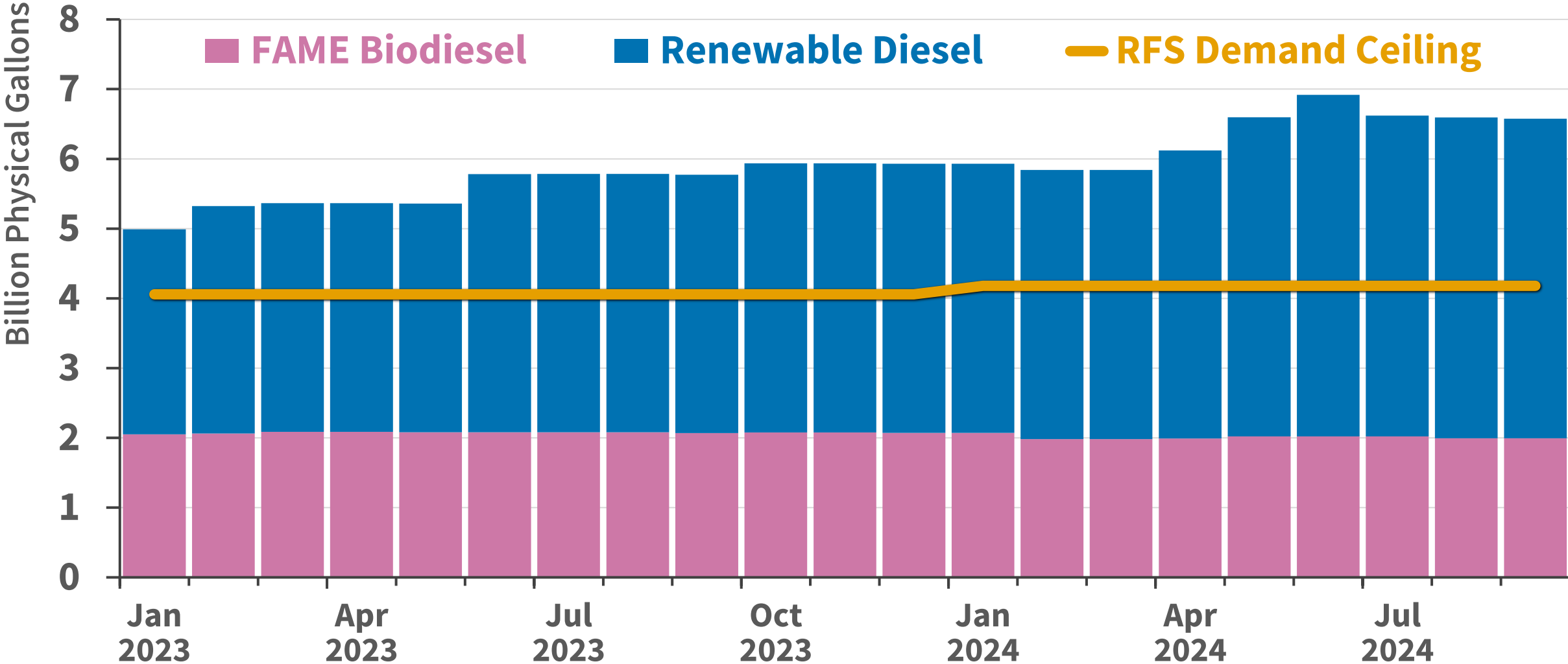


**Conventional Gap
Conventional Mandate
above E10 Blend Wall**

****2023-25 RFS renewable volume obligations (RVOs) imply these three buckets add up to a maximum demand for renewable diesel and FAME biodiesel of 4.1 to 4.6 billion gallons per year**

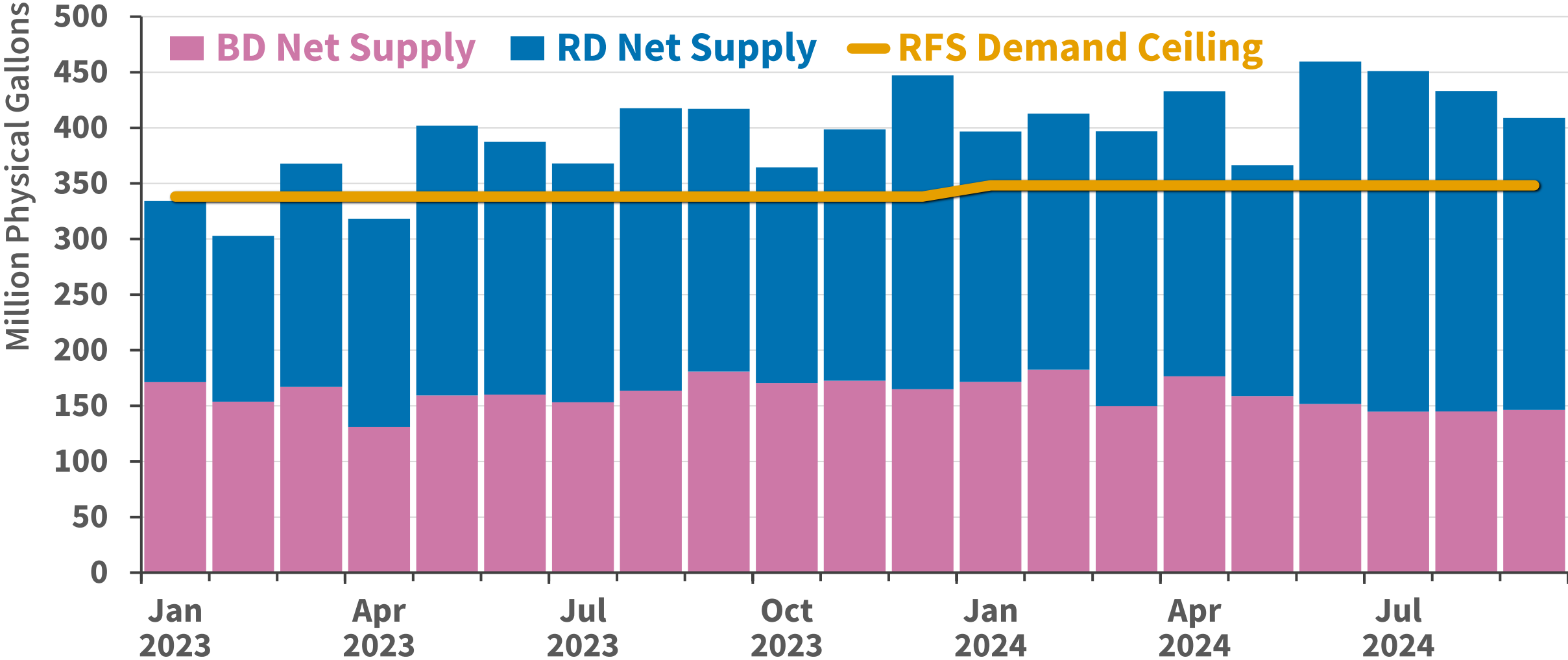
Operable FAME Biodiesel and Renewable Diesel Production Capacity in the U.S. vs. Annual RFS Demand Ceiling

