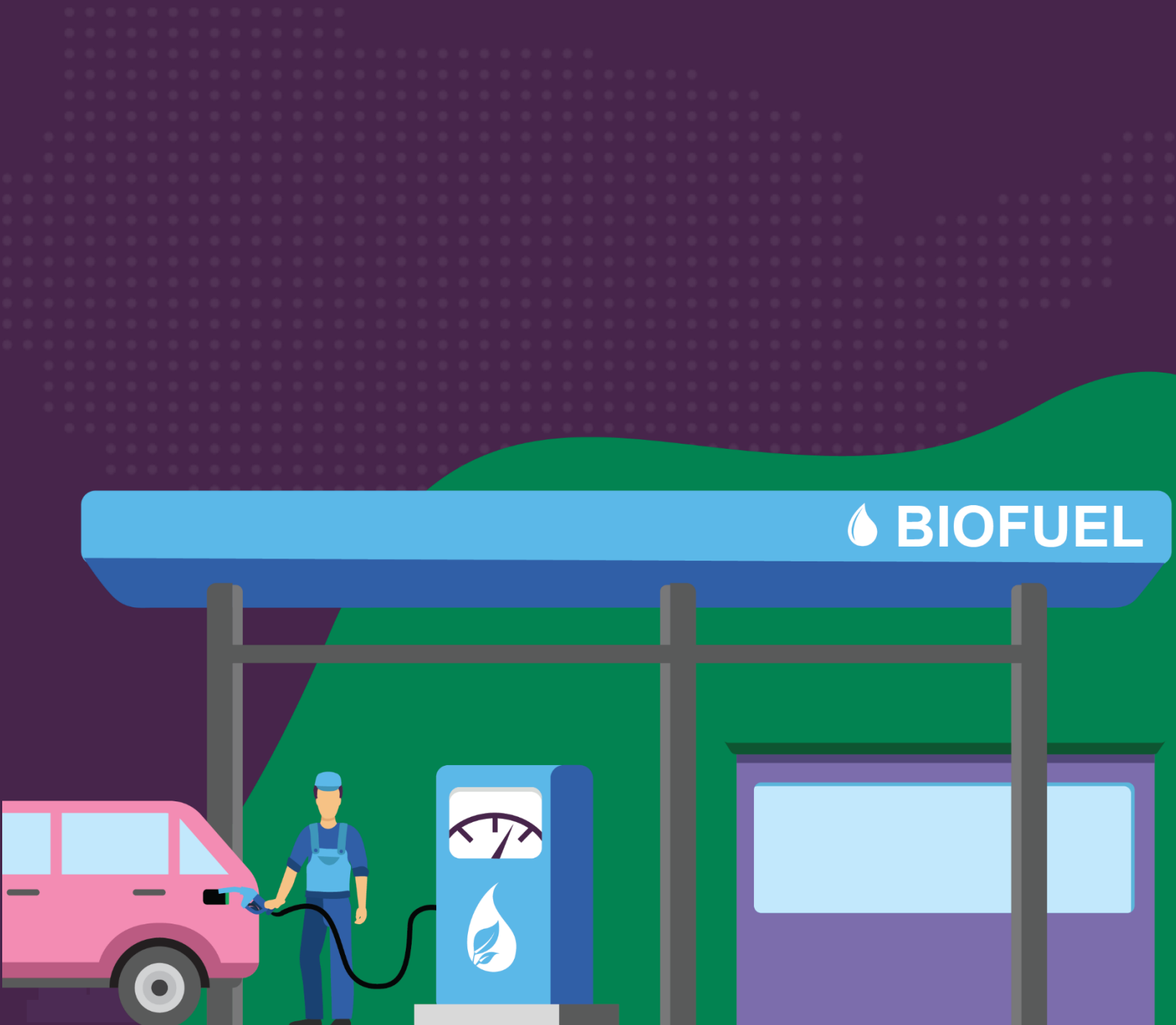


Will biofuel mandates help the U.S. achieve its goal to be a net zero emissions economy by 2050?



