Bio Biotechnology Industry Organization

THE RENEWABLE FUEL STANDARD:

A DECADE'S WORTH OF CARBON REDUCTIONS

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America's Renewable Fuel Standard was signed into law by President George W. Bush on August 8, 2005 as part of the Energy Policy Act of 2005. The first version of the Renewable Fuel Standard (RFS1) called for annual increases in production and use of biofuels through 2012. Congress updated and expanded the program (RFS2) in December 2007 to more aggressively increase use of biofuels through 2022 and to promote commercialization of advanced biofuels. Over the past decade, the RFS1 and RFS2 programs have successfully displaced the use of petroleum fuels, reduced reliance on foreign oil, and decreased carbon emissions from the transportation sector. However, the Environmental Protection Agency's recent notice for the RFS2 program for 2014, 2015, and 2016 proposes to halt or slow growth in the use of biofuels for the future.[1] If finalized, EPA's plan would forego achievable increases in biofuel production and use, automatically increasing the use of petroleum fuels and raising associated carbon emissions.

When RFS1 was established, U.S. drivers already used small volumes of ethanol and biodiesel. In 2005, about 4 billion gallons of ethanol and 0.092 billion gallons of biodiesel were blended into the U.S. transportation fuel mix, making up just over 3 percent of gasoline use.[2] (RFS1 applied only to gasoline use.) RFS1 sought to nearly double biofuel use to 7.5 billion gallons by 2012 and support commercialization of cellulosic ethanol beginning in 2013. However, the law reserved only 5.4 percent of the projected gasoline market in 2012 and 2013 for biofuel use.

The RFS2 program significantly expanded the market reserved for bio-

OVER ITS 10-YEAR LIFESPAN, THE RENEWABLE FUEL STANDARD HAS REDUCED U.S. TRANSPORTATION-RELATED CARBON EMISSIONS BY 589.33 MILLION METRIC TONS.

THE RFS HAS DISPLACED NEARLY 1.9 BILLION BARRELS OF FOREIGN OIL OVER THE PAST DECADE BY REPLACING FOSSIL FUELS WITH HOMEGROWN BIOFUELS.

27 PERCENT OF ALL U.S. CARBON EMISSIONS COME FROM THE TRANSPORTATION SECTOR

fuels to approximately 20 percent of the projected transportation fuel pool in 2022. It also applies to both gasoline and diesel fuels. In 2015, U.S. drivers will use more than 13.8 billion gallons of ethanol (including 250 million gallons of advanced ethanol) and 1.7 billion gallons of renewable diesel or biodiesel, according to the U.S. Department of Energy's Energy Information Administration (EIA). This represents a 345 percent increase in ethanol use and a 1,848% increase in renewable diesel use since 2005.

RFS2 also specified that biofuels qualifying for the program would have to achieve specific, verifiable reductions in carbon emissions compared to gasoline and petroleum diesel. The transportation sector accounts for 27 percent of all U.S. carbon emissions, according to EPA.[3] Substituting lower carbon fuels for petroleum fuels remains an important tool for reducing overall U.S. transportation carbon emissions.[4] And biofuels achieve measureable reductions in carbon emissions when used to displace petroleum gasoline and diesel.[5] While existing ethanol and biodiesel facilities were grandfathered into the RFS2, more than 40 of the nation's 200 ethanol facilities have now petitioned EPA to certify that their production systems do achieve the required reduction in carbon emissions.

EPA's recent proposed rules for the RFS would cut short achievable future carbon emission reductions. In 2015 alone, the proposal would add 19.6 million tons of CO2e for the year, equal to putting 7.3 million cars back on the road, compared with achievable levels of biofuel use.

Over the decade that the RFS1 and RFS2 programs have been in effect (2006 – 2015), displacement of gasoline and diesel fuels with lower carbon biofuels has reduced U.S. carbon emissions (CO2e) from the transportation sector by 589.33 million metric tons. This is equal to removing more than 124 million cars from the road over the decade.