January 2023 - September 2024



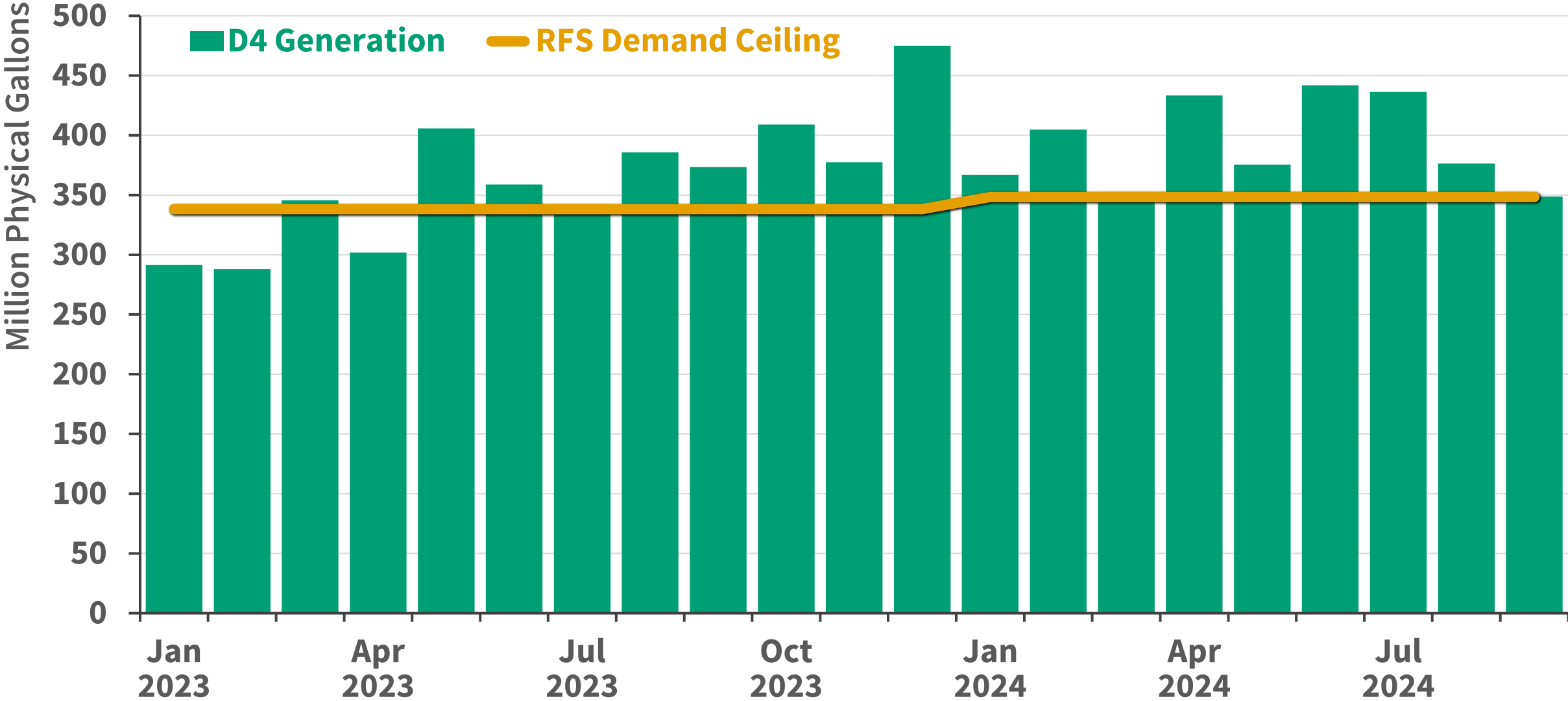
Source: EIA

Monthly FAME Biodiesel and Renewable Diesel Net Supply (domestic + imports - exports) vs. RFS Demand Ceiling in U.S. January 2023 - September 2024



Source: EIA

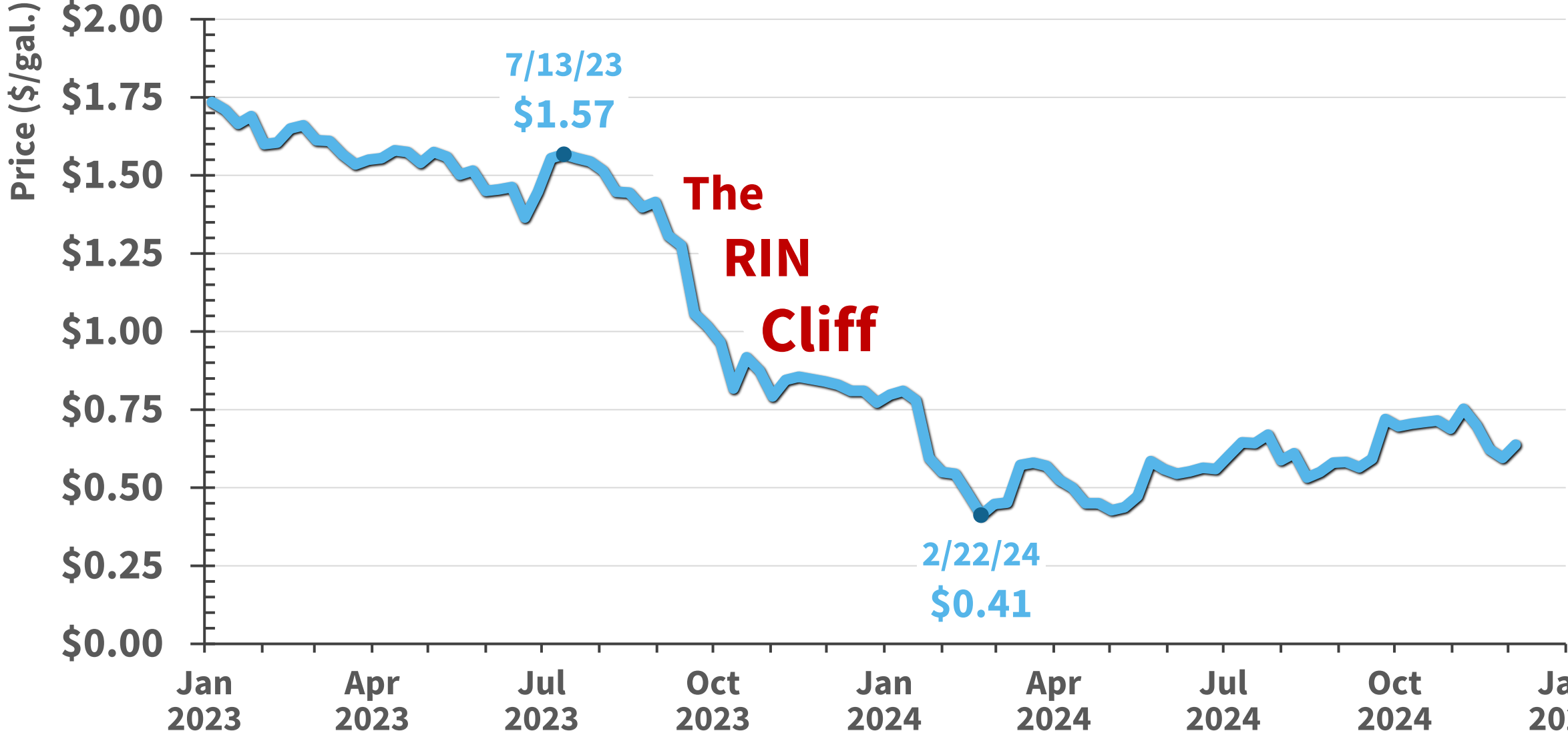
Monthly D4 RIN Generation Net of Exports vs. RFS Demand Ceiling in the U.S., January 2023 - September 2024



