



October 2024



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## Charting the Path Forward for SAF

### Key Points:

- The goal of producing 3 billion gallons of sustainable aviation fuel (SAF) by 2030 is within reach but needs additional government and market incentives to encourage expansion. The lack of longer-term incentives from governments as well as minimal offtake agreements from the airline sector will limit SAF adoption and growth.
- Potential higher costs and emission requirements act as a profitability deterrent for renewable diesel (RD) producers to shift to SAF. In the absence of favorable policy incentives or commitments from airlines or consumers in paying higher prices for SAF, a refinery would make a higher profit producing RD than SAF.
- The anticipated release of guidance for the Inflation Reduction Act’s 45Z tax credit will set the stage for whether farmers and the industries that serve them can find new revenue opportunities with the expansion of the sustainable aviation fuel market. Proper auditing and accounting requirements for climate-smart agricultural practices may also limit farmer profit prospects.
- The delay of the finalized GREET (Greenhouse gases, Regulated Emissions and Energy use in Technologies) model ahead of the January 2025 potential start date brings more uncertainty for farmers to make farm input and conservation decisions for their 2025 crops. The 2024 election outcomes will also impact the future of tax policy, as well as slow implementation with a change in federal government administration personnel.
- Ag retailers can play a key role in educating their customers about sustainable practices that provide both environmental and economic advantages. Non-governmental organizations and foundations can dedicate dollars to directly fund agronomists at the retail level to expand adoption of agricultural conservation practices, which can also help meet lower emission goals.



## Introduction

The sustainable aviation fuel opportunity could bring a resurgence to rural America seeking a boost for corn and soybean farmers pummeled by low margins. However, to succeed, the biofuels industry needs favorable policies and adequate incentives in the near-term that will provide certainty in the infancy years and chart the path for meaningful growth.

Faced with expanding production capabilities and low commodity prices, the biofuels industry was firmly established with Congressional passage of the Energy Policy Act of 2005, authorizing the Renewable Fuel Standard, and expanded in the Energy Independence and Security Act in 2007. Higher corn prices plus renewed profitability and investment fueled a revival throughout the entire supply chain in rural America. Purdue University researchers estimated biofuel production increased the U.S. annual farm income by \$8.3 billion between 2004–11 with an extra additional annual income of \$2.3 billion between 2011–2016<sup>1</sup>.

Agricultural feedstocks can help lead the way for a new biofuel-induced demand expansion of SAF adoption and production. Domestic producers, particularly soy crush facilities, have invested \$6 billion to expand capacity 30% above 2023 levels. With lower gasoline usage due to increased electric vehicle adoption, SAF could be a new demand opportunity for domestic ethanol producers. Imported oil feedstocks have pushed prices lower and led some soybean processors to slow or stall planned expansions. U.S. vegetable oil producers want imported feedstocks to be validated, as used cooking oil's carbon intensity score is significantly lower than palm oil.

Additional investments from the airline industry plus government incentives will help support future expansion of SAF. The International Air Transport Association plans to launch a new SAF Matchmaker in the first quarter of 2025. It will share information about suppliers' planned SAF volumes and airlines' purchase interests.

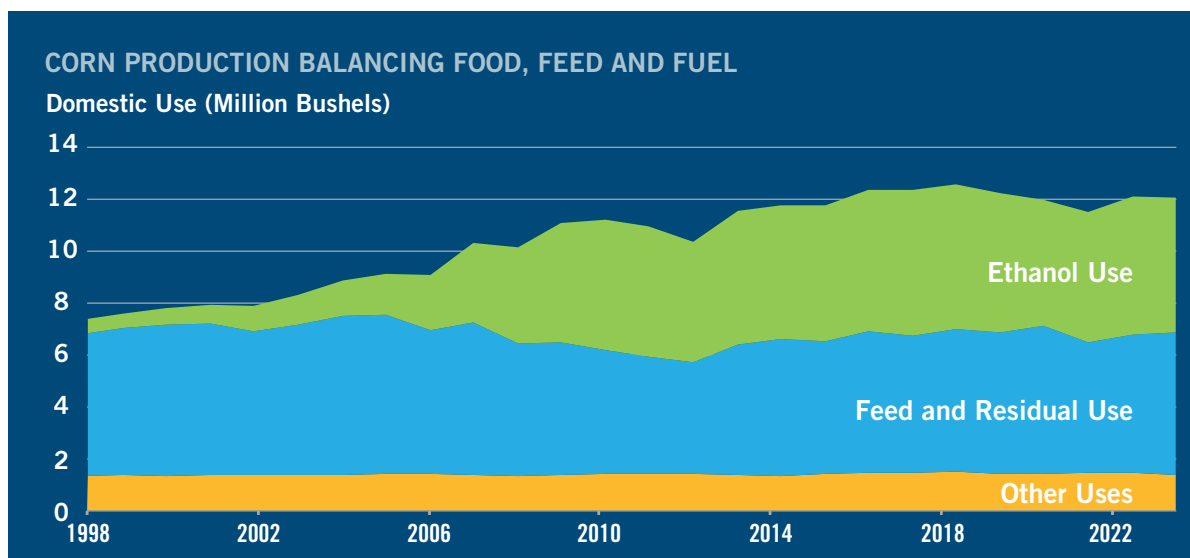
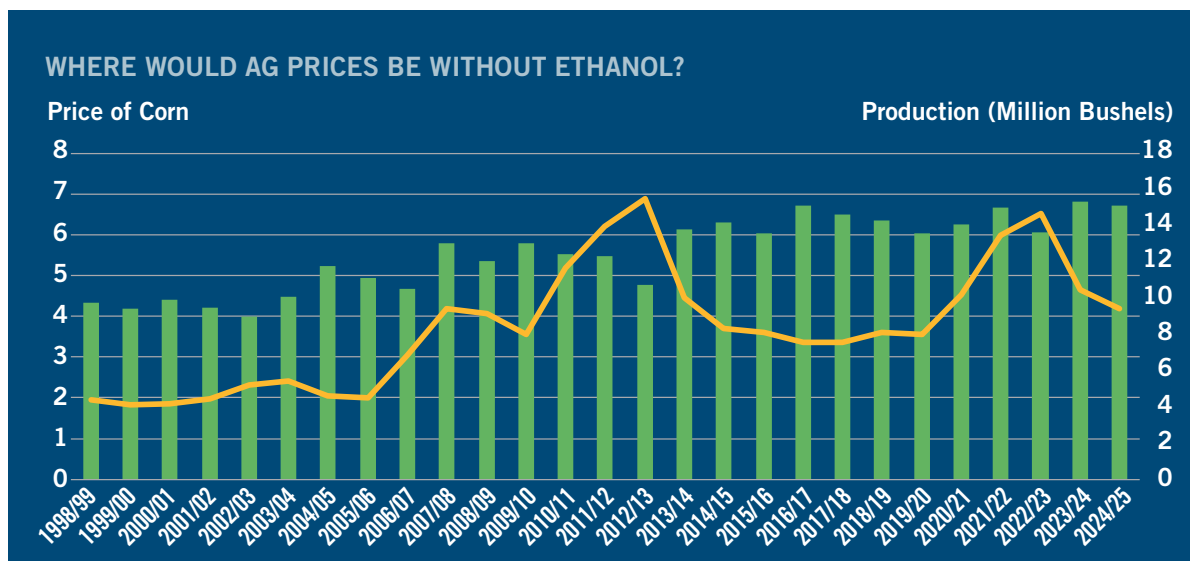
The anticipated release of guidance for the 45Z tax credit will set the stage for whether farmers and the industries that serve them can find new revenue opportunities. (Also known as the Clean Fuel Production Credit, the 45Z tax credit was established to encourage production and sale of clean transportation fuels in the U.S.) The previous 40B tax credit guidance for SAF fell short in properly incentivizing farmers for on-farm practices that help meet net-zero emission goals. The Inflation Reduction Act only authorized 45Z for three years beginning in 2025. The lack of longer-term incentives from governments as well as minimal offtake agreements from the airline sector will limit adoption and growth in this market.



