WORLD RESOURCES INSTITUTE

EPA's New Renewable Fuel Standard Will Increase Global Carbon Emissions — Not Lower Them

July 3, 2023 By **Dan Lashof** Cover Image by: adamkaz/iStock

Commentary

Topic **Climate** *Region* **North America**

When it comes to clean fuel for transportation, the EPA has taken a wrong turn.

On June 21, 2023, the U.S. Environmental Protection Agency established new Renewable Fuel Standards (RFS) for 2023-2025. The rule, intended to lower greenhouse gas emissions from transportation while reducing reliance on foreign oil, will require increased use of "renewable fuels" in coming years — specifically, biofuels produced from crops, such as corn ethanol and soy biodiesel.

But, unlike when the RFS was originally created in 2007, it's now clear these fuels are not the answer to decarbonizing transportation. In fact, strong evidence shows that the RFS is set to *increase* carbon emissions — not reduce them — while hindering food production.

The New RFS Builds on Faulty Assumptions

When Congress first set renewable fuel volume targets in 2007, under the Energy Independence and Security Act (EISA), it expected that new technology would make ethanol from agricultural waste and other cellulosic (woody) materials the primary source of biofuels by 2022. Compared to crop-based options, these and other "advanced" biofuels can have a significantly lower environmental impact to the extent that they don't compete for prime farmland which could be used for food or require damaging inputs such as fertilizer and pesticides.

However, the shift didn't happen. EISA mandated consumption of 16 billion gallons of cellulosic biofuels in 2022, but the technology did not come to fruition as hoped. Less than 1 billion gallons of qualifying cellulosic biofuel was produced in the form of gaseous fuel — mostly methane from landfills and manure — used in compressed natural gas vehicles. And the supply of cellulosic ethanol was zero gallons, forcing EPA to use its authority to waive the requirement.

Consumption of corn ethanol, by contrast, did rise to meet RFS targets. Corn ethanol use was just under 14 billion gallons in 2022, close to the implied Congressional target of 15 billion gallons of conventional biofuels. (EISA mandated an overall target of 36 billion gallons of renewable fuel by 2022, of which 21 billion gallons was supposed to be cellulosic and other "advanced" biofuels, not including ethanol made from corn starch.) Almost all gasoline now contains 10% ethanol (E10), with small amounts containing 15% (E15) or 85% (E85), resulting in ethanol making up 10.4% of total gasoline consumption.

This reliance on crop-based biofuels comes with real consequences.

Biofuels produced from crops require a large amount of land for fuel production. Today, 60 million acres of U.S. farmland — almost 25% of the total area planted in the United States — is being used to produce fuel. This amount of land dedicated to fuel production harms the climate and consumers as the growing global land squeeze threatens food security. At the same time, overall demand for gasoline and ethanol is set to decline as electric vehicles (EVs) replace internal combustion engine vehicles (ICEVs). We now know that electrification, not biofuels, is the path forward to eliminate emissions from road transportation.

A tractor sprays a large corn field with insecticide. About one-quarter of all U.S. farmland is used to produce crop-based biofuels, which increases pressure on food systems and requires harmful inputs such as fertilizer and pesticides. Photo by Bim/iStock

How Increased Biofuel Requirements Will Drive Higher Emissions

Despite these realities, the RFS mandates an increase in overall renewable fuel consumption from 19.3 billion gallons in 2022 to 22.3 billion gallons in 2025. Fuel suppliers are expected to blend about 10% ethanol into gasoline, with or without the RFS, because doing so supplies needed levels of octane and oxygenate. As a result, EPA

does not expect the RFS to substantially increase corn ethanol consumption over the next three years; it is effectively capped at 14 billion gallons.

Given that ethanol consumption is not expected to rise significantly, how will fuel suppliers comply with the new RFS mandate? The answer is primarily by increasing the use of soybean oil to produce diesel fuel.

The tragedy is that diverting soybean oil from the food supply to produce fuel is even more problematic than diverting corn. Soybean and other vegetable oils (such as canola and palm) are in high demand globally for everything from food to cosmetics as well as fuel. Their production causes significant forest loss and carbon emissions worldwide; for example, palm oil plantations are a major driver of deforestation in Indonesia while soybean production causes extensive deforestation in Brazil.

This means increased carbon emissions from land-use change, driven by higher soybean demand for biofuels, could outweigh the benefits of reduced fossil fuel use. And yet EPA based the RFS rule on an assumption that using soybeans grown in North America for fuel would not significantly impact forests. This defies logic: **Because vegetable oil markets are linked globally, increased demand for vegetable oil anywhere increases deforestation pressure everywhere.**

A large swath of the Amazon rainforest cleared for a soy farm. Increased reliance on soy biodiesel and other crop-based biofuels will likely lead to an increase in carbon emissions driven by land-use change. Photo by Frontpage/Shutterstock

EPA does acknowledge this risk to some extent. The rule cites an emissions range of 1.9-11.8 kilograms of CO2-equivalent per gallon of soybean-based biofuel (kgCO2e/gal), compared to 11.4-12.7 kgCO2e/gal for petroleum diesel.[1] However, these ranges greatly underestimate the likely emissions impact of the new RFS.

