2014

Avoiding the Catch-22: Reforming the Renewable Fuel Standard to Protect Freshwater Resources and Promote Energy Independence

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COMMENT

AVOIDING THE CATCH-22: REFORMING THE RENEWABLE FUEL STANDARD TO PROTECT FRESHWATER RESOURCES AND PROMOTE ENERGY INDEPENDENCE

INTRODUCTION

"No beaches have been closed due to ethanol spills!"[1] An ethanol advocacy group near the United States Capitol shouted these words in 2010. Proponents of ethanol parade an environmentally benign image that plays up ethanol as a "clean fuel" that could never harm water resources, unlike well-publicized oil spills, such as the Exxon Valdez incident.[2] But this is not the case.

The ethanol industry arose out of a two-fold regulatory scheme under the Renewable Fuel Standard ("RFS") to reduce greenhouse gases ("GHGs") and promote energy independence.[3] At first glance, the RFS appears beneficial; it promotes energy independence by force-blending homegrown fuel (ethanol) with gasoline, which reduces the total volume of gasoline imported.[4] However, these benefits do not come without costs. Ethanol production has put United States energy independence in a catch-22 because of the unintended consequences of ethanol production on the nation's freshwater resources. Whether or not the RFS meets its two

1. Erica Gies, *As Ethanol Booms, Critics Warn of Environmental Effect*, N.Y. TIMES (June 24, 2010), http://www.nytimes.com/2010/06/25/business/energy-environment/25iht-rbogeth.html?pagewanted=all&_r=0.

2. *See id.*

3. NAT'L CTR. FOR ENVTL. ASSESSMENT, U.S. ENVTL. PROT. AGENCY, EPA/600/R-10/183F, BIOFUELS AND THE ENVIRONMENT: FIRST TRIENNIAL REPORT TO CONGRESS, at ix (2011) [hereinafter FIRST TRIENNIAL REPORT], *available at* http://www.epa.gov/ncea/biofuels/.

4. *Id.* at xiv.

goals, its success needs to be measured from a holistic perspective that includes the cross-system impacts of ethanol production on freshwater resources as well as air quality.[5]

Congress should reform the RFS of the Clean Air Act ("CAA") to phase out the mandated biofuel volume requirements because the accelerated ethanol production created by the RFS has had unanticipated negative impacts on freshwater resources. The current system permits up to fifteen billion gallons of ethanol to be used to meet the mandate. Reform should encourage states to adopt Low Carbon Fuel Standard ("LCFS") programs that include provisions requiring study of the non-air pollution impacts of ethanol, including water consumption and contamination. This proposal would institute a cooperative relationship between the federal and state governments, remove the mandated biofuel volume requirements from the federal mandate, and require states to take on renewable fuel regulation through LCFS programs, moving the U.S. Environmental Protection Agency ("EPA") into a role of oversight and interstate regulation.

Part I presents background on the ethanol industry and the implementation and development of the RFS. It also gives a brief overview of the non-water-related reasons that have led various sectors of the economy to oppose ethanol. Part II provides an overview of ethanol production (from cornfield to refinery) and the impact each stage of the process has on freshwater resources in the United States. Given the harm that the current RFS has caused by failing to consider the impact of the ethanol production process on our nation's freshwater resources, a policy change needs to happen. Yet there are some benefits that biofuels might still provide, which is why Part III argues for a *reform* and not a *repeal* of the RFS. Part IV offers a proposal for reforming the RFS. Instead of mandating that fuels contain a fixed volume of conventional biofuels, the RFS should provide the states with more flexibility to adopt renewable biofuel programs that reduce the localized freshwater impacts. By reforming the RFS to con-

5. NAT'L ACAD. SCI., NAT'L RESEARCH COUNCIL, RENEWABLE FUEL STANDARD: POTENTIAL ECONOMIC AND ENVIRONMENTAL EFFECTS OF U.S. BIOFUEL POLICY 247 (2011) [hereinafter NAS: POTENTIAL ECONOMIC AND ENVIRONMENTAL EFFECTS] ("An assessment of overall environmental outcomes requires a systems approach that considers various environmental effects simultaneously using a suite of indicators. Such assessment would have to be conducted across spatial scales because some effects are localized while others are regional or global.").

sider ethanol production's effects on water resources, Congress can promote a cooperative relationship between the states and the EPA to avoid the catch-22 between ethanol and water.

I. BACKGROUND ON THE RENEWABLE FUEL STANDARD

This section will briefly discuss the background of ethanol use in the United States. It will explain the statutory development of the RFS, as well as give a detailed discussion of the EPA's relevant rules and regulations.[6] It is important to understand how the current RFS originated and the regulatory approach the federal government has since taken to promote the use of biofuels for transportation energy before undertaking a reform.