Will biofuel blending mandates have positive or negative impact on the U.S.?



On April 22, 2021, United States President Joe Biden made a remarkable, if ambitious, announcement. Contrary to the previous Trump administration's climate change denial, Biden has said that the government will cut America's greenhouse gas (GHG) emissions 50 to 52 percent from their 2005 levels within this decade. Biden views this challenge as an economic opportunity, calling for innovators to look at creating union jobs through it. Bioethanol, which is made from America's largest crop, corn, may or may not play a critical part of this "economic imperative". Can Ethanol blended into gasoline serve only as a near-term solution or does it offer a longer-term solution considering increasing green options?



Biden had been speaking of backing and even strengthening biofuel mandates as part of the proposed policy change during his presidential campaign. His recent announcement comes after a year that witnessed demand for conventional as well as renewable fuels drop due to the ongoing COVID-19 pandemic and resulting shutdown or slowdown across industries and businesses. More recently, gasoline prices have averaged above \$3 per gallon for the first time since 2014.

Unknowns

Increasing Ethanol demand will spur corn agriculture growth. How significantly will this impact biodiversity, water acidification and other elements of the environment?

Policy differences

President Donald Trump, through waivers during his tenure, had nearly quadrupled the exemptions granted to oil refiners of blending biofuels into their oil-derived fuel products.

These waivers had negatively affected the sentiment among the corn-producing Farm Belt. Subsequently, in late 2020, Trump ordered the U.S. Environmental Protection Agency (EPA) to deny 54 such requests received by the Department of Energy.

The waivers, according to the corn lobby, only served to undermine the demand for corn-based Ethanol at a time when farmers had already been reeling from Trump's trade war with China. The oil and corn lobbies, both deep-pocketed, have had different takes on the biofuel blending mandates in the United States.

While Trump's supporters had always championed him as being farmer-friendly, the waivers to oil companies chipped away at that impression. As for President Biden, he was seen as the "big unknown" by farmers and Ethanol producers for his use of the term "advanced biofuels" on the campaign trail. The phrasing, to them, hints at supporting the cause of next generation alternative fuels that are still in early stages of development, rather than traditional corn starch-based Ethanol, a first-generation biofuel.

Their fears may not have been far from the truth, however. Biden's April 22 statement also mentions that his administration will pledge to make America carbon emissions-neutral, economy-wide by 2050. This would indicate a rather steep uptake for electric vehicles (EVs) and possibly some high-efficiency biofuel-powered vehicles. EVs have been part of Biden's focus.

Most recently, it has been reported that the US EPA's blending mandates for the current and next years are likely to stay in line with those of 2020. This may offset the lower overall fuel demand resulting from the coronavirus pandemic, as against the blending mandates, according to which oil companies need to increase the volumes of biofuel being blended each year.

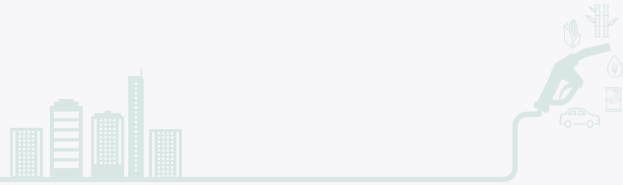
For the 2020 compliance year, the mandated target for refiners was to blend 20.09 billion gallons of renewable fuels into the nation's fuel mix. Of this, conventional biofuels such as Ethanol constituted 15 billion gallons, while the rest included other forms of biofuels including biomass-based diesel, cellulosic biofuels, and advanced biofuels.



Unknowns

What are the comparative environmental and economic impacts of the lifecycle of an Ethanol-gasoline powered vehicle as compared to an EV?