## DEMAND OUTLOOK

### Biofuel demand boosts commodity prices

Today, as corn production keeps outpacing demand, corn and soy producers are looking for new uses to support prices going forward. The National Oilseed Processors Association (NOPA), the national trade association representing the U.S. soybean, canola, flaxseed, safflower seed and sunflower seed crushing industries, reports the oilseed industry has invested \$6 billion to expand crush capacity for oil to be used in renewable diesel and sustainable aviation fuel production. The corn industry also wants to position itself to take advantage of airlines and governments seeking decarbonization in the airline transportation sectors. The biofuels industry has proven there is no food versus fuel debate as production has been able to continually meet the needs of all use sectors. For instance, corn ethanol production also has important coproducts such as dried distillers grains that can be fed to livestock or in corn oil for use in renewable diesel production. ■

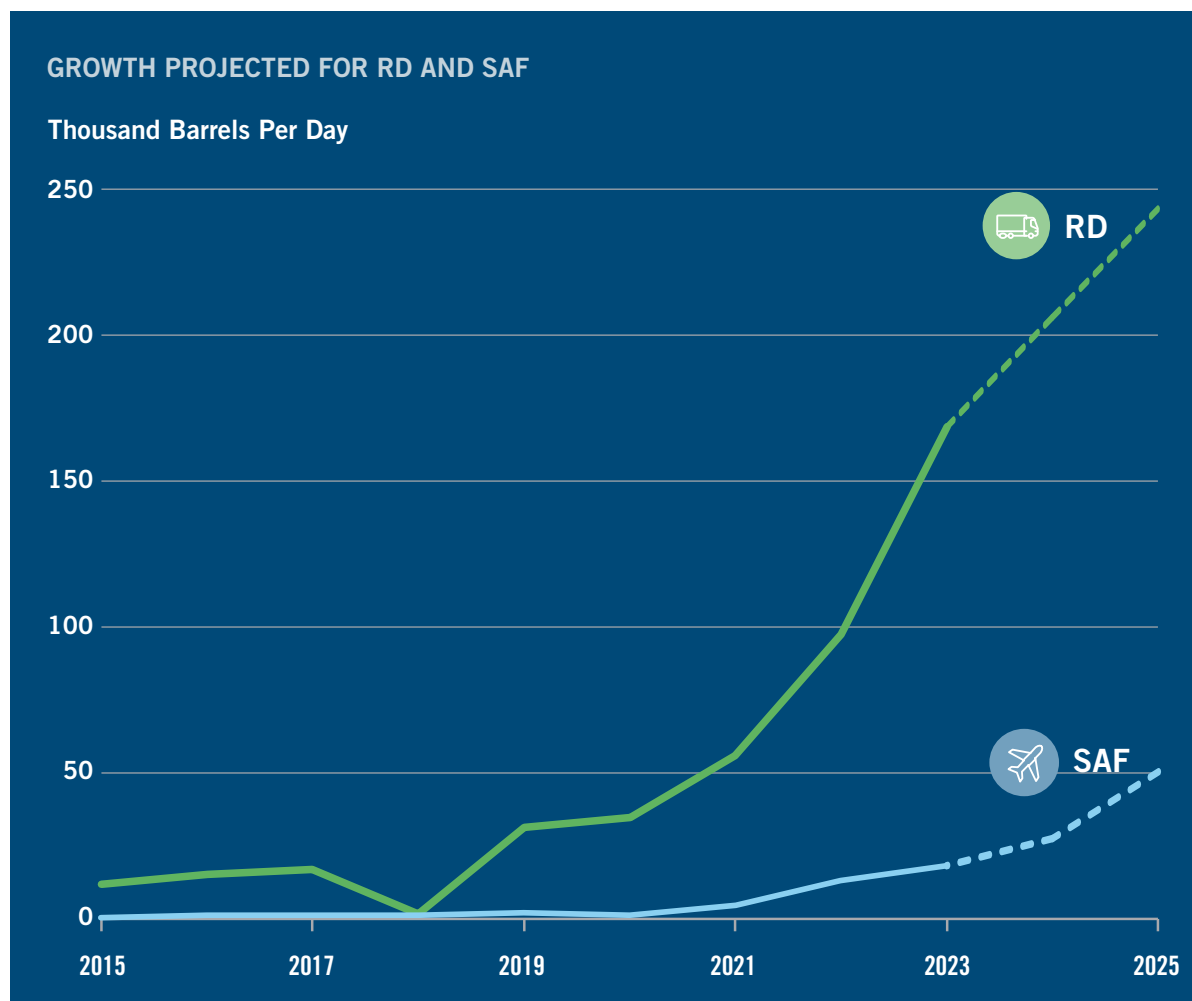


Source: USDA Feed Grains Yearbook

## DEMAND OUTLOOK

### Ethanol production to stay steady with growth building for RD, SAF

The U.S. Energy Information Administration projects ethanol production to remain stable for the next decade. The Renewable Fuels Association estimates for every 1 million electric vehicles added to the U.S. fleet, ethanol demand drops by 45 million gallons assuming a 10% blend rate. Higher ethanol blends, such as E15 or E85, can help offset some of the lost ethanol blending with the domestic fuel supply. However, more is needed, and ethanol producers see alcohol-to-jet SAF as a promising new demand opportunity. Renewable diesel's drastic expansion in recent years has been predominantly driven by California's Low Carbon Fuel Standard (LCFS). Unlike biodiesel's blending limitations, renewable diesel's chemical makeup allows it to be a drop-in fuel or substituted one-for-one with petroleum diesel. Companies can blend renewable diesel and biodiesel because of the cleaner burning and environmentally preferred attributes. For example, Chevron's renewable diesel blend is a fuel that contains up to 20% biodiesel and 80% renewable diesel. ■