As petroleum became a desired commodity worldwide, the United States felt the need to develop policies that encouraged domestic energy security and reduced reliance on foreign oil.[7] Policymakers started looking into biofuels because the nation had vast amounts of fertile land that could be converted to grow crops.[8] These crops could then be turned into fuel (biofuel) and added to transportation fuel to reduce the total volume of gasoline needed.

A. *Encouraging Energy Independence and Reducing Greenhouse Gases*

The Energy Policy Act of 2005 amended section 211 of the CAA and provided the basis for the Renewable Fuel Standard, a program designed to reduce GHGs and increase the use of biofuels.[9]

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6. This section only offers a brief overview of ethanol in relation to the RFS; however, ethanol policy has had a much broader scope over the past few decades with tax credits, subsidies, farm bill incentives, etc. For a more in-depth look at ethanol policy in the United States, see James A. Duffield et al., *Ethanol Policy: Past, Present, and Future*, 53 S.D. L. REV. 425 (2008); NAS: POTENTIAL ECONOMIC AND ENVTL. EFFECTS, *supra* note 5, at 16–20; Melissa Powers, *King Corn: Will the Renewable Fuel Standard Eventually End Corn Ethanol's Reign?*, 11 VT. J. ENVTL. L. 667, 677–82 (2010).

7. FIRST TRIENNIAL REPORT, *supra* note 3, at ix.

8. *Cf. How Will the U.S. Produce 36 Billion Gallons of Biofuels by 2022?*, WORLDWATCH INST. (Nov. 2007), http://www.worldwatch.org/node/5600 (explaining how producing thirty-six billion gallons—the total RFS mandate for 2022—would require 120 million acres of agricultural land, but that amount only constitutes 15% of the total U.S. land currently used for livestock grazing).

9. *See* Energy Policy Act of 2005, Pub. L. No. 109-58, § 1501, 119 Stat. 594, 1067 (codified as amended at 42 U.S.C. § 7545 (2006)).

Congress directed the EPA to promulgate regulations to carry out the program.[10] The RFS requires fixed volume amounts of biofuel to be added to the gasoline sold in the United States every year.[11]

In 2007, Congress enacted the Energy Independence and Security Act ("EISA"), amending the CAA by increasing the mandated biofuel volume requirements in the RFS and including separate categories of renewable fuel.[12] The regulations under the RFS target petroleum refiners, manufacturers, wholesalers, and other fuel dealers because they have to purchase the renewable fuels to blend into their gasoline.[13]

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10. FIRST TRIENNIAL REPORT, *supra* note 3, at ix.

11. *Id.*

12. Energy Independence and Security Act, Pub. L. No. 110-140, § 202, 121 Stat. 1492, 1521–28 (2007) (amending section 211(o)(2) of the CAA). The 2007 standard is commonly referred to as RFS2 because it is an updated mandate. U.S. ENVTL. PROT. AGENCY, RENEWABLE FUEL STANDARDS (RFS), http://www.epa.gov/otag/fuels/renewable fuels/ (last visited Feb. 18, 2014). However, this comment will refer to it as the RFS because there is only one RFS currently being implemented. Why a bill that was initially spurred by national security was incorporated into an air pollution law is not entirely clear, but it could be an attempt "to kill two birds with one stone." To reduce dependence on foreign oil, the United States had to switch to something it has plenty of—fertile land. If the nation can grow its own fuel, then it can reduce its imports. And, as explained later, crop-based fuel absorbs CO_2 during its lifetime. *See infra* note 17 and accompanying text.