Role of RFS

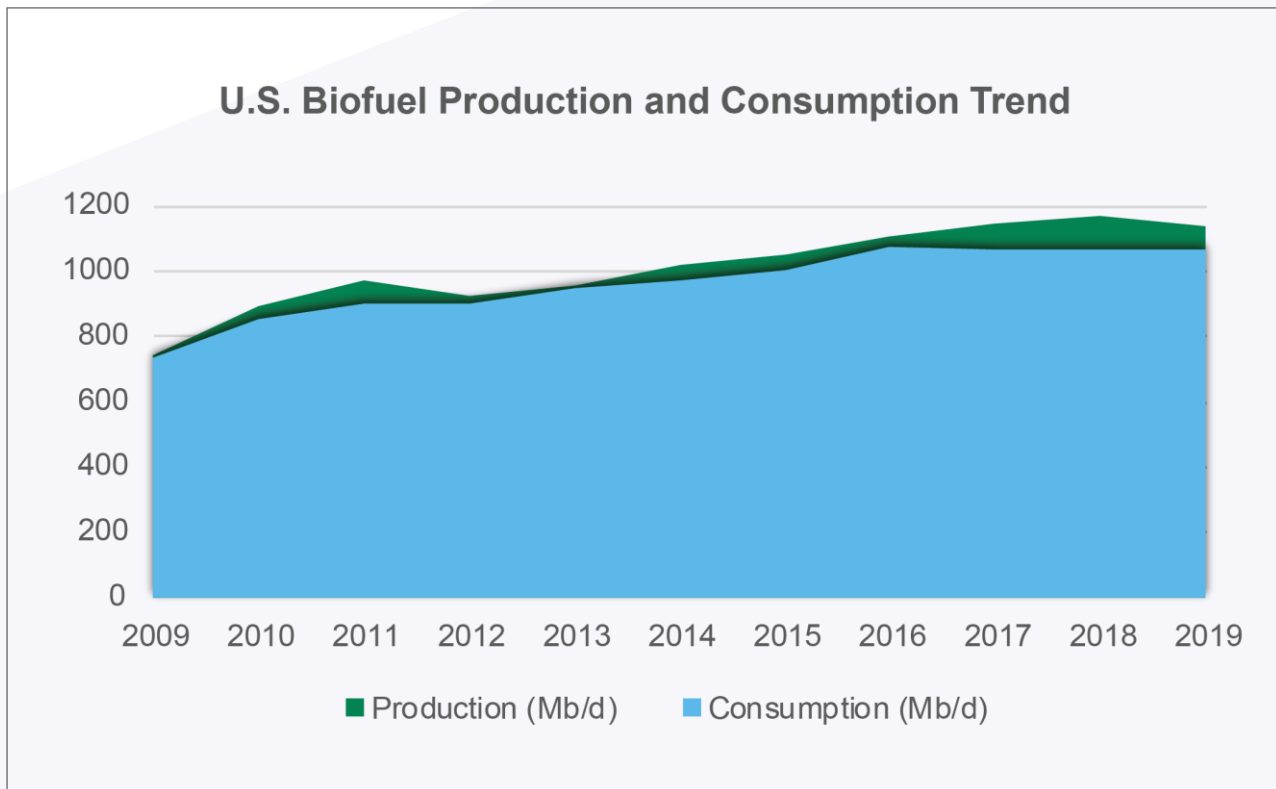


One of the biggest concerns for players in this space remains the Renewable Fuel Standard (RFS). The biofuel blending mandate and other policies supporting it are a result of the RFS, which was first constituted in 2005.

Its mandate prescribes the addition of primarily Ethanol into petroleum gasoline in 10, 15 and up to 85 percent blends - E10, E15 and E85. Of these, E10 is the most common blend. Similarly, biodiesel blends are available in the range of B5, B7, B10, B20, and B99 added to petroleum diesel, apart from B100 which is pure biodiesel. B5 is the most common blend found in the U.S. and its use is even mandated in several states.

The RFS has only outlined quotas for annual biofuel blend targets through 2022. So, unless lawmakers constitute a new policy, the EPA will be empowered to call the shots on annual biofuel-gasoline blend quotas from 2023 - a cause of uncertainty and concern for both oil and corn lobbies.

