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Public Interest Comment[1] on

The Environmental Protection Agency's Proposed Rule

Renewable Fuel Standard Program: Standards for 2014, 2015, and 2016 and Biomass-Based Diesel Volume for 2017

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The George Washington University Regulatory Studies Center works to improve regulatory policy through research, education, and outreach. As part of its mission, the Center conducts careful and independent analyses to assess rulemaking proposals from the perspective of the public interest. This comment on the Environmental Protection Agency's proposed rule establishing renewable fuel standards for 2014, 2015, and 2016 does not represent the views of any particular affected party or special interest, but is designed to evaluate the effect of EPA's proposal on overall consumer welfare.

[1] This comment reflects the views of the author, and does not represent an official position of the GW Regulatory Studies Center or the George Washington University. The Center's policy on research integrity is available at http://regulatorystudies.columbian.gwu.edu/policy-research-integrity.

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Introduction

As a part of its Renewable Fuel Standard (RFS) program, the Environmental Protection Agency is proposing biofuel blending targets for 2014, 2015, and 2016. The RFS requires refiners to blend specific amounts of renewable fuels into transportation fuel, such as gasoline and diesel. The RFS program was created in 2005 to reduce both American dependence on foreign oil and domestic gasoline consumption. According to EPA's 2013 proposed rule, the RFS program "was created to promote substantial, sustained growth in biofuel production and consumption" resulting in "reductions in greenhouse gas emissions, enhanced energy security, economic development, and technological innovation."[3] To that end, this proposal would mandate the production of 17.4 billion gallons of total renewable fuel in 2016, an 850 million gallon increase from the last published standards promulgated for 2013.

In its current proposal, EPA includes production standards for biomass-based diesel (biodiesel), total renewable fuel, advanced biofuel, and cellulosic biofuel, which can be seen in the table below.

EPA-Regulated Renewable Fuel Standards

	2010	**2011**	**2012**	**2013**	***2014***	***2015***	***2016***
Ethanol *(billion gallons)*	12.0	12.6	13.2	13.8	*13.25*	*13.4*	*14*
Biodiesel *(billion gallons)*	0.65[a]	0.8	1.0	1.28	*1.63*	*1.7*	*1.8*
Cellulosic biofuel *(million gallons)*	6.5	6	10.45	6	*33*	*106*	*206*
Advanced biofuel *(billion gallons)*	0.95	1.35	2.0	2.75	*2.68*	*2.9*	*3.4*
Total[b]	**12.95**	**13.95**	**15.2**	**16.55**	***15.93***	***16.3***	***17.4***

All gallon values are ethanol-equivalent on an energy content basis, except for biodiesel which is actual

[a] The rule implementing the 2010 RFS combined the 2009 and 2010 biomass-based diesel requirements and applied them to 2010.

[b] The totals listed at the bottom are the sum of the ethanol and advanced biofuel totals. The standards set by EPA are a minimum, and the advanced biofuel minimum can be reached by either increases in biodiesel, cellulosic biofuel, or other advanced biofuel production above the minimum standards ascribed by EPA.

Although it is the largest type of domestic biofuel, corn ethanol is only one component of the overall total renewable fuel standards promulgated by EPA. The agency also sets advanced

[3] 78 FR 71731

biofuel standards, which can be met by the production of three main fuel sources: biodiesel, imported sugarcane ethanol, and cellulosic biofuel. As can be seen in the above table, EPA sets minimum standards for the production of biodiesel and cellulosic biofuel, which also count toward the agency's total renewable fuel standards. The total renewable fuel standards prescribed for 2015 and 2016 must be met through a combination of corn ethanol and advanced biofuels (cellulosic and biodiesel).

While the stated goals of the RFS are to reduce crude oil imports and increase the use of renewable fuels, an implicit purpose of the RFS program is to benefit the environment by moving away from fuels that result in substantial carbon emissions (e.g. gasoline and diesel). However, while crude oil imports and gasoline demand have decreased, it is less clear whether the increased production of biofuels has actually reduced emissions or benefitted the environment.

