



## A Decade of Futility: The Renewable Fuel Standard, 2007-2017

---

Sheila Karpf  
Jonathan Lewis

---

### Overview

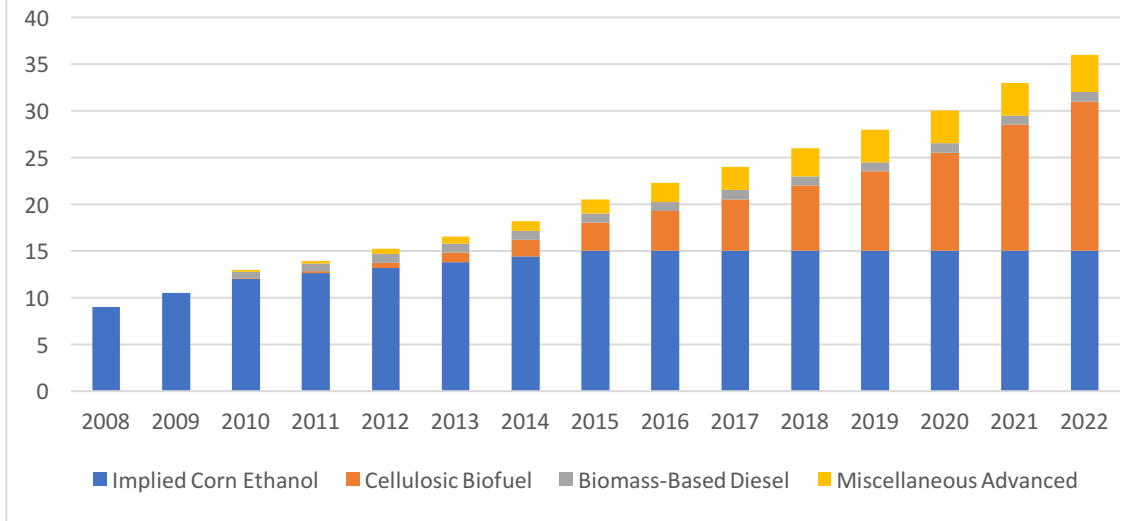
Ten years ago, on December 19, 2007, President George W. Bush signed the Energy Independence and Security Act (EISA) into law. EISA greatly expanded the Renewable Fuel Standard (RFS), a federal law that effectively requires Americans to put billions of gallons of biofuel into our vehicles each year. At the time of the bill signing, President Bush [said](#) that requiring more biofuel use, in addition to other energy policy changes, “will help us improve our environment... [and] reduce projected CO<sub>2</sub> emissions by billions of metric tons.” The RFS was not only sold as a policy to reduce greenhouse gas (GHG) emissions and increase energy security, but also as a tool for advancing the development and deployment of non-food, waste-based cellulosic biofuel technologies. As Bush [stated](#), “we also believe strongly that research will enable us to use wood chips and switchgrass and biomass to be able to develop the ethanol necessary to help us realize the vision outlined in this bill.”

A decade later, the RFS has failed to meet these goals. The RFS has delivered lots of corn ethanol, but not much else. Promises of billions of gallons of next-generation cellulosic biofuels derived from non-food crops such as agricultural and forest residues and perennial grasses have fallen flat. More generally, although advanced biofuels were also intended to minimize competition with food crops, the so-called “advanced biofuels” mandate has been primarily filled with soy biodiesel, a first-generation, food-based biofuel. For these reasons, the National Research Council and other experts have [raised doubts](#) about whether the RFS as a whole will actually reduce GHG emissions. The two primary biofuels filling the RFS—corn ethanol and soy biodiesel, which comprise approximately 85% of the RFS—[can be worse for the climate than gasoline and diesel](#). A full decade after the RFS2 was expanded, it is clear the policy must be revisited.

### Background on the Renewable Fuel Standard

As amended by EISA, the RFS requires 36 billion gallons of biofuels to be blended with U.S. gasoline and diesel on an annual basis by 2022:

Figure 1: Statutory Volume Targets for Annual Biofuel Consumption Under EISA (2007) (in billions of gallons)



The RFS requires that biofuels consumption be subdivided into four different categories, some of which are nested underneath one another. Each category has different life-cycle GHG emissions reduction requirements, as seen in Table 1.