Ethanol consumption



source: [U.S. EIA](#); Mb/d = Thousand barrels per day

Getting back to the blending mandates, the E10 fuel mix remains the most common as it is an acceptable fuel for most gasoline-powered motor vehicles built since 1990 and newer, according to the Clean Air Act, 1990. This mandate was later amended to include the E15 fuel mix only for cars and light duty vehicles built in 2001 or newer. However, the latter did not catch on as well as E10.

The higher blend E15 was introduced in the U.S. market in 2011. Due to the EPA regulations surrounding its year-round use, the E15 blend could not be sold during a 3.5-month period starting June, each year. In addition, some car manufacturers had also initially informed their customers that using E15 in their gasoline vehicles would void the vehicle's warranty, further discouraging its use. While this stance has since changed and many OEMs now support use of E15 in their vehicles, the earlier discouragement it brought to E15 consumption has been slow to fade.

Making E15 fuel available year-round was part of the Trump administration's agenda in 2018. With no restrictions in E15 sales during summertime for a change, the Renewable Fuels Association (RFA) claims to have had an increased E15 annual sales volume in the year 2019, estimated at about 450 million gallons. Trade association Growth Energy states E15 sales were 46 percent higher than 2018 numbers. Meanwhile, more than 98 percent of the gasoline sold in the U.S. typically contains Ethanol in the E10 blend. According to U.S. Energy Information Association (EIA) estimates, in 2020, the country consumed 123.49 billion

gallons of finished motor gasoline which contained about 12.63 billion gallons of fuel Ethanol, just around 10% of the total volume.

To distinguish between regular gasoline, E10 and E15, we can use their octane ratings, which indicate the fuel's ability to ignite and burn cleanly through the engine's combustion stage. Regular gasoline has an average octane rating of 84, which is augmented to 87 with E10, while E15 increases this to 88. Both, E10 and E15, are categorized as low-level Ethanol blends.

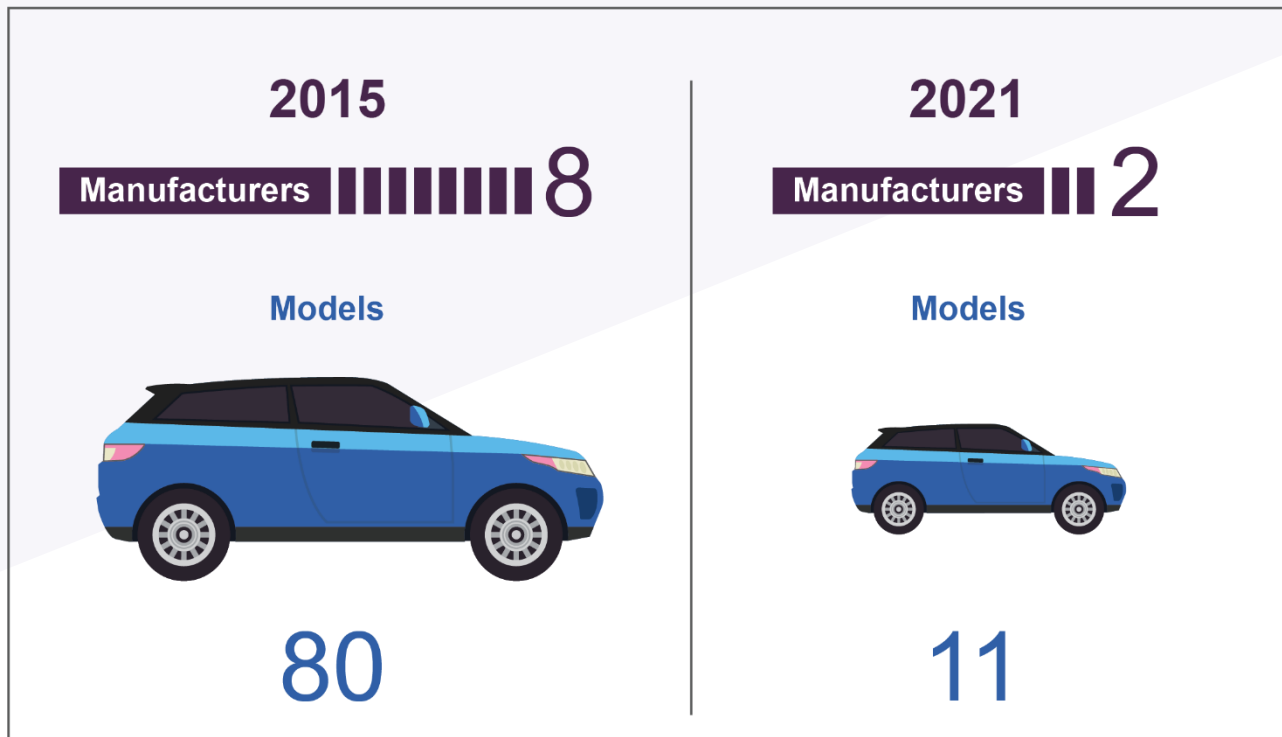
However, EIA states that the energy content of Ethanol is 33 percent less than pure gasoline. The impact of an Ethanol blend on the fuel economy of an engine, can vary depending on the amount of denaturant added to the Ethanol. Typically, Federal law dictates 2 percent of the Ethanol volume be denaturant to make it unfit for human consumption. This denaturant contains about the same energy content as pure gasoline. On average, EIA estimates that fuel economy of a vehicle running on E10 is 3 percent lower than it is on pure motor gasoline.