Source: EPA

Weekly (Thursday) D4 Biomass-Based Diesel RIN Price

January 5, 2023 - December 5, 2024




Source: OPIS

Climate & Energy


Renewable diesel glut hits US refiner profits, threatens nascent industry

By Shariq Khan and Nicole Jao

May 14, 2024 3:51 AM CDT · Updated 7 months ago



[1/3] A handout photo of Braya Renewable Fuels' refinery that produces renewable diesel in Come By Chance, Newfoundland and Labrador, Canada February 20, 2024. Braya Renewable Fuels/Handout via REUTERS [Purchase Licensing Rights](#) 



<https://www.reuters.com/business/energy/chevron-idles-two-us-midwest-biodiesel-plants-profits-slip-2024-03-01/>



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Climate & Energy

Chevron idles two US Midwest biodiesel plants as profits slip

By Laura Sanicola

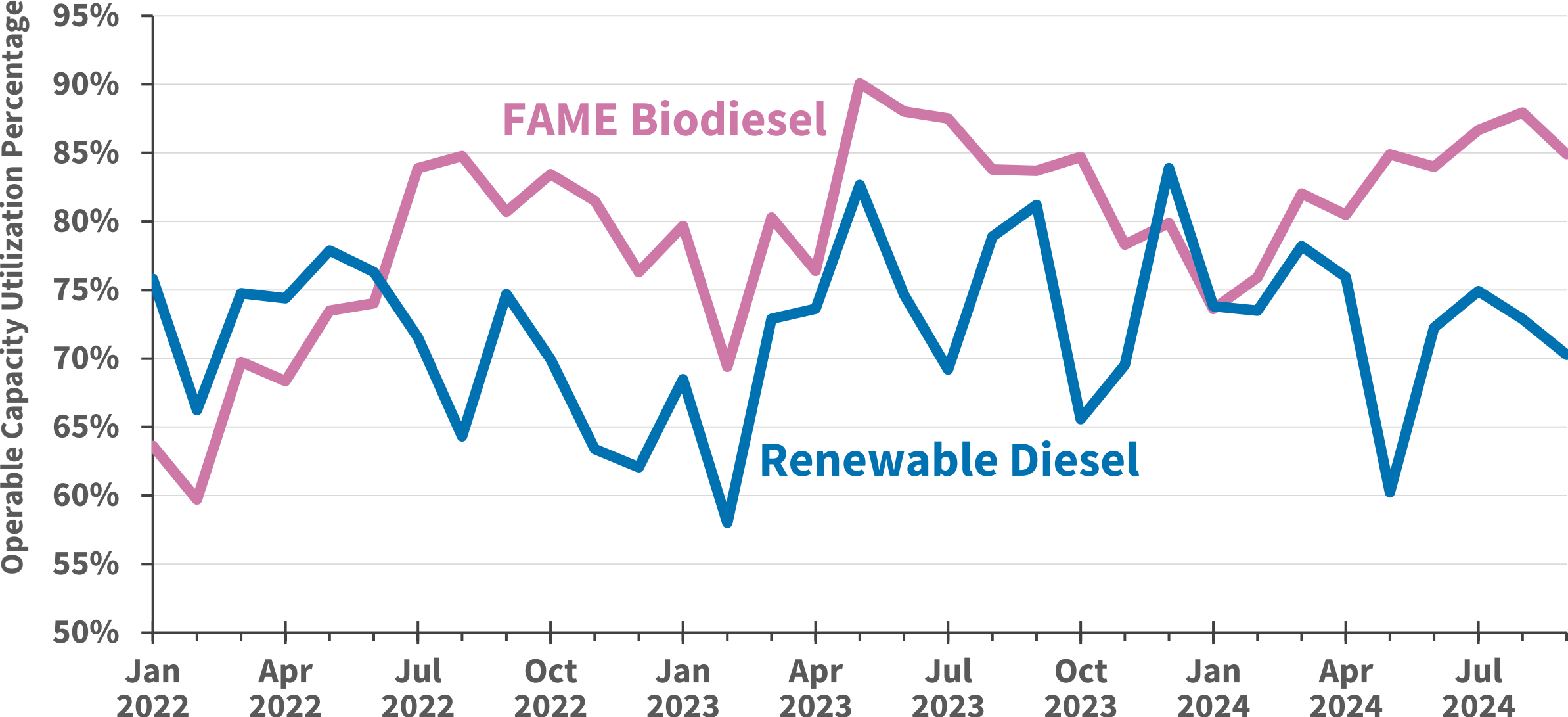
March 1, 2024 5:03 PM CST · Updated 9 months ago



A Chevron gas station sign is seen in Austin, Texas, U.S., October 23, 2023. REUTERS/Brian Snyder/File Photo [Purchase Licensing Rights](#)

"Chevron idled plants in Ralston, Iowa, and Madison, Wisconsin, that combined can process 50 million gallon per year of biodiesel"

FAME Biodiesel and Renewable Diesel Operable Capacity Utilization in the U.S., January 2022 - August 2024



Source: EIA

Why Has FAME Biodiesel Been So Resilient?

- **FAME biodiesel costs less to produce than renewable diesel**
 - 7.5 pounds of feedstock per gallon for FAME vs. 8.5 pounds for renewable diesel
 - For same feedstock, renewable diesel feedstock costs are at least 10% higher
 - Other variable costs (natural gas, electricity, catalysts) also higher for renewable diesel

Why Has FAME Biodiesel Been So Resilient?

- FAME biodiesel state-level mandates and tax incentives provide a floor on demand
- A blend of FAME and renewable diesel is popular with users (e.g., 80% RD/20% FAME) because FAME adds lubricity to the relatively “dry” renewable diesel
- FAME demand is less dependent on LCFS credit values for profitability than renewable diesel

Why Has FAME Biodiesel Been So Resilient?