The emissions estimates used to justify the RFS do not include a separate model comparison exercise that EPA published alongside the final rule. That analysis used three separate models to estimate the net effect of an increase in soybean biofuel consumption, considering both vegetable oil and petroleum market dynamics. Two of the three models show significant net increases in greenhouse gas emissions, primarily due to deforestation to make way for soybean production, while only one showed a net emissions decrease.

The differences are stark. On the high end, EPA estimates that soybean biofuel could emit about three times as much carbon as petroleum diesel per gallon. And other

analyses have yielded similar results — including a more straightforward approach which measured the "carbon opportunity cost" of biofuels by comparing the impact of dedicating land to their production against the alternative of using that same land to sequester carbon through reforestation.

EPA provides no justification for not considering this carbon opportunity cost calculation or its own model comparison results in setting the renewable fuel standard volume requirements for 2023-2025.

Estimating the Carbon Cost of the RFS

EPA's Model Comparison Exercise Technical Document reports results of a study in which three global economic and land use models (ADAGE, GCAM and GTAP) were used to estimate the impact of a hypothetical increase in soybean biodiesel demand by 1 billion gallons per year. Both ADAGE and GCAM show a net increase in greenhouse gas emissions driven by land-use change from increased soybean production. The ADAGE model estimates a net increase of 35.5 kgCO2e/gal, dramatically higher than any estimates cited in the rule itself. The GCAM model projects a more modest, but still significant, net increase in emissions of 5.4 kgCO2e/gal. Only GTAP shows a net decrease in emissions, of 5.4 kgCO2e/gal, which is more in line with the carbon intensity range cited in the rule.[2]

Given the complexities and uncertainties inherent in global economic and land-use modeling, some researchers have proposed a more straightforward approach based on the carbon opportunity cost of dedicating prime farmland to biofuel production. The idea is that to the extent farmland is not needed for food production, it could be used to sequester carbon through reforestation. If the land is instead dedicated to biofuel production this opportunity is foreclosed, which should be considered a "carbon cost" of biofuel production. This approach yields a carbon opportunity cost of 36.6 kgCO2e/gal for soybean biodiesel, similar to the land-use emissions estimate from the ADAGE model (38 kgCO2e/gal).

Low-carbon Alternatives to Crop-based Biofuels

There's no reason the RFS should dedicate millions of acres of prime farmland to produce fuel for polluting vehicles when a much better solution exists: electric vehicles powered by clean energy.

While all energy projects require land, generating renewable energy for EVs is dramatically more efficient and less carbon-intensive than producing crop-based biofuels. For example, even if prime farmland is dedicated to solar panels to power an

EV, the carbon opportunity cost per mile is hundreds of times lower than using crop-based biofuels to power an internal combustion engine vehicle. That's because solar panels capture more than 100 times as much useable energy per acre as crops do and because EVs are more than 3 times as efficient at converting that energy into mobility as ICEVs. Moreover, solar projects can be sited to avoid prime farmland and solutions like agrivoltaic systems — which incorporate crops and solar panels on the same land — can be used to further reduce their carbon opportunity cost.

Finally, the United States could be focusing more heavily on biofuels that have much lower, or even negative, carbon opportunity costs. For example, diesel fuel made from waste fats, oils and greases (think of a hippie running their VW bus on used French fry oil, but on a massive industrial scale) does not require additional farmland. Using biogas captured from landfills also doesn't require additional land and it can avoid methane emissions that would otherwise occur, resulting in a negative emissions fuel. These sources, however, account for only about 2 billion gallons of renewable fuel out of the more than 20 billion gallons required by the RFS. In the future, additional negative emissions biofuels could be produced by focusing on agricultural waste. For example, corn stover (the stalks, leaves and cobs that remain in the field after corn harvest) could be converted to negative emissions hydrogen if the CO_2 produced in the process were captured and permanently sequestered.

A Better Way to Move Forward

The Renewable Fuel Standard has not panned out as expected since 2007, when Congress mandated the use of increasing volumes of cellulosic biofuels through 2022. Now that the original targets are no longer in effect, the United States needs to change gears.

Congress should replace the RFS with a technology-neutral low-carbon fuels standard that requires reductions in total greenhouse gas emissions from the transportation sector, including the carbon opportunity cost of land dedicated to fuel production. That would create proper incentives to use clean electricity and waste biomass instead of

crop-based biofuels. In the meantime, EPA should set volume targets under the RFS that don't risk making the climate crisis worse.

The future will not be propelled by corn or soybeans. It's time to rededicate our farmland to feeding people — not fueling vehicles.

1 Converted from grams of CO2-equivalent per megajoule of fuel reported in the rule, using 135.6 megajoules per gallon of diesel fuel on a lower heating value basis. 2 Converted from kilograms CO2-equivalent per million British Thermal Units reported in the Model Comparison Exercise Technical Document.

Relevant Work

CLIMATE

STATEMENT: U.S. EPA Increases Crop-based Biofuels Mandate in Renewable Fuel Standard, Hampering Climate Action

News JUNE 21, 2023

FOOD

How to Manage the Global Land Squeeze? Produce, Protect, Reduce, Restore

Insights JULY 20, 2023

CLIMATE

Why Dedicating Land to Bioenergy Won't Curb Climate Change

Insights JANUARY 28, 2015

FOOD

The World Is Growing More Crops — but Not for Food

Insights DECEMBER 20, 2022