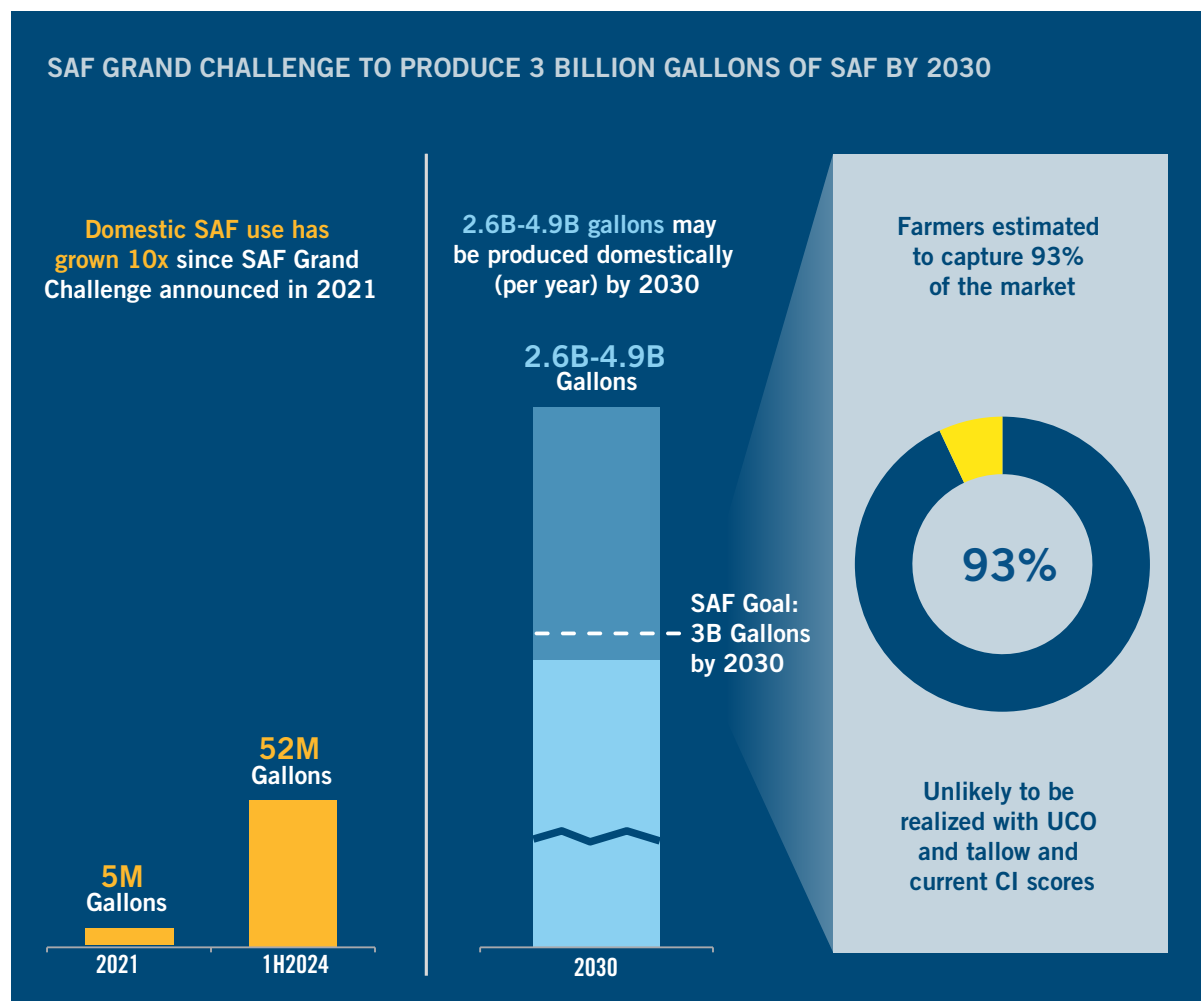
Source: EIA



## DEMAND OUTLOOK

### SAF Grand Challenge goal within reach

In September 2021, the Biden administration announced the Sustainable Aviation Fuel Grand Challenge to encourage 3 billion gallons of SAF by 2030 and 35 billion gallons by 2050 to satisfy 100% of domestic airline fuel demand. The whole government approach helps coordinate policies from the U.S. Department of Energy, Department of Transportation and Department of Agriculture (USDA). Since the SAF Grand Challenge was announced, annual SAF domestic production and imports have grown from 5 million gallons in 2021 to 52 million gallons through the first six months of 2024<sup>2</sup>. Based on a database of active projects, between 2.6 billion and 4.9 billion gallons per year of SAF may be produced by 2030, creating a clear pathway to achieve the SAF Grand Challenge near-term goal, according to the latest government dashboard of SAF and RD projects. However, this relies on favorable policy and market conditions to shift to greater SAF production while maintaining RD growth needs. ■



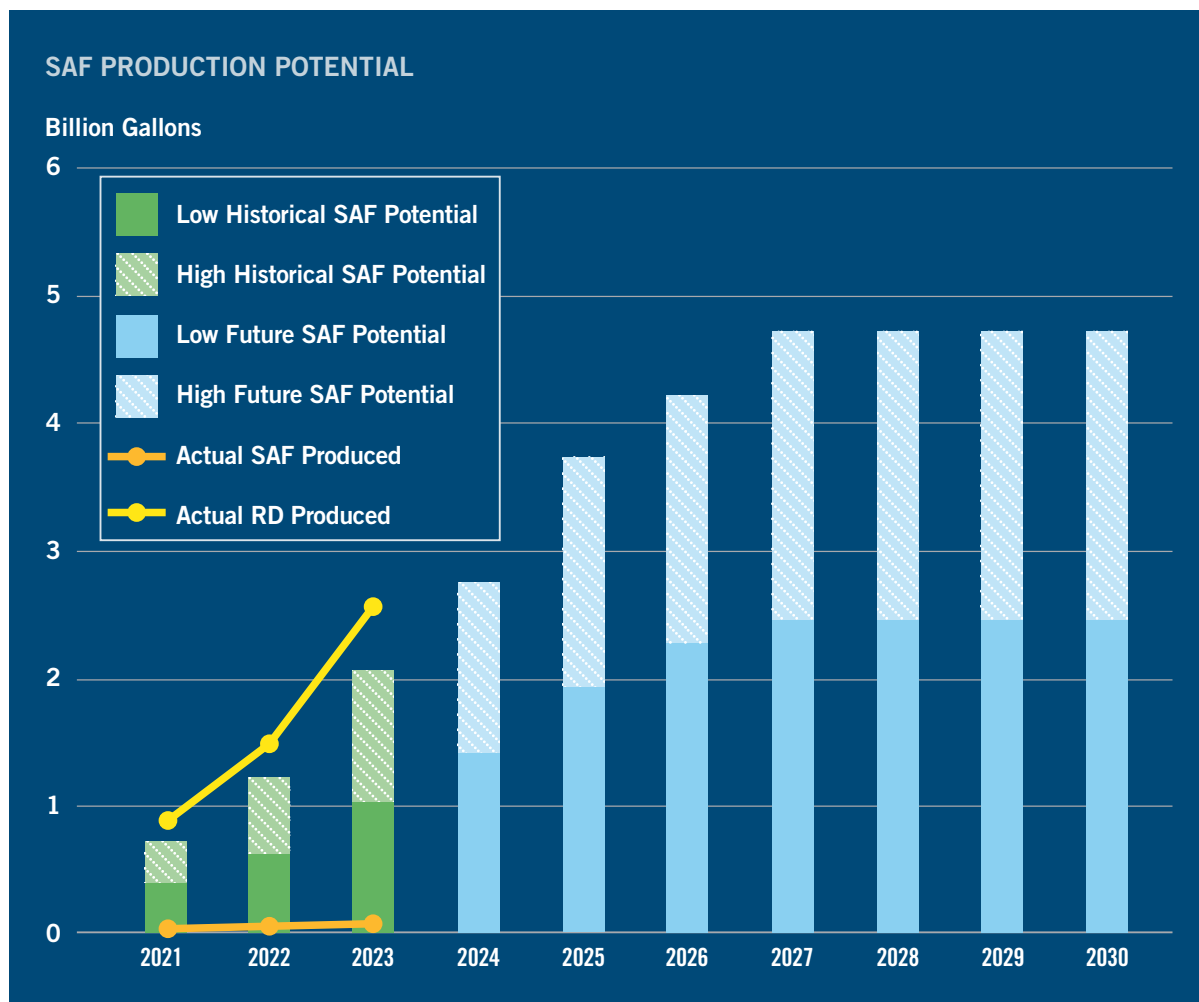
Source: CARB, SAF Grand Challenge Roadmap



## DEMAND OUTLOOK

### Production needs to shift from RD to SAF to meet expansion goals

Current and policy market uncertainty has limited SAF expansion. The National Renewable Energy Laboratory (NREL) estimates total announced domestic hydroprocessed esters and fatty acids (HEFA) capacity (RD and SAF), including construction and planned projects, is expected to reach about 9.6 billion gallons per year by 2030. A joint venture between the Federal Aviation Administration and the commercial aviation industry is tracking more than 2 billion gallons per year of SAF production that could come online by 2028 with over 200 potential SAF producers working on commercialization efforts. To date, private company announcements indicate a projected 600 million gallons per year from alcohol-to-jet facilities. A January 2024 economic impact study commissioned by the Iowa Renewable Fuels Association found that meeting the goal of the SAF Grand Challenge would add \$427 million to farm revenues in ethanol plant basis premiums alone and raise farm income by \$11,670 for a typical 1,000-acre farm split 50/50 between corn and soybeans. ■