Unknowns

What are the areas within the Ethanol fuel value chain where smart solutions could be applied to streamline supply and hence facilitate higher demand?

Outlook

FFV Models on Offer



The RFA in its report, '[2020 Ethanol Industry Outlook](#)' has also stated that they will push for the adoption of mid-level blends including E25-E30. However, not all vehicle manufacturers in the U.S. have approved any Ethanol blend beyond E15 for their complete vehicle line-ups for

2021. Hence, any higher Ethanol blend fuel usage is currently limited to vehicles categorized as flex fuel vehicles (FFVs). These FFVs can safely use Ethanol blends up to E85.

At the same time, FFVs made and sold by all car manufacturers in the U.S. for the model year 2021 have been reduced to 11 in all, of which 5 are fleet-only vehicles. This number has steadily declined from the 80 FFV models sold by various manufacturers in 2015. The decreasing models may be attributed to fewer gas stations offering the higher blend fuels as well as to the increasing number of green vehicle options. There has been an exponential growth in the number of battery electric vehicle (BEV), hybrid electric vehicle (HEV) and plug-in hybrid electric vehicle (PHEV) models being offered by carmakers over the same period. The market has also witnessed the advent of fuel-cell electric vehicles (FCEVs).

To sum up the situation, the E15 blend can be considered the new “blend wall” for the U.S. at present. Of the estimated 180,000 gas stations across the U.S., approximately 2,000 sell E15 and 5,000 sell E85. One major reason for the disparate numbers is that being non-compliant with many vehicles, fuel stations selling the higher blends need to monitor that customers do not fuel up on the wrong mix. Storage, transport, and dispensation of the biofuel cannot be carried out using methods which are a standard for its petroleum counterparts.

Even looking at overall numbers for 2020, the EIA estimates motor gasoline consumption was 8.03 million barrels per day (approx. 337 million gallons), which constitutes about 44 percent of total U.S. petroleum consumption. Whereas all biofuels (ethanol, biodiesel, others) as part of total motor gasoline and diesel consumption accounted for less than 10 percent.

To add to this, EIA’s projections in its report, ‘Annual Energy Outlook 2021’, do not show the biofuel share moving upwards beyond 15 percent till 2050, even in optimistic use cases. In the same charts, biofuel share is not projected to rise to more than 10 percent of the total by 2030.

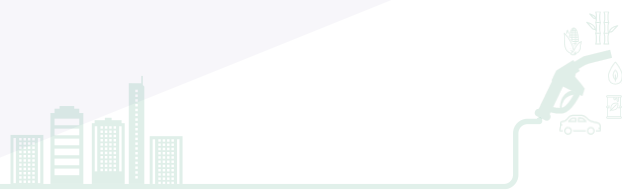


Unknowns

Can the current E15 “blend wall” be overcome to increase uptake of higher Ethanol blends including E25, E30 and others? How?