Bottom-line: Projections of the demise of the FAME biodiesel industry in the U.S. were premature



Optionality of HEFA Renewable Diesel Plants

**First type of optionality is to
convert back to processing crude oil**

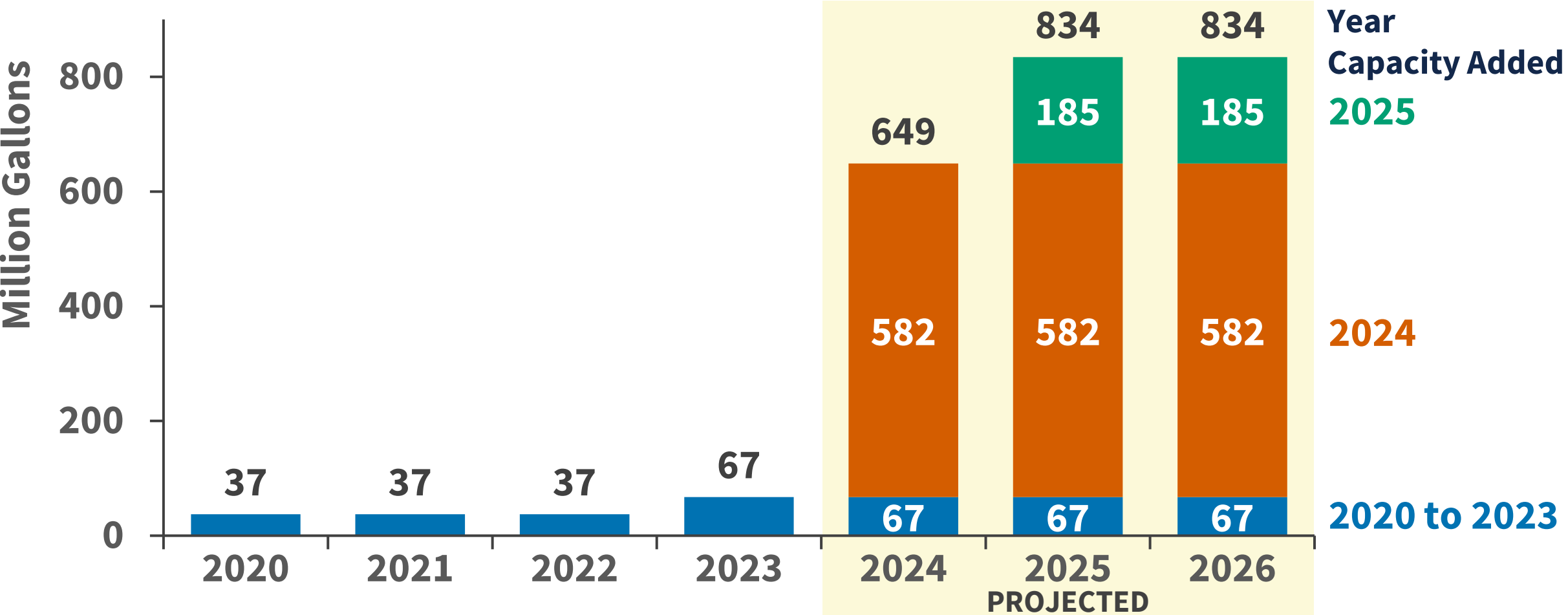
- Chevron's El Segundo, California plant, with a nameplate capacity of 184 million gallons per year, switched back to processing crude oil in 2024
- Not clear how widespread this optionality is across renewable diesel plants

Optionality of HEFA Renewable Diesel Plants

Second type of optionality is to convert capacity to producing sustainable aviation fuel (SAF)

- Requires substantial additional investment
- Less SAF made per unit of feedstock than renewable diesel because of additional hydrocracking required to produce SAF
- Higher production of lower valued co-products

Maximum Annual Nameplate Capacity for Sustainable Aviation Fuel (SAF) Production at HEFA Renewable Diesel Plants in the U.S., Actual for 2020 - 2023 and Projected for 2024 - 2026



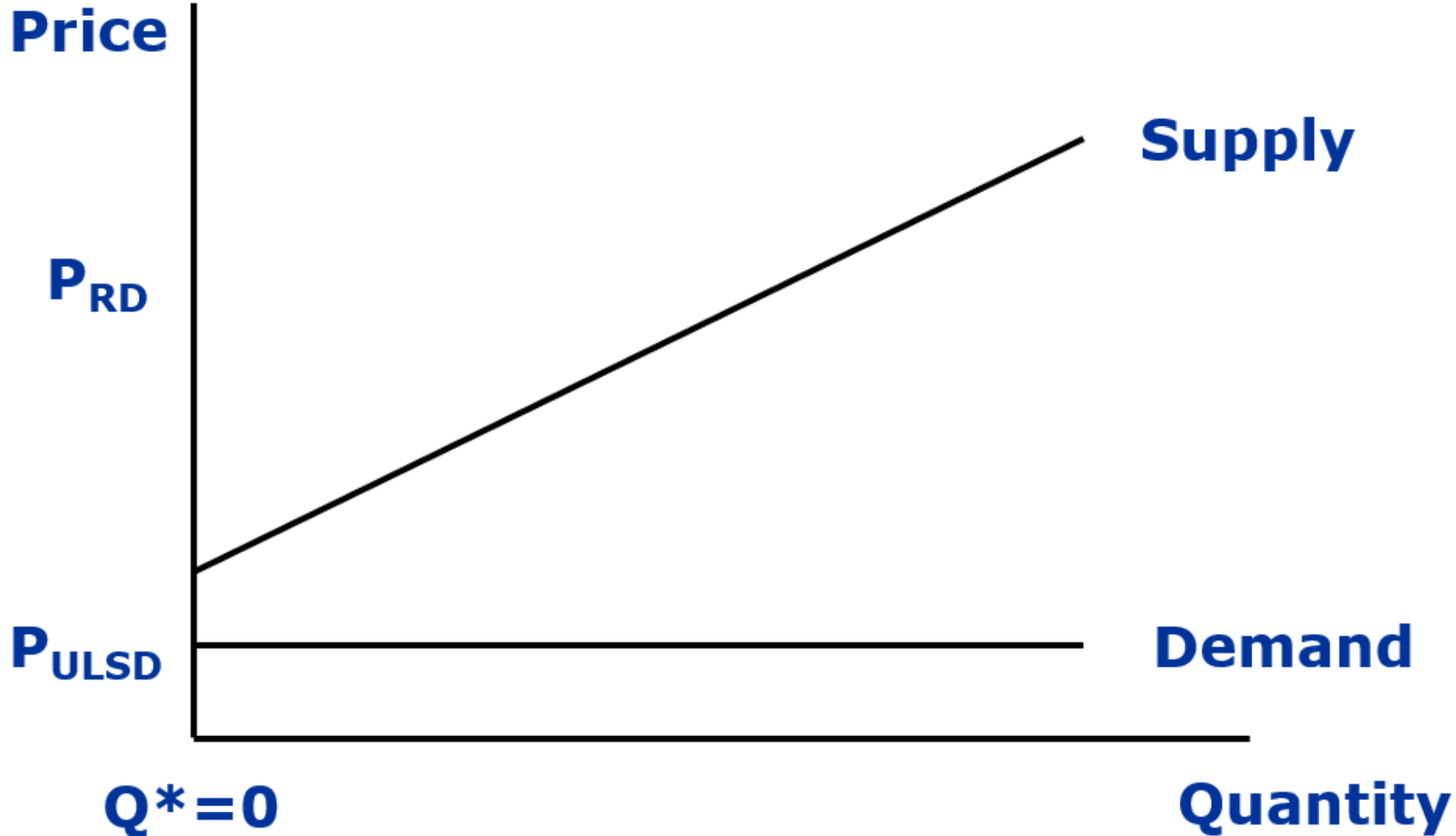
What are Key Policy Impacts for Renewable Diesel and FAME Biodiesel in the U.S.?