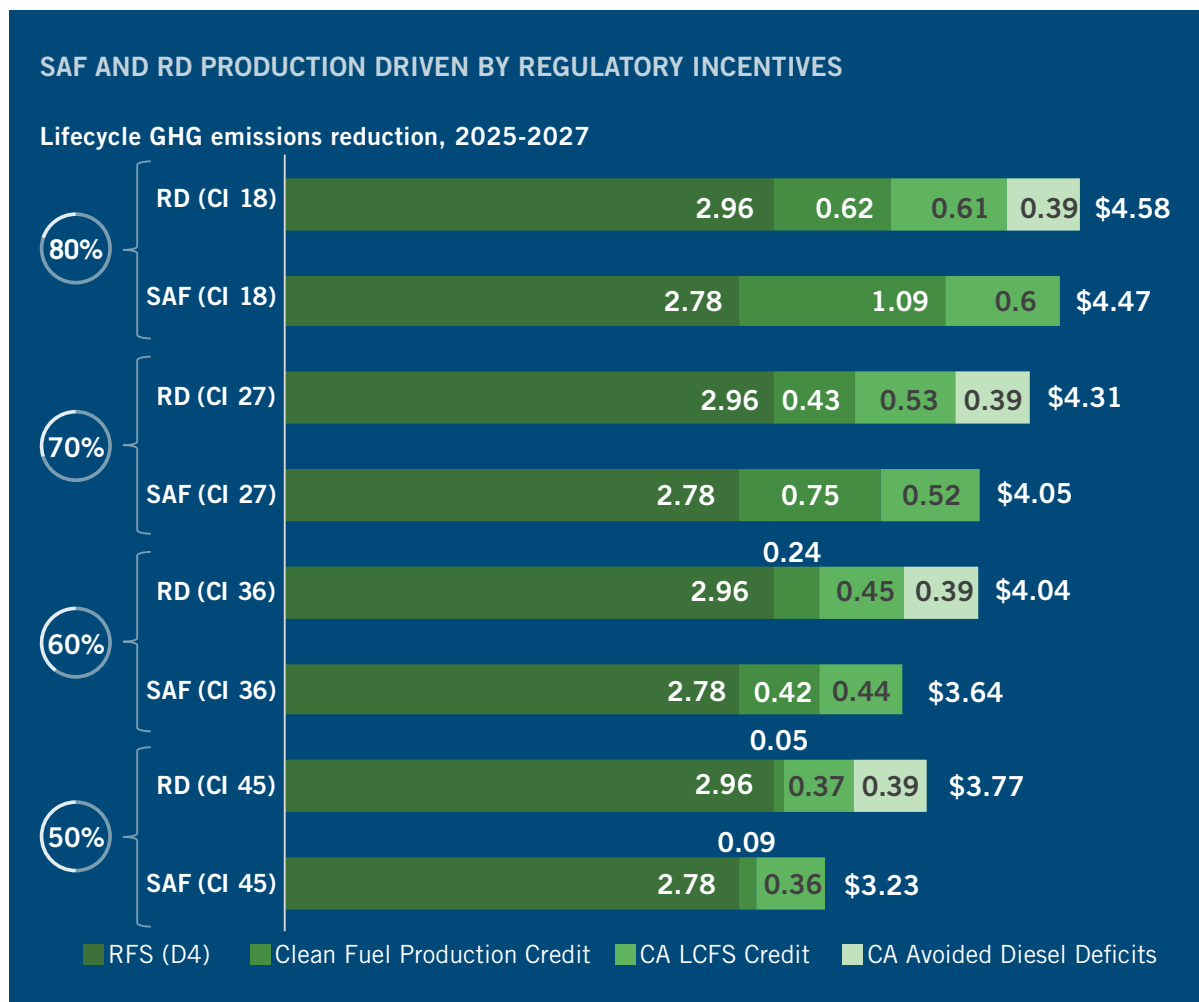
Source: EIA, EPA



## POLICY IMPACT

### SAF buildout requires favorable policy to drive growth

The HEFA process can use multiple feedstocks including fats, oils, and greases. At some stage HEFA capacity could be flexible enough to toggle back and forth between RD and SAF, but today some plants are set up to easily make the change compared to others. Even those plants that are easily set up require additional incremental investment to produce SAF. Sustainable aviation fuel requires more hydrogen and higher-severity operations, which also reduces carbon yield. Higher costs and potential greater emissions act as a profitability deterrent for an RD producer to shift to SAF. In the absence of favorable policy incentives or commitments from airlines or consumers to pay higher prices for SAF, a refinery would almost always make a higher profit producing RD than SAF. Today, the combined policy incentives show greater economic returns for RD over SAF for lifecycle greenhouse gas emission reductions from 50% to 80% compared to the conventional counterpart. Additional state incentives, such as approved by Illinois, Nebraska and Washington, create additional stimulus for future SAF investments and viability. ■



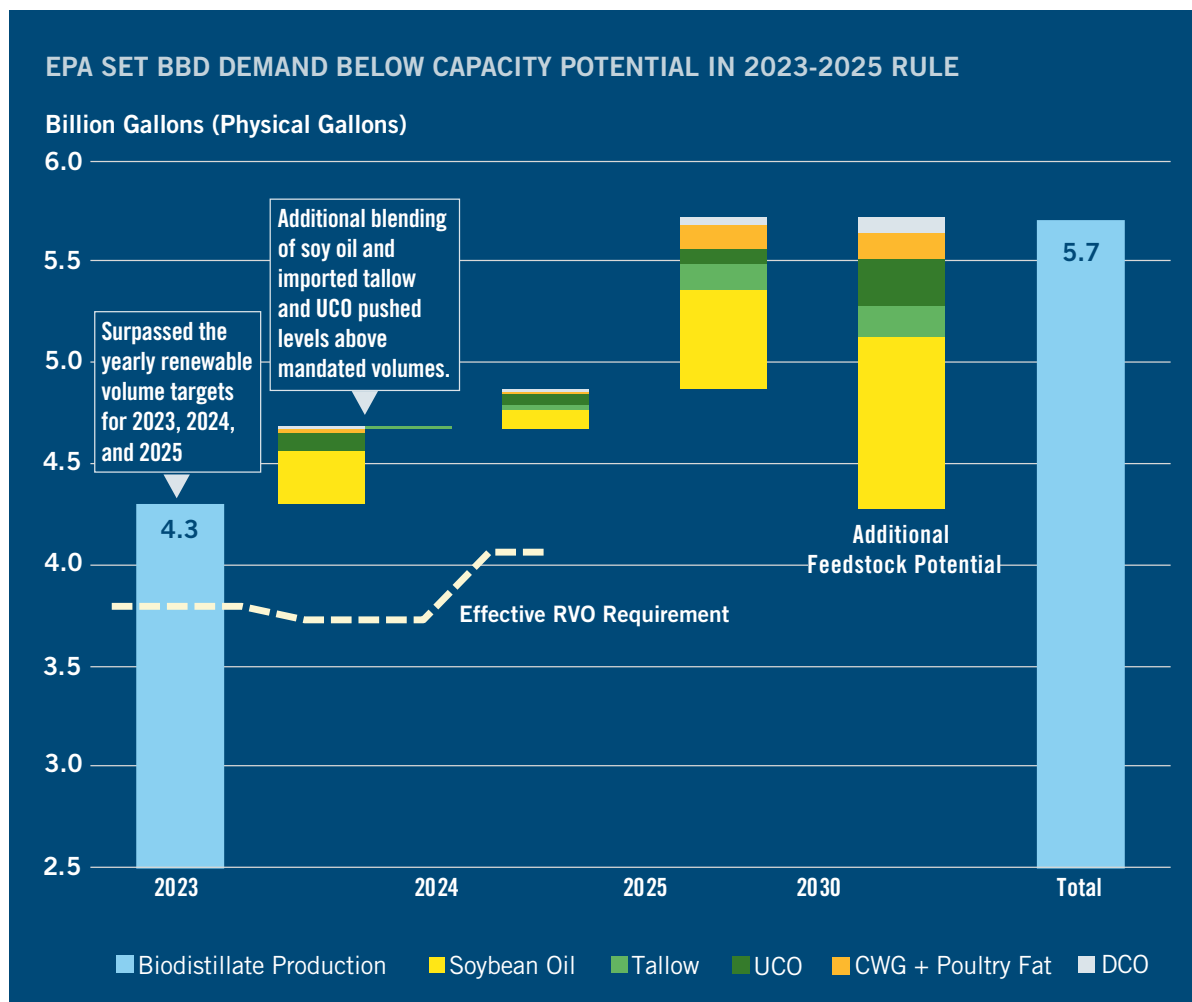
Source: NREL



## POLICY IMPACT

### EPA underestimated domestic capacity to meet BBD demand

The Renewable Fuel Standard mandates renewable volume obligations (RVO) to encourage blending of biofuels. In mid-2023, the Environmental Protection Agency set the biomass-based diesel (BBD) RVO levels below the actual production and import capabilities. NOPA published a study conducted by S&P Global Insights that found in 2023 alone, domestic and imported feedstocks supported the production of 4.3 billion gallons of renewable diesel and biodiesel, surpassing the yearly RVO targets for 2023, 2024, and 2025. Existing U.S. feedstocks can support domestic production of an additional 1.4 billion gallons by 2030 in part due to investments in NOPA members' crush capacity. EPA is statutorily obligated to propose 2026 levels by November of 2024; however, the Biden administration's regulatory agenda indicated it would delay publication until March 2025. A change in leadership at the White House after the November election could further delay publishing the proposal for the next RVO rule. ■