The literature is mixed on the environmental effects of biofuel production, with many estimates indicating that the production of ethanol and biodiesel may significantly increase emissions, specifically of the greenhouse gases carbon dioxide (CO_2) and nitrous oxide (N_2O) and criteria pollutants such as particulate matter. The following sections explore the proposed renewable fuel standards for 2014, 2015, and 2016, examine the tradeoffs that the agency faces in setting these standards, and critique the composition of the total renewable fuel standards in the proposed rule.

Statutory Authority

Under the Clean Air Act (CAA), as amended by the Energy Policy Act of 2005 (EPAct) and the Energy Independence and Security Act of 2007 (EISA), EPA sets the annual volume of biofuel required to meet its renewable fuel standard. Section 211(o)(2)(B) of the CAA specifies annual biofuel targets for EPA's RFS; the volume requirements for 2016, both from the statute and EPA's proposed rule, are outlined in the table below.

	Current volume requirements (*2013*)	**Statutory applicable volume requirements (*2016*)**	**Proposed volume requirements (*2016*)**
Cellulosic biofuel	6 million gallons	4.25 billion gallons	206 million gallons
Biomass-based diesel	1.28 billion gallons	≥1.0 billion gallons	1.8 billion gallons
Advanced biofuel	2.75 billion gallons	7.25 billion gallons	3.4 billion gallons
Total renewable fuel	16.55 billion gallons	22.25 billion gallons	17.4 billion gallons

Note: Cellulosic biofuel and biomass-based biodiesel are nested within the "advanced biofuel" category, which is itself nested within the "renewable fuel" category.

As can be seen in the above table, EPA's proposed rule increases the overall volume requirements for renewable fuels from 16.55 billion gallons in 2013 to 17.4 billion gallons in 2016. Cellulosic biofuel and biomass-based diesel (biodiesel) are both advanced biofuels which are nested within the "renewable fuel" category. EPA's proposal would set volume requirements for these advanced biofuels at 3.4 billion gallons in 2016, a 650 million gallon increase over the last standards promulgated by the agency for 2013.

However, these increases fall short of the statutory applicable volumes for 2016 outlined in the table above. For all but one fuel type, EPA proposes to set the volume requirement below the statutory level. Although mandated cellulosic biofuel production is proposed to increase by 291%, the 206 million gallons proposed for 2016 are still 4.19 billion gallons below the levels set in the CAA. The proposed targets for advanced biofuel (a category which includes both cellulosic biofuel and biodiesel) are 3.85 billion gallons short of the statutory volume levels, and the proposed standards for total renewable fuels are 4.85 billion gallons shy of the volume levels specified in the CAA.

However, EPA does have some discretion to set applicable volume requirements below those specified in the statute, in certain conditions. In this proposal, EPA exercises its cellulosic waiver authority under CAA section 211(o)(7)(D)(i) and the general waiver authority under CAA section 211(o)(7)(A) to mandate less cellulosic biofuel and total renewable fuel than Congress specified in the EISA.

EPA is opting to exercise its waiver authority because there was in 2014 (and will continue to be in 2015 and 2016) an insufficient supply of total renewable fuels and advanced biofuels to meet the statutory mandate. There are a few reasons for this supply shortage. As EPA explains in its proposal:

> For non-ethanol renewable fuels, the primary supply constraint at present is the projected shortfall in domestic production or importation of qualifying volumes. For ethanol blends, there are both legal and practical constraints on the amount of ethanol that can be supplied to the vehicles that can use it, notwithstanding the considerable volumes that can be produced and/or imported.[4]

For the advanced biofuels, the primary constraint is growth in the cellulosic biofuel market. While Congress set ambitious targets for cellulosic production in 2014, actual production was 33 million gallons, less than 2% of the statutory volume requirements for 2014. Due to the high

[4] 80 FR 33121

costs of producing cellulosic and the technological barriers facing the industry, it is likely that cellulosic production will continue to fall short of statutory levels. Increased production of biodiesel, although it currently surpasses the minimum volumes prescribed in the statute, is not sufficient to make up for the shortfall of cellulosic ethanol. Because both of these fuels are nested within the "advanced biofuels" category, EPA must reduce both the cellulosic volume requirements and the advanced biofuel volume requirements as a result of these supply shortages.