Category	Consumption Requirement in 2022	Biofuels Filling Each Category in Practice	Lifecycle GHG Emissions Reduction Requirement
<b>Conventional biofuels</b>	15 billion gallons	Primarily filled with corn ethanol	20% (but virtually all corn ethanol production is exempted)
<b>Advanced biofuels</b>	21 billion gallons (made up of 16 billion gallons of cellulosic biofuels, at least 1 billion gallons of biomass-based diesel, and up to 4 billion gallons of "other advanced biofuels")	Primarily filled with soy biodiesel but also other types of biomass-based derived from waste greases, animal fats, and other vegetable oils, in addition to smaller amounts of sugar ethanol and cellulosic biofuels	50%

<b>Cellulosic biofuels</b>	16 billion gallons (nested under the advanced biofuels mandate)	Primarily filled with cellulosic biofuels derived from municipal solid waste and corn kernel fiber	60%
<b>Biomass-based diesel</b>	At least 1 billion gallons (nested under the advanced biofuels mandate)	Primarily filled with soy biodiesel but also other types of biomass-based diesel	50%

**RFS in Reality: Recent RFS Volume Adjustments**

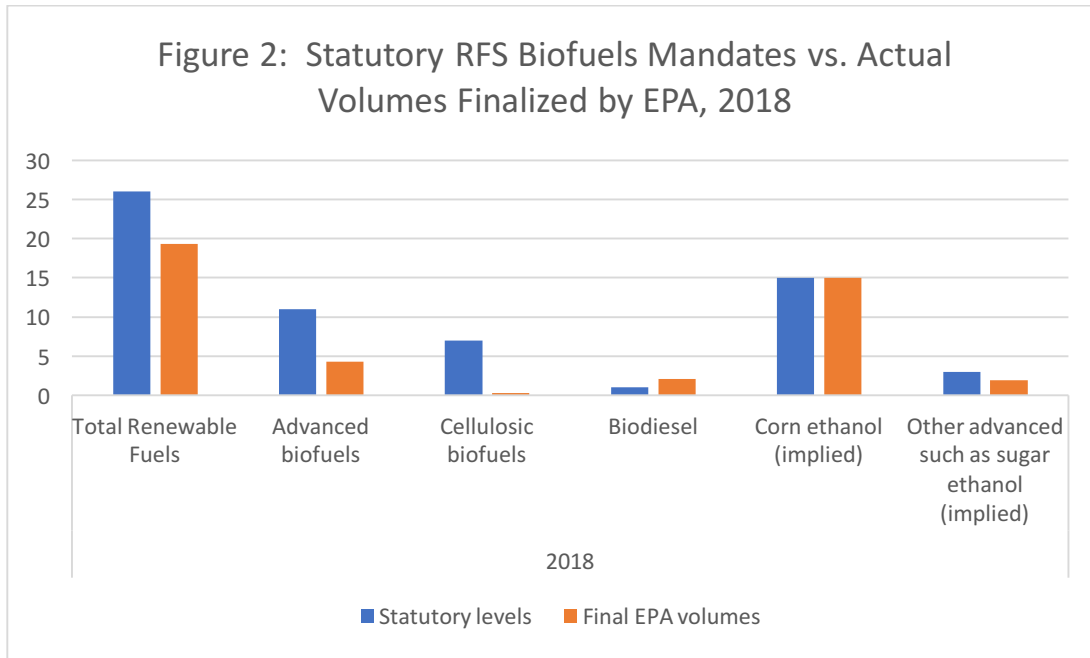
The Environmental Protection Agency (EPA), the agency charged with overseeing and implementing the RFS, is authorized to ratchet down annual biofuels volumes (known as renewable volume obligations, or RVOs) if certain consumption volumes are not expected to meet Congressional targets. The Agency has exercised this authority each year since 2014. EPA is required to set final RVOs by November 30 for each upcoming calendar year, in addition to setting biomass-based diesel volumes one year in advance.

**For calendar year 2018, EPA used its authority to reduce the total renewable fuel mandate from the statutory target of 24 billion gallons down to 19.28 billion gallons, a 19.7% reduction.<sup>1</sup> The 2018 mandates for advanced biofuels and cellulosic biofuels were reduced by 61% and 96%, respectively. Given that the relative shortage of cellulosic biofuel is projected to continue for the foreseeable future, EPA is likely to make similar reductions through 2022.**

Total renewable fuel volumes have been reduced primarily due to shortfalls in consumption of advanced and cellulosic biofuels, which are nested underneath the total renewable fuel mandate. Specifically, cellulosic and advanced biofuels have struggled to meet Congressional targets, [causing EPA to reduce the fuels’ annual RFS volume requirements](#) by more than 90% and 50% respectively in recent years.

Cellulosic biofuels, the biofuel category with the most promise for reducing GHG emissions while minimizing competition with the food supply, has [struggled to gain a foothold](#) due to various technological, economic, and logistical hurdles. The cellulosic biofuels mandate in 2018, for instance, was [reduced](#) from 7 billion gallons to just 288 million gallons, a 96% reduction.

Meanwhile, consumption of food-based biofuels such as corn ethanol and soy biodiesel has ballooned. Figure 2 shows that while corn ethanol continues to meet its Congressional target of 15 billion gallons per year and biodiesel volumes even exceed the biomass-based diesel RFS target of at least 1 billion gallons each year, the EPA-adjusted cellulosic biofuel requirement consumption barely registers on the chart.