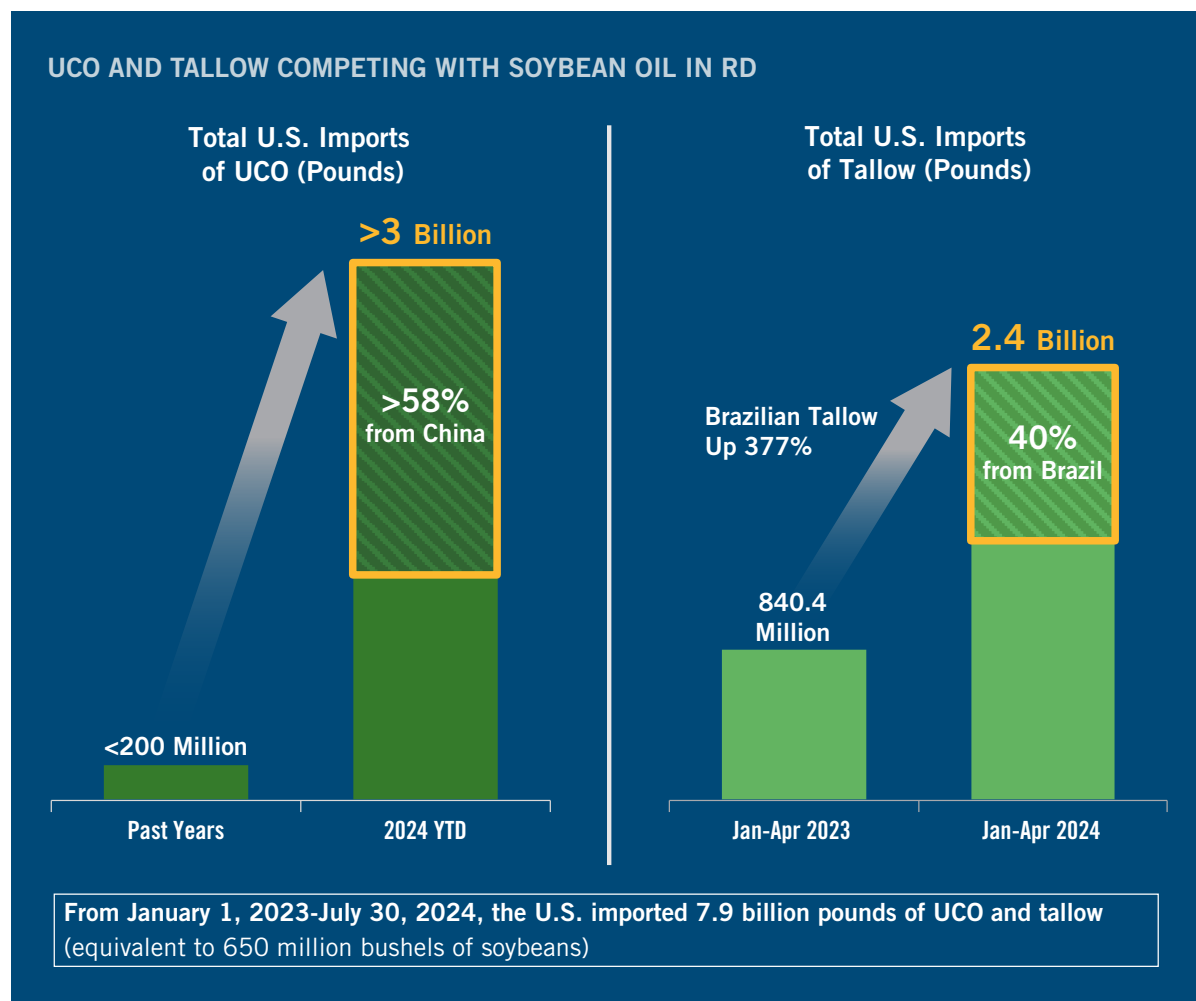
Source: S&P Global Commodity Insights



## POLICY IMPACT

### Lower-carbon intensity oils pushing out domestic feedstocks

Imported feedstocks can further support an additional 1 billion gallons of biomass-based diesel by 2030 supporting a total of 6.7 billion gallons of BBD production by 2030. EPA underestimated the amount of used cooking oil (UCO) and tallow that could be imported to supply domestic RD and SAF markets. Questions exist around whether China's UCO is fraudulent and instead heated palm oil. USDA has stated evidence that China's UCO collection rates match export and use volumes<sup>3</sup>. California proposed a 20% cap on soy oil, canola oil, and sunflower oil for use in RD but does not impose the same restrictions on use in SAF. This may shift some return of crop-based oil demand for use in HEFA processing plants. Current feedstock needs for 3 billion gallon/year of SAF and existing biomass-based diesel consumed 36.2 billion pounds in the first of 2024. An additional 3 billion gallons of all HEFA SAF would require an addition 25+ billion pounds per year. ■



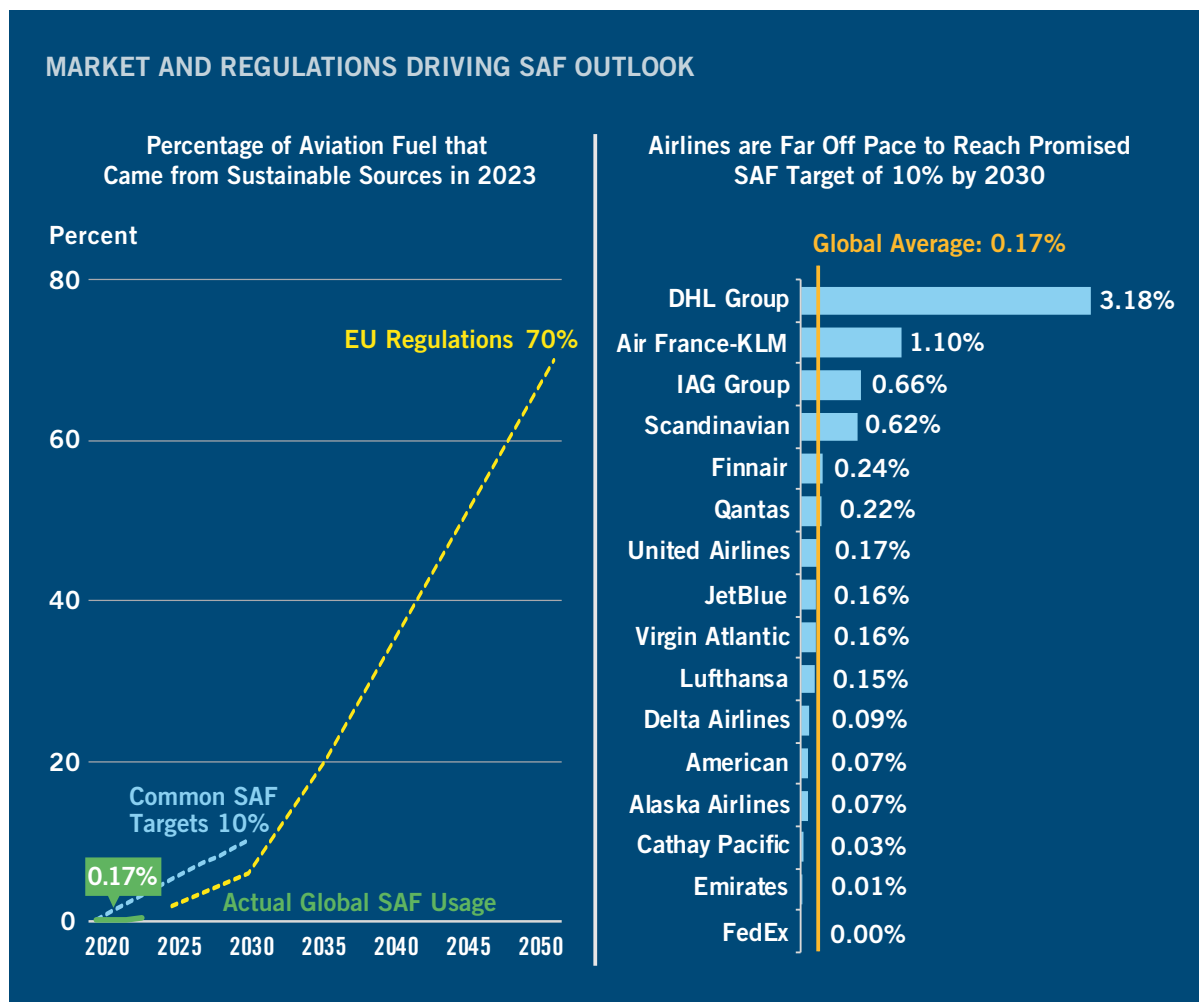
Source: EIA Monthly Biofuels Capacity and Feedstocks Update; National Oilseed Processors Association