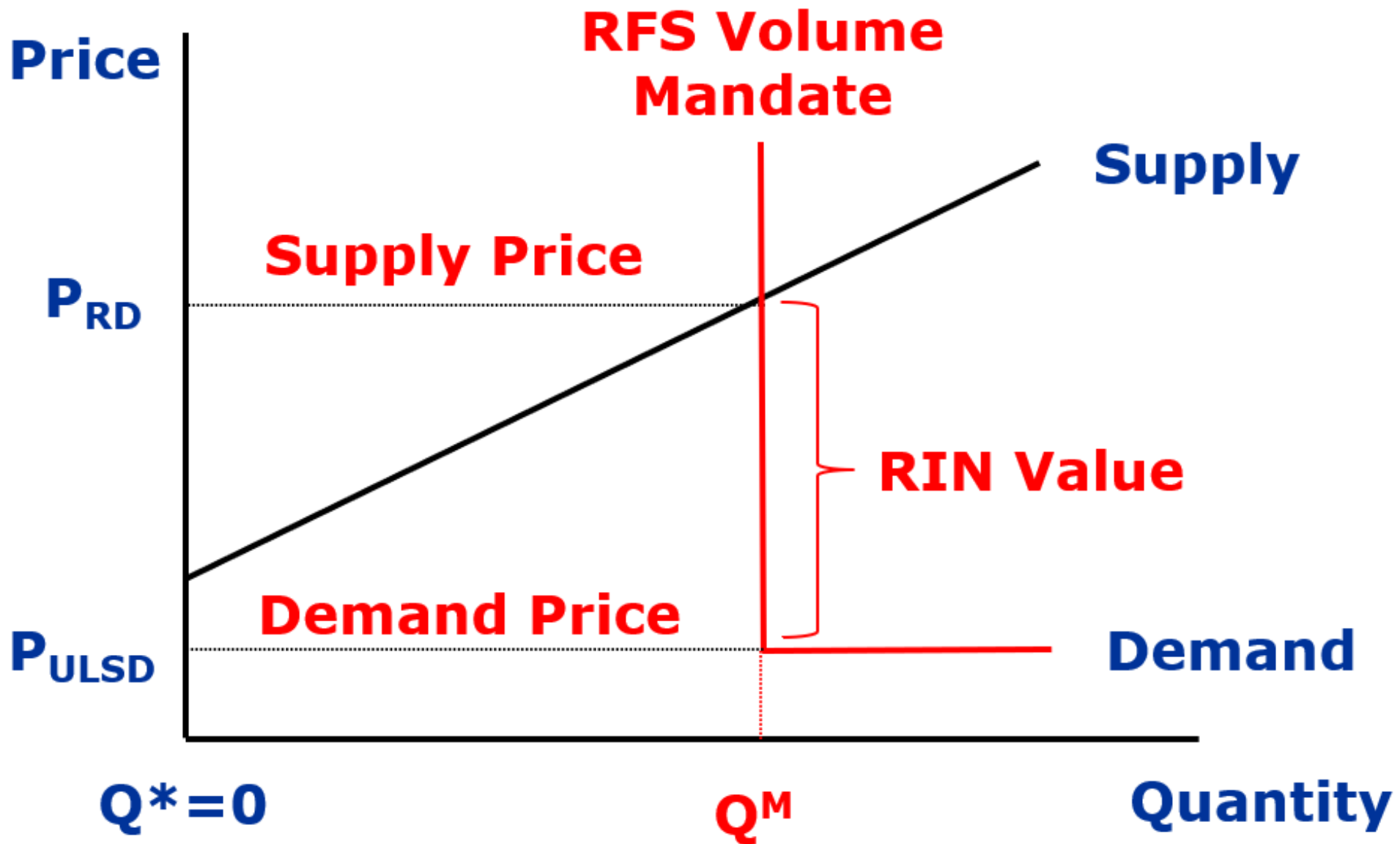
The answer depends on who is asking the question?

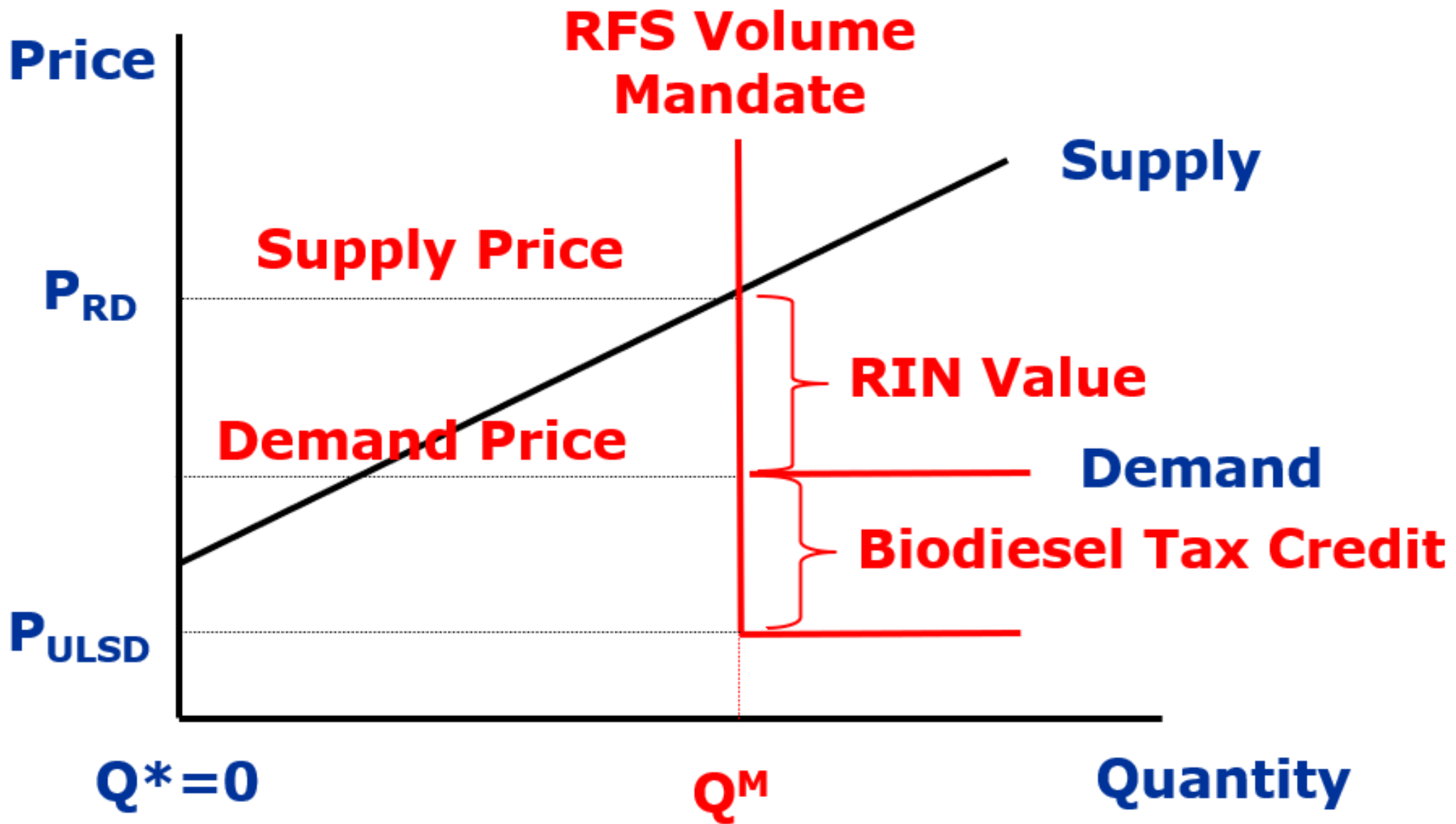
- Farmers
- Biofuel producers
- Refiners
- Consumers