Ethanol faces a different set of obstacles. While the US has the capacity and ability to either import or produce more ethanol, more ethanol cannot feasibly be blended into gasoline. Legally, only flex fuel vehicles (FFVs) can use fuel with ethanol concentrations greater than 15%, and these vehicles only constitute about 6% of all light-duty cars and trucks.[5] Practically, non-flex-fuel vehicles cannot use fuel with ethanol concentrations greater than 10%, which is termed the "blendwall." While the authorizing statute requires more ethanol to be blended into transportation fuel each year until 2022, the only way this is possible is if demand for gasoline increases significantly in the near term. As explained in a later section of this comment, this creates a ceiling on the practical growth of ethanol as a transportation fuel. In its proposal, EPA is very cognizant of the fact the blendwall makes it infeasible to significantly increase the volume requirements for ethanol.

These constraints certainly justify EPA's use of its waiver authorities to prescribe lower volume requirements than those listed in the statute. However, because the RFS program is on an unsustainable trajectory, Congress should reevaluate the statutory volume requirements established in the 2007 EISA and consider other approaches that would be more feasible and better for the environment.

Regulatory Analysis

Need for Incremental Analysis

In this proposed rule, EPA provides some cost estimates for increased production of corn ethanol, sugarcane ethanol, and soybean-based biodiesel, but does not provide any estimated benefits.[6] EPA justifies this omission by referring back to two initial analyses of the overall RFS program, which were finalized in 2007[7] and 2010.[8] Because these analyses examine the costs and

[5] 80 FR 33120
[6] 80 FR 33131
[7] Environmental Protection Agency. April 10, 2007. "Regulatory Impact Analysis: Renewable Fuel Standard Program." http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2005-0161-0282
[8] Environmental Protection Agency. February 2010. "Renewable Fuel Standard Program (RFS2) Regulatory Impact Analysis."

benefits of the RFS as implemented in 2022, and because they assume that EPA will be able to meet the statutory goals for biofuel production, it's difficult to parse out the actual effects of EPA's proposal.

Despite this difficulty, EPA maintains that it is not necessary to analyze incremental effects of the RFS program. This approach fails to appreciate the economic and environmental difference between different biofuel sources, which may be significant for different fuel sources (particularly as EPA deviates from the standards prescribed in the authorizing statute). In its proposal, EPA argues that:

> The short time frame provided for the annual renewable fuel rule process does not allow sufficient time for EPA to conduct a comprehensive analysis of the benefits of the 2015 and 2016 standards and the statute does not require it. Moreover, as discussed in the [2013 biodiesel proposal], the costs and benefits of the RFS program as a whole are best assessed when the program is fully mature in 2022. We continue to believe that this is the case, as the annual standard-setting process encourages consideration of the program on a piecemeal (i.e., year to year) basis, which may not reflect the long-term economic effects of the program. Therefore, for the purpose of this annual rulemaking, we have not quantified benefits for the 2015 and 2016 proposed standards. We do not have a quantified estimate of the GHG impacts for the single year (e.g., 2015, 2016).[9]

It is true that Congress, in authorizing the EPAct and the EISA, did not give EPA a significant amount of time to conduct a thorough analysis. This is a shortcoming of the legislation rather than a shortcoming with the Agency.

However, EPA is not correct in its assertion that incremental analysis would not be helpful for evaluating the RFS program. Because the program is implemented on a yearly basis, and each yearly standard reflects marginal changes both from the previous standard and from the levels prescribed in the authorizing statute, incremental analysis would be useful for researchers and the public in understanding the effect of EPA's individual proposed renewable fuel standards. This is particularly true in a rulemaking such as this one, in which ethanol and cellulosic fall short of their statutory levels—by 1 billion and 4.19 billion gallons, respectively—and biodiesel exceeds its statutory level by 800 million gallons. In this case, the benefits of the overall RFS program that EPA calculated in 2007 and 2010 only represent the benefits and costs of a hypothetical RFS program that has not been implemented and likely will not be implemented in the future.