## POLICY IMPACT

### Countries take a carrot vs. stick approach to urge production growth

Sustainable aviation fuel remains a very small component of the overall airline fuel use today at just 0.17%. In 2024, the European Union and the United Kingdom mandate a 2% use level, whereas the U.S. has a goal of 3 billion gallons by 2030, or roughly 10% of overall use. Fuel contributes 20%-30% of airlines' operating expenditures. The cost of SAF production ranges from \$6.40 to \$19.01 per gallon, with HEFA on the lower end and alcohol-to-jet the higher end. Airlines have shown a willingness to pay \$6 per gallon, up from the conventional fuel price of \$2.29<sup>4</sup>. If airline companies lock in long-term sustainable aviation fuel at a higher cost for substantial amounts of their fuel, it could make them uncompetitive against their peers. Reluctance of fuel purchasers to commit to more than three-year offtake agreements makes financing more difficult. NREL reports from signed agreements since 2020, 32% are commitments for less than three years, while 50% are signed for four to eight years. SAF offtake agreements provide project owners with a reliable source of revenue, which helps them secure financing for their new projects. ■

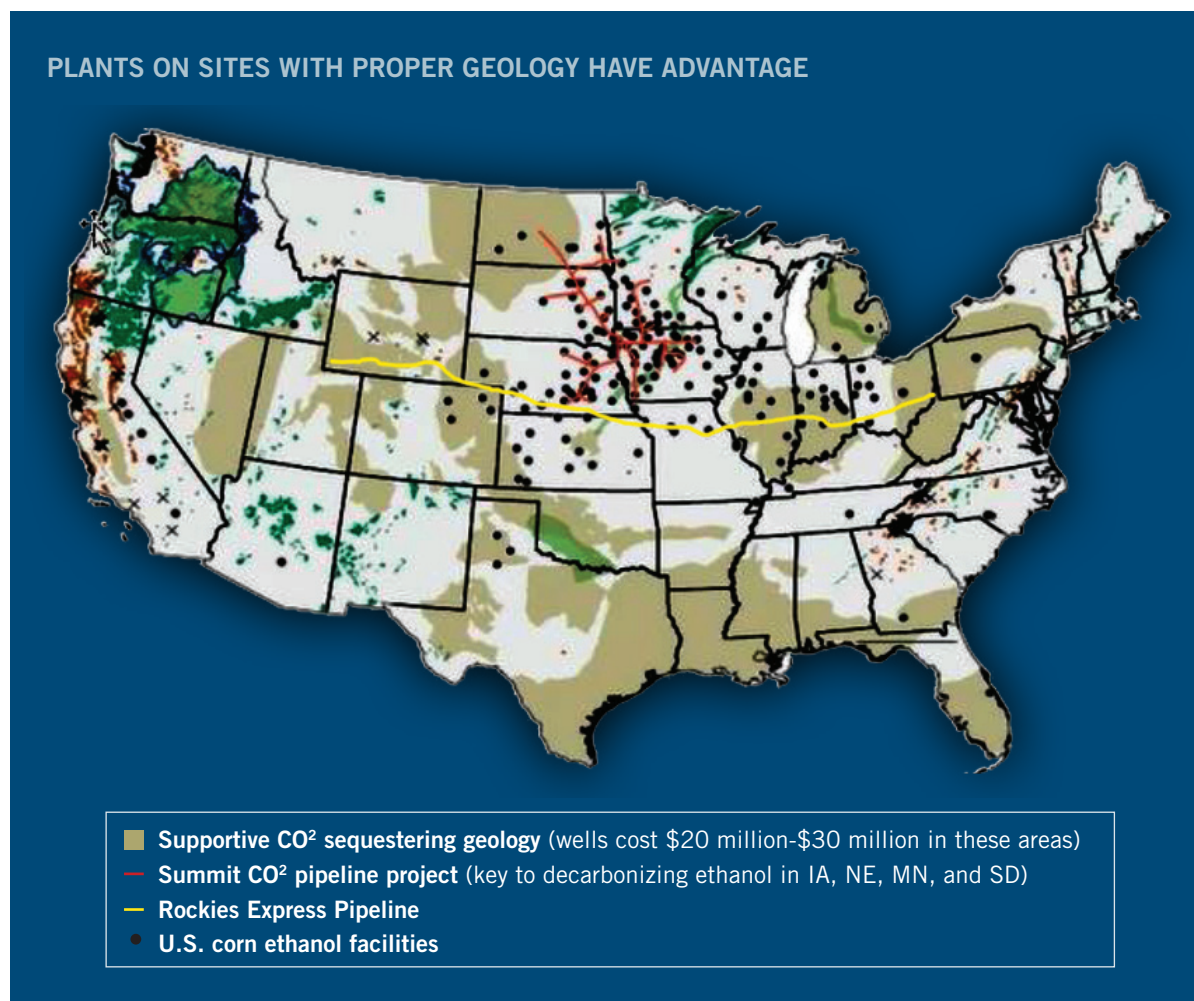


Source: Bloomberg

## POLICY IMPACT

### Advantage goes to ethanol plants with proper geology or CO<sup>2</sup> pipeline access

Section 45Q of the IRA provides tax credit for qualified carbon oxide (CO<sub>x</sub>) captured and either securely stored in underground geological formations or reused for specified purposes. Currently, 45Q credits are available to a qualifying carbon capture, utilization and storage project for 12 years, beginning when the equipment is placed in service. Ethanol plants in regions with the geological capability to store CO<sub>x</sub> underground will have higher profit possibilities than those depending on approvals of the Summit Carbon Solutions Pipeline (shown in red). The Trailblazer Pipeline Company plans to convert a natural gas pipeline to a CO<sub>2</sub> pipeline through regions of Nebraska, Colorado and into Wyoming. Ethanol producers can obtain lower carbon intensity score feedstocks to qualify for 45Z if the updated GREET life cycle analysis adequately accounts for the emission reductions for on-farm practices. Ethanol plants cannot stack 45Q and 45Z tax credits to capture higher payments. ■