To develop this estimate, we utilized the GREET1.2013 model[6] to compare car-

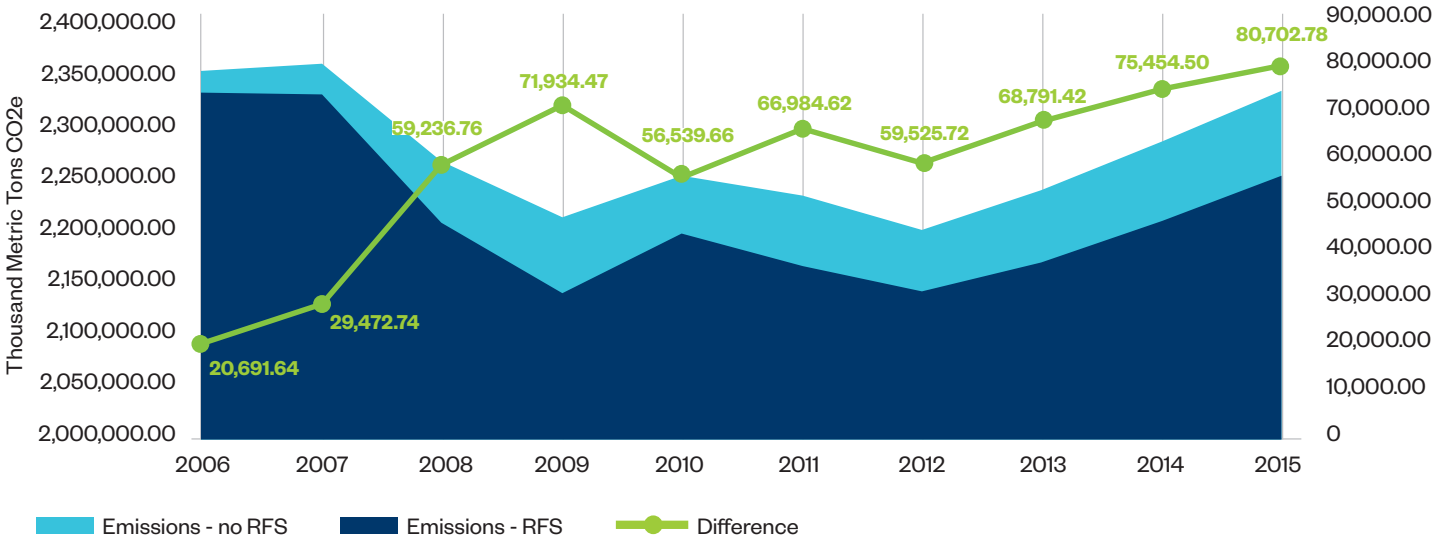
bon emissions from the mixture of U.S. transportation fuels (both petroleum and biofuel) under two scenarios. To develop the first scenario, we applied the annual required RFS Renewable Volume Obligation (RVO) percentages, as established by EPA rulemakings, to the volumes of fossil-based, non-renewable gasoline and diesel used in the United States. These volumes are reported in EIA's Short-Term Energy Outlook for August 2015. For years 2006-2009, we applied the established RVO percentages only to gasoline use (since RFS2 came into effect only in July 2010). For 2010-2015, we applied the RVOs established in annual rulemakings to the non-renewable portion of gasoline and diesel use. Further, we applied the RVO percentages as nested requirements, inherently assuming that advanced ethanol was used as a portion of overall ethanol use. To establish a second scenario for U.S transportation fuel use without the RFS1 and RFS2 programs in place, we assumed that corn ethanol and soy biodiesel would have continued to meet just over 3 percent of the total reported transportation fuel use over the decade and that petroleum gasoline and diesel would have been used instead.

GREET1.2013 utilizes 2012 average estimates of the carbon emissions of gasoline, diesel, corn ethanol, sugarcane ethanol, soy biodiesel and corn stover cellulosic ethanol. We therefore assume that the volumes of various fuels in the fuel mix generated these average emissions each year over the entire decade. Figure 1 shows the calculated annual emissions from the mix of transportation fuel use under each scenario as well as the measured reduction (the difference between the two). The annual measured reduction represents the savings attributable to the existence of

SCENARIOS FOR COMPARING GHG EMISSIONS WITH AND WITHOUT THE RFS

Scenario 1: Emissions – RFS (2006 – 2009)	Scenario 1: Emissions – RFS (2010 – 2015)	Scenario 2: Emissions – no RFS	Alternate Scenario – no RFS
▪ Non-renewable gasoline use (total annual gasoline minus total annual ethanol). ▪ Annual RVOs, as a percentage.[8] ▪ Annual diesel and biodiesel use.[7]	▪ Non-renewable gasoline and diesel use (total minus total ethanol and biodiesel).[7] ▪ Annual RVOs for nested categories (cellulosic, biodiesel, advanced and overall).[9] ▪ Non-cellulosic or biodiesel advanced volumes assumed to be advanced ethanol.	▪ Total gasoline and diesel use.[7] ▪ Ethanol assumed to meet 2.9% total gasoline. ▪ Biodiesel assumed to meet 0.17% diesel.	▪ Total gasoline and diesel use.[7] ▪ Ethanol assumed to meet 5% total gasoline. ▪ Biodiesel assumed to meet 0.4% diesel.

FIGURE 1: U.S. TRANSPORTATION FUEL MIX CARBON EMISSIONS UNDER TWO SCENARIOS, 2006-2015



the RFS, and the total for the entire decade is 589.33 million metric tons.