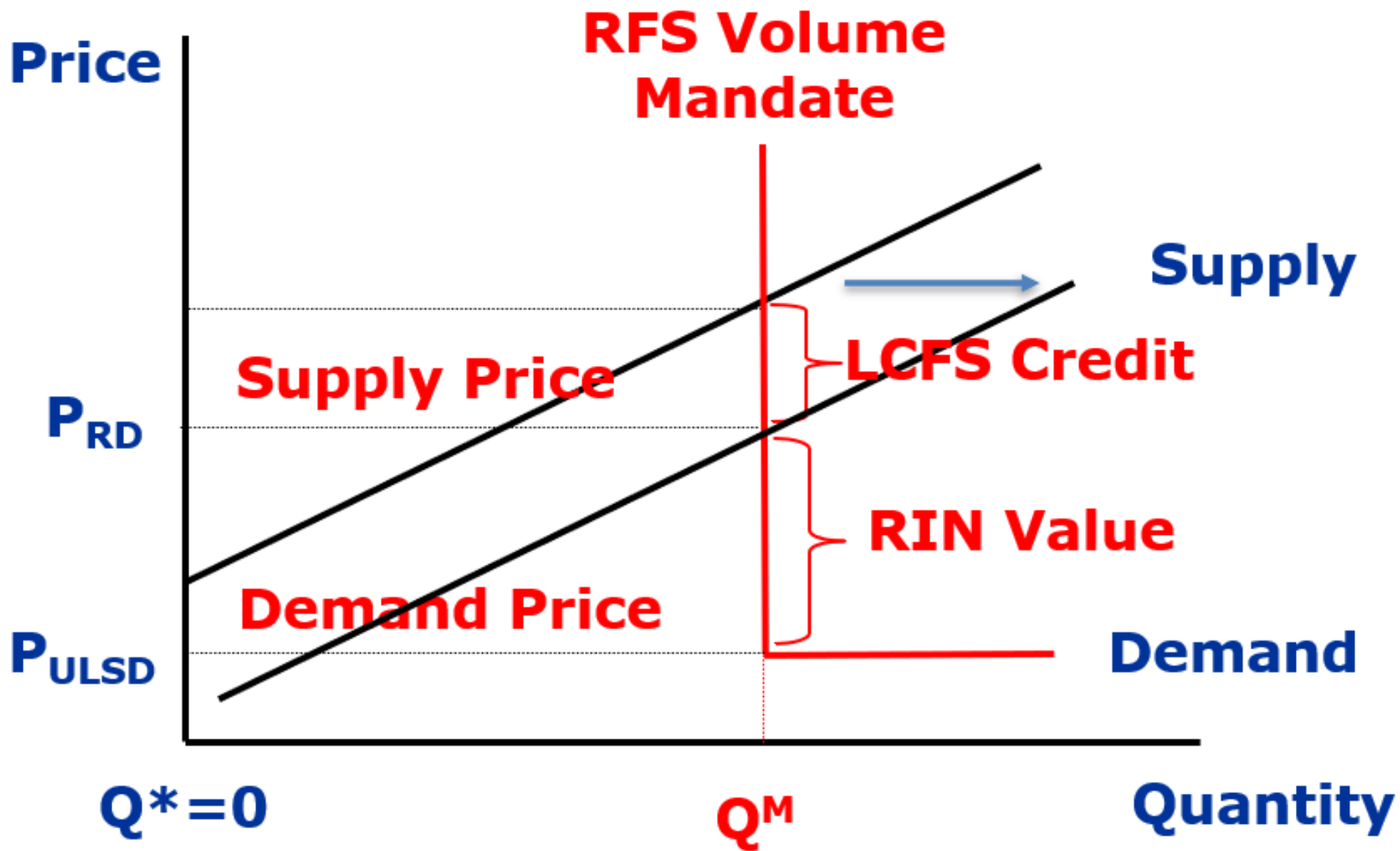


A Policy Market









Summary: Key Policy Impacts for Renewable Diesel and FAME Biodiesel

RFS mandate set the total size of the domestic market for renewable diesel and FAME biodiesel

All other policies are distributional:

- **Consumer vs. taxpayer cost: BTC, LCFS**
- **Domestic vs. imported RD/FAME? BTC, LCFS**
- **Location of RD/FAME usage? LCFS**
- **Type of feedstock? LCFS**
- **Domestic vs. imported feedstock? Import tariffs**

Implemented EPA Renewable Volume Obligations (RVOs) for 2023, 2024, and 2025 and Estimated Maximum Biomass-Based Diesel (BBD) Needed for Compliance