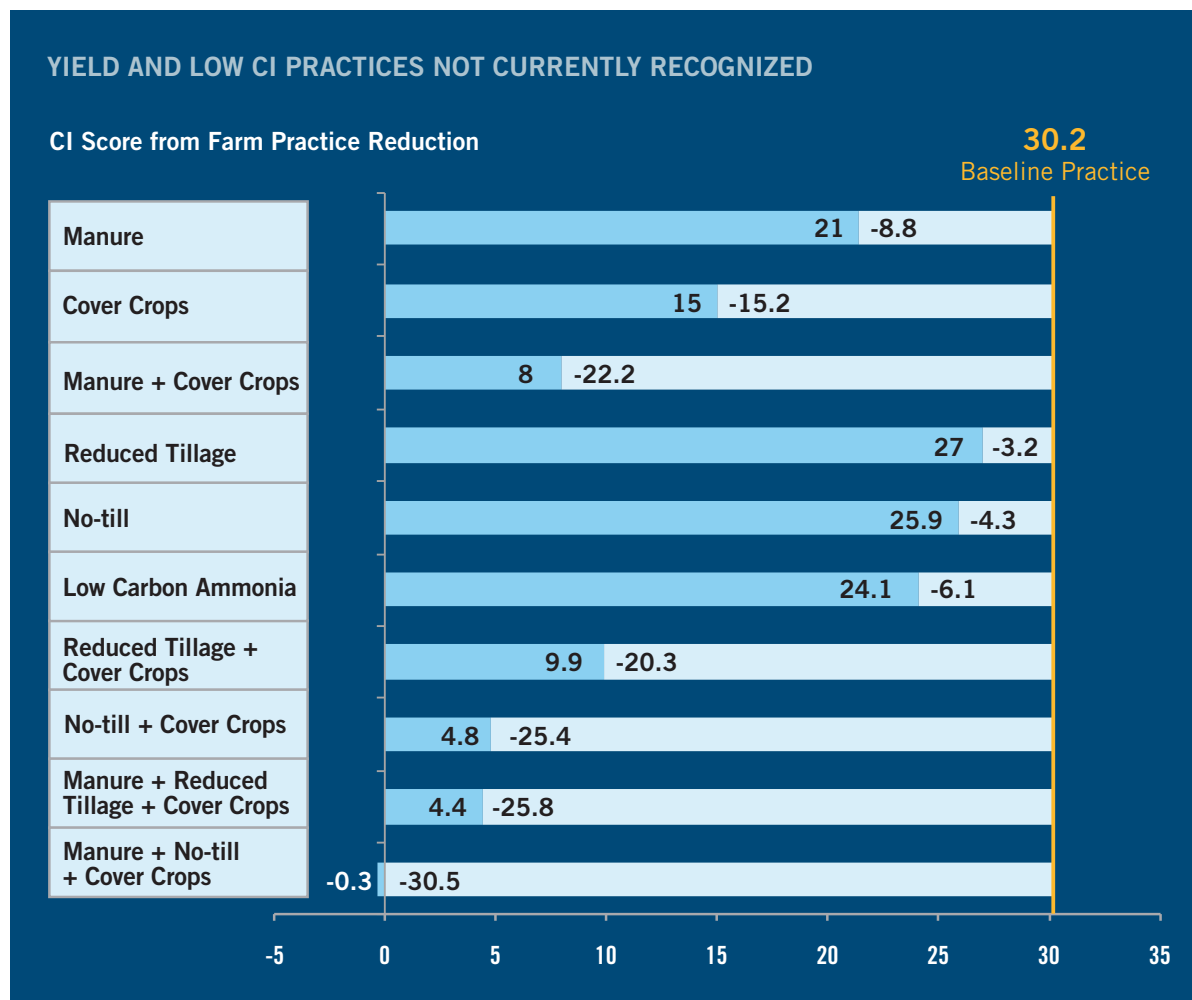
Source: CF Industries



## FARMER VALUE

### Farmers need CI scores that reward them for climate-smart practices

The 40B tax guidance offered a mere 10-point reduction for corn producers if the farm implemented cover crops, reduced tillage or no-till and nitrogen efficiency products. Continuum Ag has scored over 330 million bushels of U.S. crops and found that the average CI score reduction is 18 points across those 1.7 million acres assessed. This could create an average value of \$1.04/bu. in 45Z credits and a sharable value of more than \$200/acre. An updated GREET model is expected with future 45Z guidance. The delay of the finalized GREET model ahead of the January 2025 potential start date brings more uncertainty for farmers to make farm input and conservation decisions for their 2025 crops. The National Corn Growers Association and American Soybean Association estimate acknowledging the benefit of individual climate-smart agricultural (CSA) practices in 45Z would allow 70% of acres for corn and soybeans to be eligible, compared to less than 20% eligible for 40B CSA credits. Avoiding a bundled approach will also allow farmers in all regions to make decisions best suited to their farms and individual soil types to lower overall emissions. ■