We also tested an alternate scenario of emissions without the RFS program in place, in which we assumed that market forces alone would have increased ethanol and biodiesel use over the decade. We found that even if biofuel use had increased to 5.4 percent through market forces alone (reaching the level envisioned under RFS1), the measured reductions in carbon emissions attributable to having the RFS program in place would be more than 390 million metric tons.

The carbon savings attributable to the RFS1 and RFS2 over the past decade is equivalent to the emissions from more than 124 million passenger vehicles. In other words, having the RFS in place over the past decade achieved carbon emission reductions equivalent to removing those 124 million cars from the road. The reductions are illustrated in Figure 2.

Substituting homegrown biofuels for petroleum gasoline and diesel also reduces U.S. reliance on foreign oil. If not for the RFS, U.S. drivers would be using more petroleum as part of the fuel mix. And since the U.S. is now using as much domestically produced oil as possible, that marginal use would likely come from foreign sources. The RFS has displaced nearly 1.9 billion barrels

of foreign oil over the past decade by replacing petroleum fuels with biofuels.

Unfortunately, EPA's proposed RFS rules for 2014, 2015 and 2016 will cut short the emission reduction and energy independence potential of the RFS program by limiting market space for renewable fuels and consequently guaranteeing more market space for petroleum fuels.

According to EIA data, the United States increased its transportation fuel demand in 2014 and 2015. The use of more petroleum to meet transportation demand in 2014 compared to 2013 automatically increased greenhouse gas emissions from the U.S. transportation sector by approximately 60.5 million metric tons of CO2e year to year.[10] As EPA concedes, its own delay in establishing annual RVOs essentially resulted in a market that operated as if the RFS2 statute did not exist.[11] If EPA had set the annual RVOs at achievable volumes and in a timely manner, the United States could have limited this significant increase in emissions. EPA's failure to establish 2014 RVOs at achievable statutory volumes resulted in an increase of 17.4 million metric tons of CO2e, which was the equivalent of putting an additional 3.6 million cars on the road during the year.

As EPA concedes, its own delay in establishing annual RVOs essentially resulted in a market that operated as if the RFS2 statute did not exist.

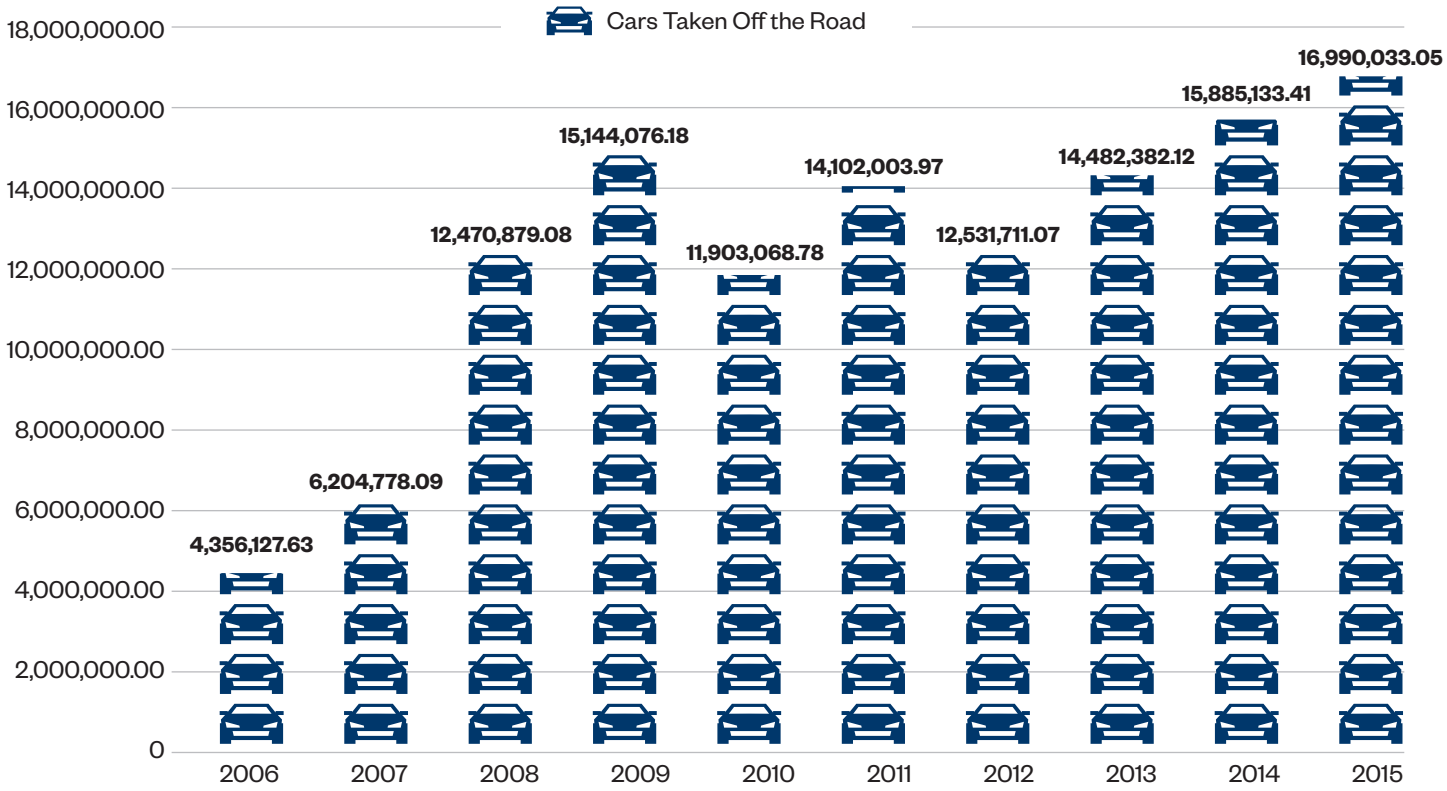
For 2015, 2016 and beyond, EPA's proposed rule would continue to cut short the emissions reduction potential of biofuels by failing to substitute them for petroleum fuels at achievable levels. For 2015, U.S. gasoline and diesel consumption are both projected to increase compared to 2014, again automatically increasing carbon emissions from the transportation sector. EPA's proposed RVOs for 2015 add 19.6 million tons of CO2e for the year compared with achievable levels of biofuel use, equal to putting 7.3 million cars back on the road during the year.