[9] 80 FR 33131-2

Opportunity to Revisit Analytical Assumptions

Since the initial regulatory impact analyses were first conducted in 2007 and 2010, new information has emerged that may affect the assumptions EPA made in its regulatory analyses. Availability of new data and the proliferation of new third-party analyses provide EPA with a key opportunity to revisit the assumptions about environmental effects and demand for gasoline that underpinned its initial benefit-cost assessment.

Relevant Literature

There has been significant development in the relevant literature on the environmental impacts of renewable fuel production since EPA's analyses were conducted, especially post-2007. Recent research indicates that the environmental effect of the RFS is extremely modest[10] at best and, at worst, could result in a significant increase in CO_2 emissions over gasoline.[11] Overall, the post-2007 literature largely reinforces this worst-case scenario, although estimates differ as to the extent of the environmental damage posed by biofuel mandates. A number of factors influence the extent of any potential environmental damage as a result of the RFS.

First, increased biofuel production causes land use changes (LUC) that result in the release of soil organic carbon. Increased demand for corn and soy provides farmers with an incentive to produce more crop and convert unused lands into cropland, which releases a significant amount of soil organic carbon and foregoes future carbon sequestration and storage. This increase in release of CO_2 may, depending on tillage practices and land type, outweigh any potential CO_2 savings from combusting ethanol.

For example, in 2008, Searchinger et al. find that that biofuels increase carbon emissions by 93% compared to gasoline when the effects of LUC are considered.[12] Fargione et al. find that diverting domestic grassland and abandoned cropland in the Midwest to ethanol production incurs between 69 and 134 megagrams (Mg) of CO_2 per hectare^{-1}, requiring a payback period of between 48 and 93 years to repay the initial carbon debt.[13] While LUC in the literature is primarily described as it relates to corn ethanol, researchers have also found that the carbon emissions from LUC are 34% greater per megajoule for soybean-based biodiesel.[14] This is

[10] Chen et al. 2014. "Alternative transportation fuel standards: Welfare effects and climate benefits" *Journal of Environmental Economics and Management* 67: 241–257

[11] Searchinger et al. 2008. "Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change." *Science*. Vol. 319 no. 5867 pp. 1238-1240

[12] Searchinger et al. 2008. "Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change." *Science*. Vol. 319 no. 5867 pp. 1238-1240

[13] Fargione et al. 2008. "Land Clearing and the Biofuel Carbon Debt." *Science* 29: 1235-1238

[14] Chen, Huang, and Khanna. "Land Use and Greenhouse Gas Implications of Biofuels: Role of Technology and Policy." Paper prepared for presentation at the Agricultural & Applied Economics Association's 2011 AAEA &

particularly troubling as EPA's proposal relies heavily on increases in biodiesel production to meet total renewable fuel mandates.

In addition, these effects are not limited to the United States: change in worldwide agricultural markets as a result of biofuel mandates may also lead to international land use change (or *indirect* land use change, "ILUC"), which occurs when other countries alter growing habits to replace crops that were previously imported from the U.S. When taking ILUC into account, Chakravorty and Hubert find that international emissions may increase by 33%, in comparison to a modest 1% reduction in domestic emissions.[15] Bento et al. find that the RFS "unambiguously" increases carbon emissions, offsetting more than 70% of the intended emissions savings.[16] Other research finds that, when considering ILUC, the environmental benefit of the RFS is very modest at best.[17,18]

EPA considered both potential LUC and ILUC in its 2010 analysis of RFS by weighing factors such as tilling practices, irrigation, crop yields over time, and supply and demand for agricultural products.[19] However, EPA estimated that production of ethanol results in 34 grams of CO_2 per megajoule, which recent evidence suggests is on the very low-end of plausible values for carbon emissions.[20] Recent research finds that potential carbon emissions could be as great as 800g/MJ, meaning that EPA may have seriously undervalued the potential environmental costs of implementing the RFS program.[21]

Second, fertilizer input for the production of crops used to produce biofuels results in emissions of N_2O, a greenhouse gas that contributes to climate change. A 2012 analysis found that the necessary fertilizer input for the increased production of corn and rapeseed leads to N_2O

NAREA Joint Annual Meeting, Pittsburgh, Pennsylvania, July 24- 26, 2011. http://ageconsearch.umn.edu/bitstream/103216/2/CCE_for_AAEA2011.pdf

[15] Ujjayant Chakravorty and Marie-Hélène Hubert. 2012. "Global Impacts of the Biofuel Mandate under a Carbon Tax." American Journal of Agricultural Economics

[16] Bento, Klotz, and Landry. "Are there Carbon Savings from US Biofuel Policies? The Critical Importance of Accounting for Leakage in Land and Fuel Markets" (2012; forthcoming 2015 in Energy Journal)

[17] Oliver and Khanna. 2015. "Implementing the Renewable Fuel Standard with the Renewable Portfolio Standard in the US: Implications for Policy Costs and Greenhouse Gas Emissions."