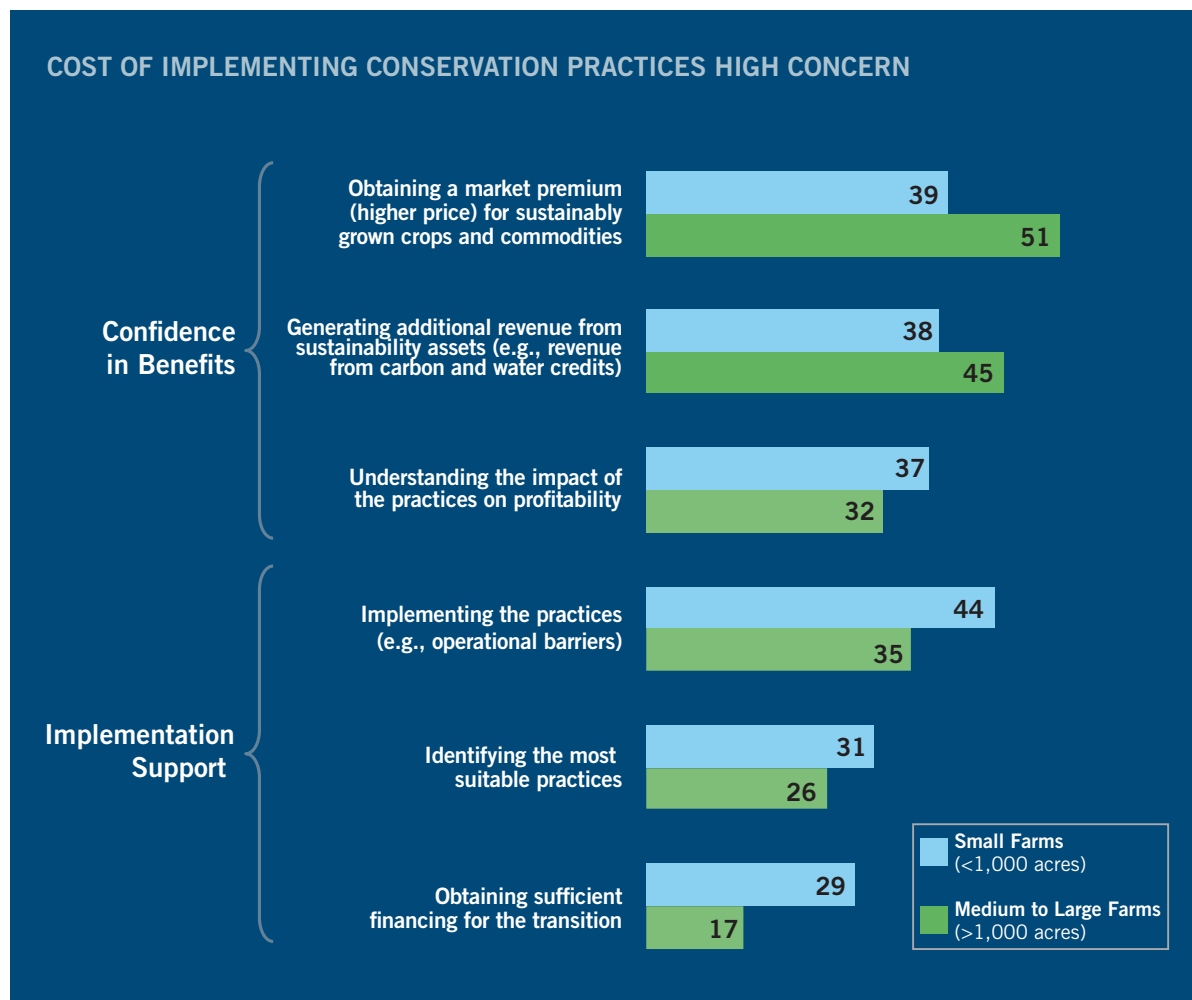
Source: EcoEngineers



## FARMER VALUE

### Conservation cost limits farmer adoption

The 45Z tax incentive will be paid directly to fuel producers. Without a verified premium or additional revenue option, farmers may not choose to adopt conservation practices that can help producers lower their overall emissions. A McKinsey survey finds that 90% of farmers are aware of sustainable-farming practices, but holistic adoption remains low as farmers seek more operational and financial support<sup>5</sup>. For both small and medium to large farms, the greatest obstacle is obtaining a market premium for sustainably grown crops and generating additional revenue from sustainability assets. McKinsey’s research finds that while more than 68% of farmers surveyed have adopted reduced- or no-till practices, only about half are using variable-rate fertilizer application and 35% are using controlled-irrigation practices. If the full credit value for 40B were passed back to farmers, it would equal \$3.46 for a typical soybean acre and \$21.29 for a typical corn acre, NCGA and ASA estimate<sup>6</sup>. This is unlikely to offset implementation costs for on-farm sustainable practices without additional economic incentives for producers. ■

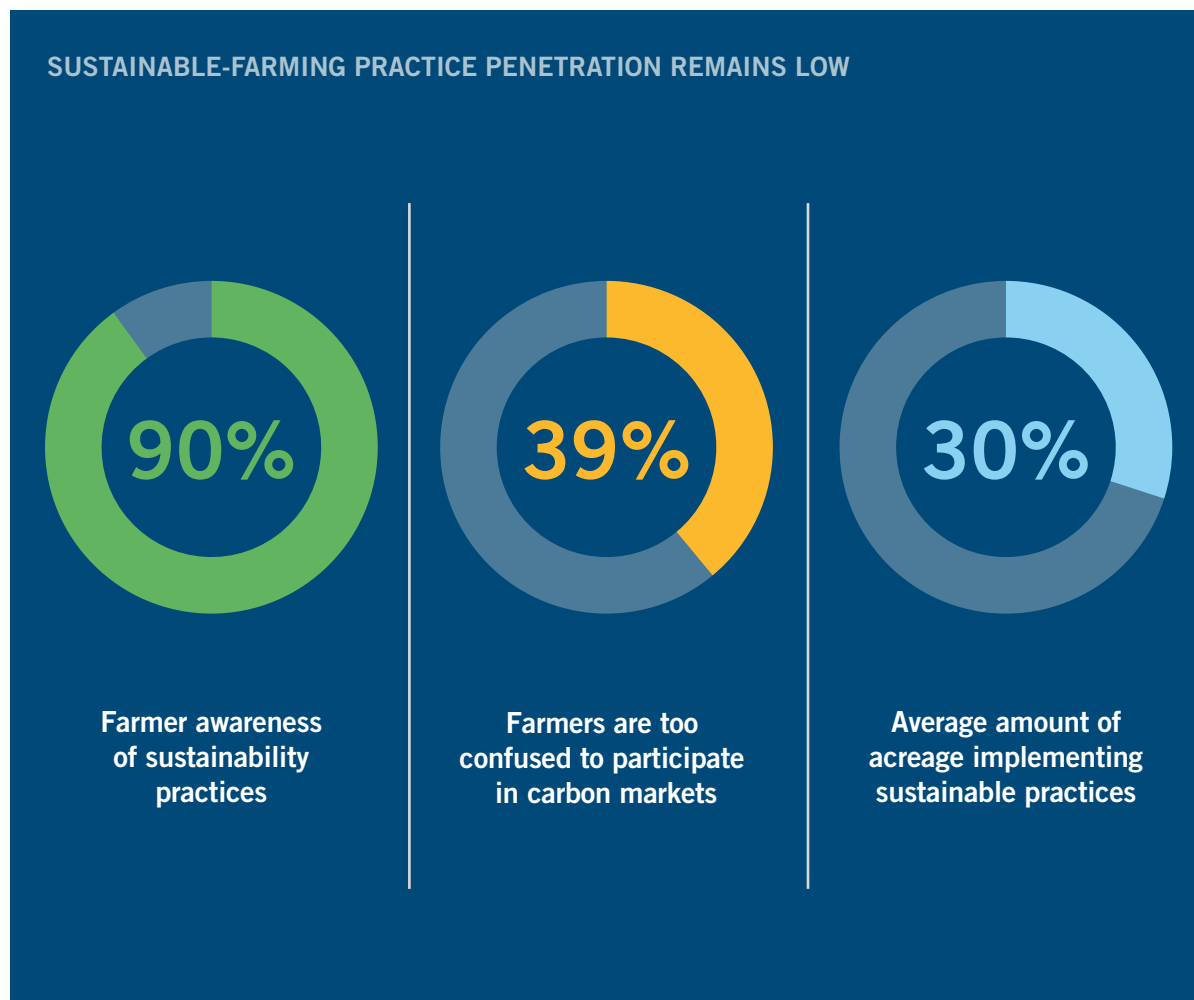


Source: McKinsey U.S. Farmer Pulse Survey 2023-24 (n=485)

## FARMER VALUE

### Ag retailers can offer farmers a trusted voice

Ag retailers can play an important role in educating their customers about sustainable practices that provide both environmental and economic advantages. Federal conservation dollars have increased, but the Natural Resources Conservation Service lacks the manpower to offer needed technical expertise to farmers. Ag retailers' agronomists on staff can help provide a trusted voice to assist in educating farmers on the decisions that include wider adoption of conservation practices. Many conservation practices have additional ancillary benefits such as reduced chemical applications, improved water retention, and fewer tractor passes. Non-government organizations and foundations can dedicate dollars to directly fund agronomists as with the partnership between the Iowa Soybean Association, Clean Waters Alliance and the Keith Campbell Foundation for the Environment. Additional public-private partnerships can help farmers remain profitable and offers a value proposition for retailers to push greater adoption of climate-smart agricultural practices at a larger scale. ■



Source: McKinsey U.S. Farmer Pulse Survey 2023-24 (n=485)

## Conclusions

- The SAF Grand Challenge of 3 billion gallons by 2030 can feasibly be met with current or planned RD and SAF plants, but additional incentives are needed to shift to greater SAF production while maintaining RD growth needs.
- Tax updates required in 2025 may also need to extend current three-year tax incentives for a longer period such as 10 years to provide additional certainty for investors.
- Airlines have been reluctant to issue longer-term offtake agreements as costs for producing SAF could make them uncompetitive to competitors with lower SAF use.
- Incentives for farmers are inadequate to encourage adoption at the farm level of climate-smart agricultural practices.
- Ag retailers can be a trusted voice in helping farmers navigate carbon intensity-based markets and new revenue streams both on the farm and at the ag retailer level.
- Although promises have been given on issuing final 45Z guidance ahead of the end of the year, it is more likely it may drag into 2025 creating more uncertainty for farmers' planting decisions for 2025 and beyond.

## References

- <sup>1</sup> *Economic Impacts of the U.S. Renewable Fuel Standard: An Ex-Post Evaluation* <https://www.frontiersin.org/journals/energy-research/articles/10.3389/fenrg.2022.749738/full>
- <sup>2</sup> [https://biomassboard.gov/sites/default/files/2024-09/safgc-metrics-factsheet-web-sep-2024\\_r1.pdf](https://biomassboard.gov/sites/default/files/2024-09/safgc-metrics-factsheet-web-sep-2024_r1.pdf)
- <sup>3</sup> <https://rmi.org/unraveling-willingness-to-pay-for-sustainable-aviation-fuel/>
- <sup>4</sup> <https://www.mckinsey.com/industries/agriculture/our-insights/voice-of-the-us-farmer-2023-to-24-farmers-seek-path-to-scale-sustainably>
- <sup>5</sup> <https://ncga.com/stay-informed/media/the-corn-economy/article/2024/07/qualifying-acres-in-the-40b-conservation-programs>

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