### Corn Ethanol and Soy Biodiesel’s Domination of the RFS Spells Disaster for the Climate

The RFS—with its continued disproportionate dependence on biofuels made corn, soybeans, and other food crops—has failed to deliver significant climate benefits, in part because a grandfathering clause in the RFS allowed most corn ethanol facilities to sidestep even the minimum 20% GHG reduction threshold required by EISA. As the Congressional Budget Office [stated](#) in a 2014 report, “ethanol has only limited potential for reducing emissions (and some studies indicate that it could increase emissions).” These studies include analyses by [CATF](#) and by the [National Research Council](#) (NRC), both of which analyzed the data and the assumptions that EPA used to improperly conclude that corn ethanol would deliver a 21% reduction in lifecycle GHG emissions as compared to petroleum gasoline. After reviewing the data, NRC worried that the [“RFS2 might not achieve the intended GHG reduction,”](#) and CATF concluded that had EPA used more reasonable assumptions about corn ethanol production practices, it would have calculated corn ethanol’s lifecycle GHG emissions to be [28% higher](#) than those from petroleum (on an energetically equivalent basis).

**As EPA [stated](#) in 2016, “while the RFS program has had success in promoting the use of conventional biofuel (primarily corn ethanol) and advanced biofuels (primarily biodiesel), the production and use of cellulosic biofuels has noticeably lagged behind.”**

At the same time that corn ethanol is underperforming, production of next-generation cellulosic biofuels is falling significantly short of EISA’s targets. Cellulosic biofuels—the biofuel category with the most GHG reduction potential—are [unlikely to be produced in significant quantities](#) by 2022.

NRC therefore [warns](#) that the RFS as a whole “may be an ineffective policy for reducing global GHG emissions because the effect of biofuels on GHG emissions depends on how the biofuels are produced and what land-use or land-cover changes occur in the process.” NRC refers to several studies showing that expanded corn production, partially spurred by greater biofuels demand, has moved onto carbon-rich grasslands and wetlands. Converting these sensitive acres to annual crops such as corn [releases significant GHG emissions](#), destroys wildlife habitat, increases water and air pollution, and worsens soil erosion. University of Wisconsin researchers [recently estimated](#) that 30 Tg/yr of carbon emissions were released in 2008-2012 when grasslands, forests, and wetlands were plowed under to plant more corn.

Corn ethanol is not the only biofuel worsening climate change. Higher biomass-based diesel mandates (and broader advanced biofuels mandates) not only result in more demand for biofuels feedstocks such as soybeans for more soy biodiesel production, but also more demand for vegetable oil in general. As demand for soybeans rises to fill greater biodiesel demand, demand for vegetable oils such palm oil increases as well since the two are largely interchangeable in the world vegetable oil market. This diversion of food to fuel exacerbates a series of attendant social and environmental problems connected to palm oil production. Palm oil expansion onto carbon-rich peatlands in Indonesia and Malaysia releases significant GHG emissions. Approximately one-fifth of soybean oil’s land use change GHG emissions are linked to palm oil’s peatland oxidation, demonstrating how the markets for the two vegetable oils are inexorably linked. For these reasons, a 2015 study for the European Commission [found](#) that the production and use of soybean oil-based biodiesel production emits 50% more lifecycle GHG emissions than petroleum diesel.

Current production of corn ethanol and soy biodiesel, the two biofuels filling a majority (at least 85%) of the RFS, can be worse for the climate than gasoline or diesel. Paired with the RFS’s failure to spur significant production of cellulosic biofuels derived from residues and wastes, the mandate as a whole will not reduce GHG emissions by 2022.

## Recommendations

December 19, 2017, marks the tenth anniversary of the dramatic expansion of the RFS. With a full decade of evidence demonstrating that the RFS is primarily a mandate for poor-performing conventional biofuels, it is time for Congress to address the policy’s shortcomings. Corn ethanol has proven to be a bridge to nowhere, while the production of non-food-based cellulosic biofuels have fallen flat.

If the RFS’s original environmental goals are to be achieved, Congress must significantly reform the policy so that it is both more modest in scale and more targeted in purpose. The goal cannot be to encourage the mass production of all types biofuel, regardless of their environmental impact. Rather, policy’s primary objective should be to provide a sustainable

supply of truly low-carbon fuels to specific segments of the transportation sector that will be most difficult to decarbonize (a subset that may include aviation).

For its part, EPA [must fulfill its statutory obligation](#) to analyze the full suite of environmental impacts connected to its implementation of the RFS. EISA requires EPA to file a report every three years on “the impacts to date and likely future impacts” of the RFS on air pollution, water pollution, soil loss, ecosystem health, biodiversity, invasive species, and other environmental challenges. EPA has produced only one of these “Triennial Reports” over the past decade, and that report (issued in 2011) [raised important concerns](#) about the program’s environmental performance. The Agency must also assess whether the RFS’s volumetric requirements “adversely impact air quality,” and “implement appropriate measures to mitigate” any impacts it finds “to the greatest extent achievable.” The “anti-backsliding” report is more than eight years overdue; in 2016, EPA announced that it does not expect to complete the analysis until 2024. Further delay is [unacceptable](#).