Category	2022	2023	2024	2025
Panel A: EPA RVOs (RIN gallons)				
(1) Total	19.44	21.89	22.50	23.51
(2) Advanced	5.27	6.13	6.82	7.72
(3) Cellulosic	0.58	0.87	1.13	1.45
(4) Biomass-Based Diesel	4.13	4.67	5.08	5.64
(5) Undifferentiated (2)-(3)-(4)	0.56	0.60	0.61	0.63
(6) Conventional (1) - (2)	14.18	15.76	15.68	15.79
Panel B: Maximum Demand for Biomass-Based Diesel (wet physical gallons)				
(6) Biomass-Based Diesel [(4) - D4 OTHER]/1.6	2.57	2.90	3.09	3.42
(7) Undifferentiated [(5) - D5]/1.6	0.14	0.22	0.23	0.24
(8) Conventional [(6) - ETH]/1.6	0.10	0.94	0.86	0.93
(9) Total (6)+(7)+(8)	2.81	4.06	4.18	4.59

Wildcard #1: RFS RVOs

**Proposed rulemaking for 2026-2028
was due before the end of 2024**

- **Biden Administration EPA
kicked the can to March 2025**
- **New Trump Administration EPA will propose
rulemaking for 2026-2028 sometime in 2025**

Wildcard #1: RFS RVOs

The players

- Ag will push for higher conventional and advanced RVOs
- Some refiners may push for higher advanced RVOs because of investment in renewable diesel plants
- Some merchant refiners will push for SREs and/or lower conventional RVOs
- Environment and climate groups will not have much input

A good starting point is to assume that Trump 1.0 approach to setting RVOs will be similar under Trump 2.0

Wildcard #2:

45z Clean Fuels Production Tax Credit

- 1. Scheduled to replace the \$1 per gallon “biodiesel” blenders tax credit starting in 2025 (expires in 2027).**
- 2. Only domestically produced clean fuels are eligible for new credit**
- 3. Credits keyed to carbon intensity (CI) scores as determined by the GREET model**

Wildcard #2:

45z Clean Fuels Production Tax Credit

4. Must have a CI score of 50 kg CO₂/MM BTU or less to earn credit (corn ethanol without carbon sequestration unlikely to qualify)

- Renewable diesel made from soybean oil may receive @ 30 cents per gallon
- Renewable diesel made from used cooking oil may receive @ 65 cents per gallon

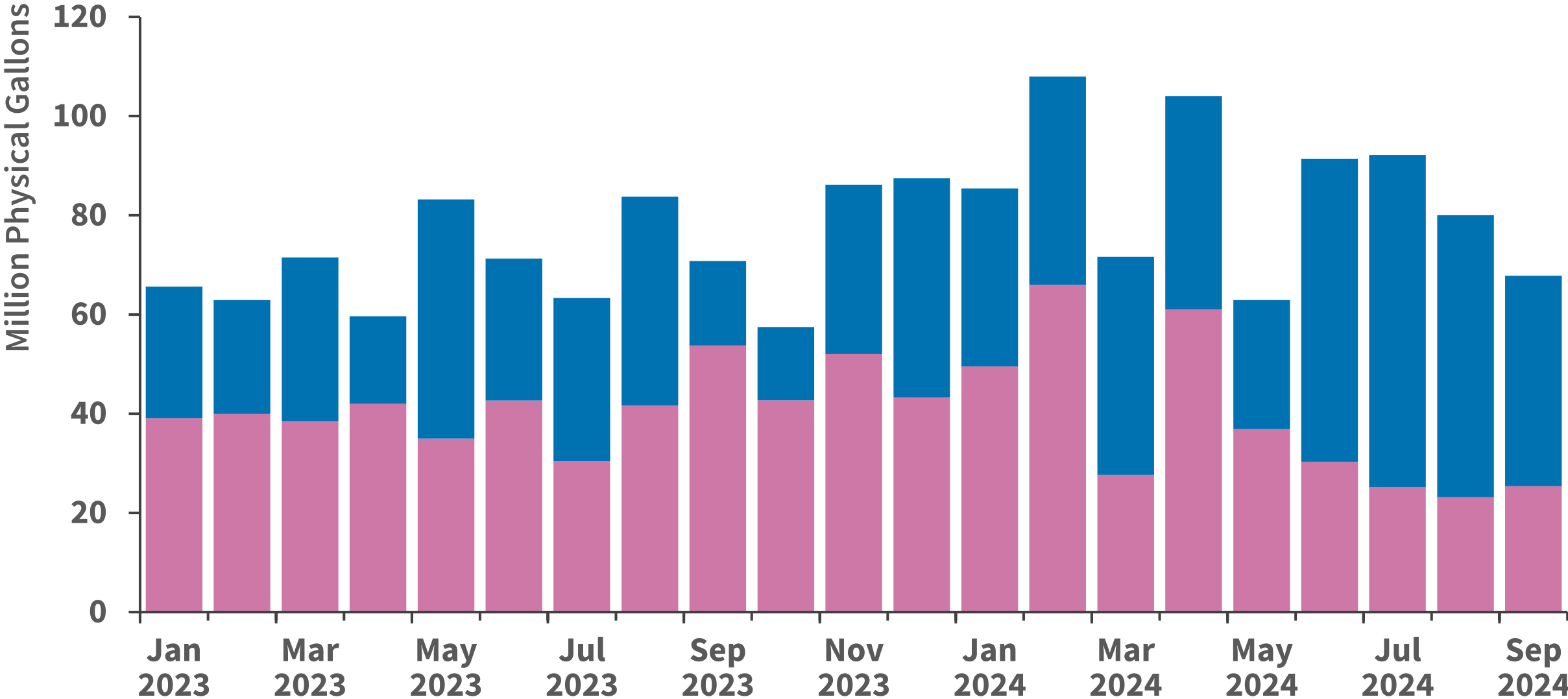
Wildcard #2:

45z Clean Fuels Production Tax Credit

5. Important trade impacts possible

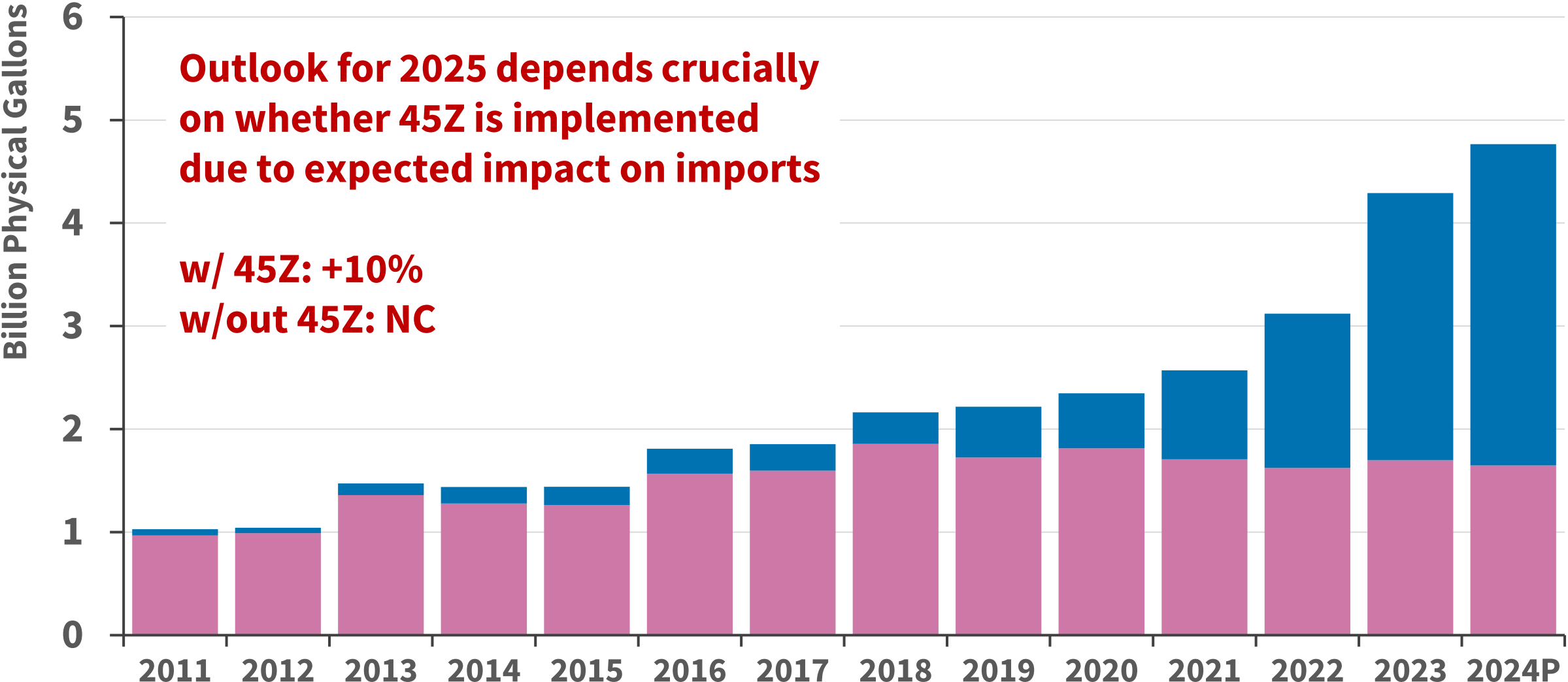
- Reduce renewable diesel and FAME biodiesel imports to the U.S.
- Increase renewable diesel exports from the U.S., especially to Canada

Monthly FAME Biodiesel and Renewable Diesel Imports into the U.S., January 2023 - September 2024



Source: EIA

U.S. FAME Biodiesel and Renewable Diesel Production 2000 - 2024P




Carbon Markets

Exclusive: Biden administration will not finalize clean fuel tax credit guidance

By Jarrett Renshaw

December 3, 2024 4:51 PM CST · Updated 6 days ago

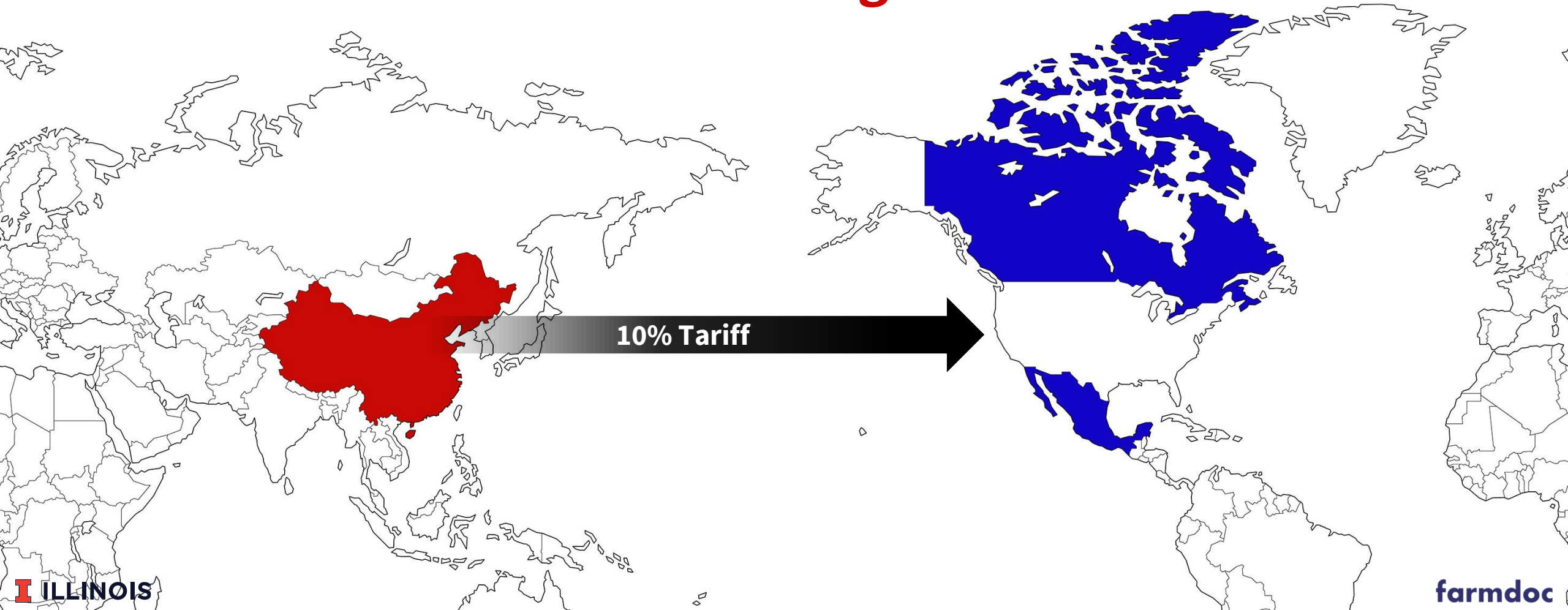


[1/2] Corn is loaded into a truck to be transported for ethanol production in Kelley, Iowa, U.S., January 21, 2020. REUTERS/Shannon Stapleton/File Photo [Purchase Licensing Rights](#) 



Wildcard #3: Trade Wars

Trump plans to impose **25% tariffs on Canada and Mexico** and an additional **10% tariff on goods from China**



Wildcard #3: Trade Wars

Within biofuels, political pressure to impose punitive tariffs on renewable diesel feedstock imports, especially used cooking oil (UCO) from China

- Idea that renewable fuels should be “American made”
- Intersects with downturn in ag economy
- Possible exclusion of imported feedstock from 45Z eligibility or a revised blender tax credit

Wildcard #3: Trade Wars

Tit-for-tat reaction of other countries to imposition of new tariffs is very unpredictable and can set off damaging economic chain reactions



Daily Cash Soybean Export Price at **New Orleans, Louisiana** and **Paranagua, Brazil**, January 1, 2014 - December 31, 2019



Conclusions

- Outlook for renewable diesel and FAME biodiesel is highly uncertain
- Biggest uncertainty is how new Trump administration will set RVOs for 2026-2028
- Implementation of 45Z tax credit is another major source of uncertainty

“Policy markets are most uncertain when policy is uncertain”

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