Although gasoline use is projected to decline slightly in 2016, diesel use is expected to increase, resulting in emissions of CO2e similar to 2015. If EPA

does not keep the RFS2 volumes on course for that year, U.S. carbon emissions will be 56.2 million tons of CO2e higher than could be achieved under the RFS2 program. This is equivalent to putting an additional 11.7 million cars on the road in 2016, compared to 2015.

The Renewable Fuel Standard was adopted by Congress and signed into law by President Bush to reduce U.S. reliance on foreign oil and carbon emissions from the transportation sector. The record shows that the policy has achieved both goals over the past decade. EPA failed to set the RFS2 RVOs at achievable volumes in 2014 and allowed petroleum fuels to displace achievable use of biofuels. The result was an increase in carbon emissions at a time that a reduction in emissions was possible. To continue the record of successful reductions in reliance on foreign oil along with reductions in carbon emissions, EPA should put the RFS2 program back on track.

FIGURE 2: ANNUAL REDUCTION IN CARBON EMISSIONS AS CARS REMOVED FROM THE ROAD



For 2015, 2016 and beyond, EPA's proposed rule would continue to cut short the emissions reduction potential of biofuels by failing to substitute them for petroleum fuels at achievable levels.

NOTES

1 80 Fed. Reg. 33100 -33153. Wed., June 10, 2015.

2 U.S. Department of Energy, Energy Information Administration, Short-Term Energy Outlook, Aug. 11, 2015.

3 U.S. Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2013, April 15, 2015.

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5 Wang, M., J. Han, J. Dunn, H. Cai, and A. Elgowainy, 2012, "Well-to-Wheels Energy Use and Greenhouse Gas Emissions of Ethanol from Corn, Sugarcane and Cellulosic Biomass for US Use," Environmental Research Letter, 7 (2012) 045905 (13pp).

6 U.S. Department of Energy, Argonne National Lab. The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model. https://greet.es.anl.gov/.

7 U.S. Department of Energy, Energy Information Administration, Short-Term Energy Outlook, Aug. 11, 2015.

8 72 Fed. Reg. 23899-24014. Tues., May 1, 2007.

9 75 Fed. Reg. 14675. Fri. March 26, 2010. 75 Fed. Reg. 76793. Dec. 9, 2010. 77 Fed. Reg. 1323. Mon. Jan. 9, 2012. 78 Fed. Reg. 49794, 49798. Thur. Aug. 15, 2013. 79 Fed. Reg. 25027. Fri. May 2, 2014. 80 Fed. Reg. 33107. Wed., June 10, 2015.

10 See Erickson, B., Carr, M., Winters, P. "Estimating Greenhouse Gas Emissions from Proposed Changes to the Renewable Fuel Standard through 2022." Ind. Biotech. J., April 2014, 10(2). doi:10.1089/ind.2014.1508. Estimates contained in these comments use Energy Information Administration May 2015 Short Term Energy Outlook data to update the previously published modeling. See also, Biotechnology Industry Organization, "Estimated GHG Increase from Obama Administration Inaction on the 2014 RFS," September 23, 2014. https://www.bio.org/advocacy/letters/estimated-ghg-increase-obama-administration-inaction-2014-rfs.

11 80 Fed. Reg. 33131. Wed. June 10, 2015.