[18] Chen, Huang, and Khanna. "Land Use and Greenhouse Gas Implications of Biofuels: Role of Technology and Policy." Paper prepared for presentation at the Agricultural & Applied Economics Association's 2011 AAEA & NAREA Joint Annual Meeting, Pittsburgh, Pennsylvania, July 24- 26, 2011.

[19] Environmental Protection Agency. 2010. "Renewable Fuel Standard Program (RFS2) Regulatory Impact Analysis." §2.4.4 - §2.4.5.

[20] Plevin, O'Hare, Jones, Torn and Gibbs. 2010. "Greenhouse Gas Emissions from Biofuels' Indirect Land Use Change are Uncertain but May Be Much Greater than Previously Estimated." *Environmental Science & Technology* 44: 8015–8021

[21] Hertel, Golub, Jones, O'Hare, Plevin and Kammen. 2010. "Effects of US Maize Ethanol on Global Land Use and Greenhouse Gas Emissions: Estimating Market-mediated Responses." *BioScience* 60 (3): 223-231.

emissions that matched or exceeded the corresponding cooling achieved by the reduction in CO_2 emissions resulting from fossil fuel replacement.[22]

One additional result of increased fertilizer usage—especially for corn ethanol—is water pollution. Increased fertilizer runoff damages ecosystems, harms biodiversity, and is contributing to the Gulf of Mexico's "Dead Zone."[23] This damage is most pronounced when acreage is diverted from another crop to corn production, which relies heavily on nitrogen fertilization and requires more irrigation than displaced crops, such as cotton.

Third, increased international gasoline demand and consumption could displace any domestic reductions resulting from the RFS, which could offset any domestic environmental benefit. EPA estimates that the largest benefit of the RFS program is a "monopsony" benefit. That is, because the U.S. is such a major consumer of international crude oil, reduced crude oil imports as a result of RFS can reduce the price of crude oil, and any remaining barrels of crude oil imported will be imported into the U.S. at a lower price. However, this lower price has a rebound effect on international gasoline demand, offsetting any reductions effected at the domestic level. This rebound effect could offset more than 60% of the intended emissions savings of the RFS program.[24]

Gasoline Demand

In addition, despite the fact that a purpose of the RFS program is to reduce gasoline consumption, domestic demand for gasoline has not kept pace with Congress's and EPA's expectations. While Congress and EPA expected gasoline consumption to continue increasing, actual demand dropped from a high of 3.389 million barrels of gasoline in 2007, when the EISA was passed, to 3.25 million in 2014.[25] As EPA explains:

> The decrease in total gasoline consumption in recent years which resulted in a corresponding and proportional decrease in the maximum amount of ethanol that can be consumed if all gasoline was E10, the limited number and geographic distribution of retail stations that offer higher ethanol blends such as E15 and E85, the number of FFVs that have access to E85, as well as other market factors,

[22] Smith, Mosier, Crutzen and Winiwarter. 2012. "The role of N2O derived from crop-based biofuels, and from agriculture in general, in Earth's climate." *Philosophical Transactions of the Royal Society* 367: 1169–1174

[23] Welch, H.L., Green, C.T., Rebich, R.A., Barlow, J.R.B., and Hicks, M.B., 2010, Unintended consequences of biofuels production—The effects of large-scale crop conversion on water quality and quantity: U.S. Geological Survey Open-File Report 2010–1229, 6 p.