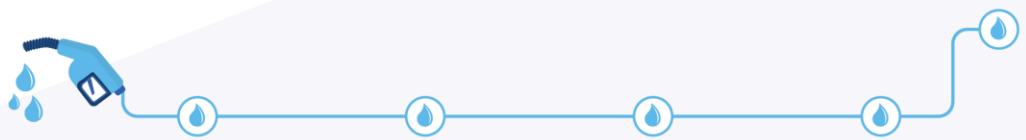
Global Mandates



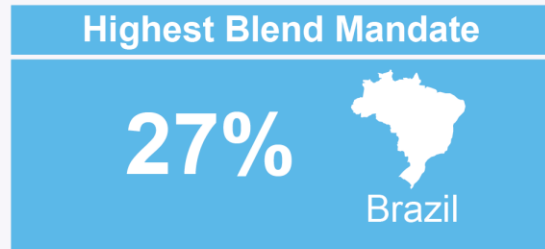
The transition towards net carbon emissions neutrality has led to various standardised shifts across geographies, among which measures are biofuel blending mandates. The EU has the most participating countries with such mandates at 27, while 14 nations across the Americas have them, followed closely 12 in the Asia-Pacific region, 11 in Africa and the Indian Ocean, as well as 4 non-EU European countries.

The US and EU are top global drivers for demand based on their Ethanol blending mandates, while Brazil, India, Malaysia, and Indonesia have high biodiesel blend targets. Most recently, on World Environment Day, India brought forward its target to achieve a 20 percent Ethanol-gasoline blend nationwide by 2025, revised from the earlier target year of 2030.

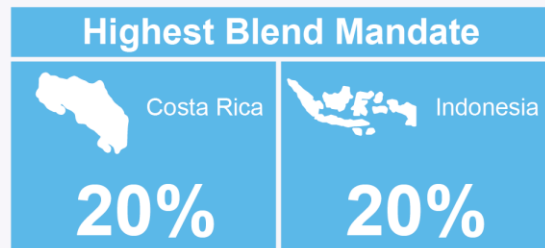
Highest Biofuel Consumers and Mandates



Bioethanol



Biodiesel



Summary



Factors including a strong pushback from the oil lobby have curtailed the widespread uptake of Ethanol-blended fuels beyond what is regulated by the EPA and mandated as per the RFS. Refiners also have the option to buy excess biofuel blending credits, known as Renewable Identification Numbers (RINs) from others in the value chain to meet the overall blend target. A report states that the value of these RINs has risen 18 times, or almost 1,800 percent, since January 2020, making them the second highest expense for oil companies, trumped only by the actual cost of crude oil.

At the same time, the purchase of these credits as well as biofuel blending adds roughly 23 cents to the price of each gallon of wholesale gasoline, claims body American Fuel &

Petrochemical Manufacturers (AFPM). This has driven up fuel prices over the past year, according to them. There may be a break for them, if the blend mandate targets for 2021 and 2022 are not increased, but that would be a momentary relief at best.

Meanwhile, the corn lobby has been fighting for stronger incentives from the administration for increasing the popularity and demand for the biofuel. But a study by the University of Illinois finds the net environmental costs for maintaining the corn ethanol mandates including affecting land use, nitrogen application, leakage of nitrogen compounds into soil, air, and water, appear higher than its social benefits. And, on economic costs, the study finds that compared to having no RFS, the cumulative net cost of the corn ethanol mandate from 2016 to 2030 would be \$200 billion.

In the end, with President Biden's call for a big cut in GHG emissions by 2030, the case for rapid development of more energy-efficient and environmentally safer second and third generation biofuels, including cellulosic ethanol, as well as that for more advanced EVs might prove stronger.

Unknowns

What makes the blending process of Ethanol with gasoline so expensive and what are the solutions to economize its supply, storage, and dispensation systems?

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