[24] Bento, Klotz, and Landry. "Are there Carbon Savings from US Biofuel Policies? The Critical Importance of Accounting for Leakage in Land and Fuel Markets" (2012; forthcoming 2015 in Energy Journal)

[25] U.S. Energy Information Administration. "Petroleum & Other Liquids: U.S. Product Supplied of Finished Motor Gasoline." Accessed July 22, 2014. http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MGFUPUS1&f=A

> combine to place significant restrictions on the volume of ethanol that can be supplied to vehicles at the present time.[26]

This is particularly important because two of the primary goals of the RFS are 1) to increase use of renewable fuels and 2) to reduce crude oil imports. However, these goals are at least partially at odds: most of the biofuels produced to comply with the RFS are not drop-in fuels, which could act as perfect substitutes for gasoline or diesel. Instead, biofuels such as corn ethanol and biodiesel must be blended into existing fuel stock, and in some cases cannot legally exceed certain concentrations in fuel (for instance, 10% for ethanol,[27] and 5% for biodiesel). Paradoxically, without more gasoline/crude oil, it will be difficult—both legally and practically—to increase the use of renewable fuels. In its proposed rule, EPA explains that:

> since the majority of renewable fuel today is currently consumed as 10 percent ethanol blends, changes in demand for gasoline can have a significant impact on the ability of the marketplace to blend fixed volumes of renewable fuels.[28]

Due to these constraints, it is becoming increasingly difficult to increase the production of renewable fuels while demand for gasoline is decreasing.

Executive Order 12866

President Clinton's Executive Order 12866, which was reinforced by President Obama's Executive Order 13563, instructs each agency to

> base its decisions on the best reasonably obtainable scientific, technical, economic, and other information concerning the need for, and consequences of, the intended regulation.[29]

Despite the emergence of new scientific, technical, and economic information, EPA continues to rely on old analysis to justify economically significant RFS rules. While many aspects of EPA's past analyses are likely still as valid as when they were written, many key assumptions may be challenged by new information. EPA should take this opportunity to revisit the analytical assumptions that underpin its RFS regulations.

[26] 80 FR 33109-10
[27] 10% ethanol is the legal maximum for most vehicles, but some 2001 and newer light-duty vehicles are permitted to use fuels with concentrations of up to 15% ethanol. Flex-fuel vehicles are the only vehicles that can legally use fuel with ethanol concentrations greater than 15%.
[28] 80 FR 33109
[29] Exec. Order No. 12866, "Regulatory Planning and Review." 58 FR 51735 (1993).

Congress

Congress bears responsibility for setting unrealistic volume requirements and binding EPA to an unsustainable regulatory approach. As EPA states in its proposed rule:

> Over the past few years, we have seen analysis concluding that the ambitious statutory targets in the Clean Air Act exceed real world conditions. Despite significant efforts by the U.S. Departments of Agriculture (USDA) and Energy (DOE) to promote the use of renewable fuels, real-world limitations, such as the slower than expected development of the cellulosic biofuel industry, less growth in gasoline use than was expected when Congress enacted these provisions in 2007, and constraints in supplying certain biofuels to consumers, have made the timeline laid out by Congress extremely difficult to achieve.[30]

In addition, a wealth of new information has become available on the environmental effect of renewable fuel production since Congress authorized the EISA in 2007. Unfortunately, the literature broadly finds that meeting the volume requirements in the statute or in EPA's regulations may increase greenhouse gas emissions, in addition to polluting waterways. This information is particularly pertinent because Congress in 2007 surely did not envision that its RFS program would cause significant environmental damage. While EPA is constrained in its ability to respond to these unintended consequences, the current Congress is not.

Given the evidence gained from implementation of the RFS program, Congress should reevaluate the goals of the program and attempt to determine whether the RFS is meeting its stated goals.

Conclusion

EPA appropriately uses its waiver authority to set renewable fuel standards below those prescribed in the statute. However, the availability of new scientific, technical, and economic information shows that the RFS program does not work as it was intended to, and is likely causing significant environmental harm through increased greenhouse gas emissions and damage to waterbodies and ecosystems. Given the environmental damage and the large economic impact of the standards, EPA should update its benefits analysis and consider using its waiver authority to further reduce the standards. Responsibility rests with Congress to reevaluate the effects of the statutes it authorized, which are now causing economic and environmental harm.

[30] 80 FR 33101