13. Regulation of Fuels and Fuel Additives: 2013 Renewable Fuel Standards, 78 Fed. Reg. 49,794, 49,794 (Aug. 15, 2013) (to be codified at 40 C.F.R. pt. 80). How does the EPA enforce the blend requirements among targeted parties? Every gallon of renewable fuel blend is assigned a Renewable Identification Number ("RIN") that allows the EPA to track industry compliance with the mandate. *See* 40 C.F.R. §§ 80.1125–26 (2008). RINs are like birth certificates—they are created at the production stage and stick with the gallon of fuel when it is transferred from the renewable fuel producer to the gasoline company. *Id.* § 80.1126(d). Once the renewable fuel is blended into a refiner's gasoline, the RIN is reported to the EPA to demonstrate that the refiner complied with its mandated biofuel volume. *Id.* § 80.1152(a)(viii)–(x). Similar to carbon trading, RINs can be bought and sold (traded) between refiners and importers after the blending stage. Robert Wisner, *Renewable Identification Numbers (RINs) and Government Biofuels Blending Mandates*, AGRIC. MARKETING. RES. CTR. (Apr. 2009), http://www.agmrc.org/renewable_energy/biofuelsbiorefining_general/renewable-identification-numbers-rins-and-government-biofuels-blending-mandates/. This happens when more renewable fuel is blended than the amount mandated. *Id.* In this case, excess RINs float on the market and refiners that do not meet their blend requirement by personally blending renewable fuel and gasoline can purchase RINs from refiners that over-blend. *Id.* For instance, if Biofuel Producer X is required to produce 100,000 gallons of ethanol to meet his 10% mandated volume for 2012, but instead he produces 110,000 gallons of ethanol, then he will have 10,000 RINs in excess of his mandated amount. These RINs then become transferable once they are blended. *Id.* For example, Refiner Y decides not to blend his gasoline with biofuels in 2013 because his gasoline market is in a state with anti-ethanol legislation. Refiner Y can then buy the RINs associated with the actual gallons of ethanol that Biofuel Producer X produced without having to buy the actual gallons. Refiner Y can then turn these RINs into the EPA to show compliance. The amounts of RINs per gallon of renewable fuel differ depending on the type of feedstock used for that fuel. "For each gallon of corn-starch ethanol produced, one RIN is issued

Ultimately, the RFS attempts to make transportation fuels more "renewable." Transportation emissions represent the second largest source of GHGs in the United States[14] and carbon dioxide ("CO_2"), the principle GHG, has recently been adjudged within the scope of the CAA.[15] Renewable fuels have the potential to play an important role in controlling harmful transportation-related emissions. A renewable fuel is "produced from renewable biomass and . . . used to replace or reduce the quantity of fossil fuel present in a transportation fuel."[16] A renewable fuel is made from a plant source that absorbs CO_2 while growing, which offsets the CO_2 emitted when the fuel is burned.[17] Thus, theoretically from an energy-in-energy-out perspective, ethanol seems beneficial.[18] However, a holistic analysis of ethanol's impact, including not just renewable fuel use and GHG emissions, but also water resources, shows that this is not the case.[19]

The EISA categorizes renewable fuels into two categories: conventional and advanced.[20] Conventional biofuels are typically

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. . . . In future years when commercial production of cellulose ethanol becomes widely available, it will receive 2.5 RINs per gallon." *Id.*

14. *Sources of Greenhouse Gas Emissions*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/climatechange/ghgemissions/sources.html (last visited Feb. 18, 2014).

15. Massachusetts v. EPA, 549 U.S. 497, 528 (2007) (holding that the EPA has statutory authority to regulate greenhouse gas emissions including carbon dioxide from new motor vehicles because these emissions fit within the Clean Air Act's definition of "air pollutant").

16. Energy Independence and Security Act § 201, 42 U.S.C. § 7545(o)(1)(J) (2006 & Supp. V 2012); *see also* 40 C.F.R. § 80.1101(d) (2008) (listing feedstock sources that are used to produce renewable fuel, including cellulosic biomass ethanol); *see also* U.S. ENVTL. PROT. AGENCY, EPA-420-R-10-006, RENEWABLE FUEL STANDARD PROGRAM (RFS2) REGULATORY IMPACT ANALYSIS 20 (2010) [hereinafter RIA], *available at* http://www.epa.gov/otaq/renewablefuels/420r10006.pdf ("Various cellulosic feedstocks can potentially be used to produce cellulosic biofuel. These include agricultural residues, forest residues, urban waste, and dedicated energy crops.").

17. *See Biofuels: The Original Car Fuel*, NAT'L GEOGRAPHIC, http://environment.nationalgeographic.com/environment/global-warming/biofuel-profile/ (last visited Feb. 18, 2014) [hereinafter *The Original Car Fuel*] ("[U]nlike underground oil reserves, biofuels are a renewable resource since we can always grow more crops to turn into fuel."); *see* RIA, *supra* note 16, at 495.

18. When gasoline made from pure fossil fuel is burned, it increases net CO_2 emissions because it releases CO_2 that has been stored underground for millions of years and, unlike with biofuels, the fossil fuel extraction and refinement process does not absorb any CO_2. *The Benefits of Biofuels: Environment and Public Health*, ENERGY FUTURE COALITION, http://www.energyfuturecoalition.org/biofuels/benefits_env_public_health.htm (last visited Feb. 18, 2014) ("The use of fossil fuels, on the other hand, releases carbon that has been stored underground for millions of years, and those emissions represent a net addition of CO2 to the atmosphere.").

19. *See The Original Car Fuel*, *supra* note 17.

20. Energy Independence and Security Act § 201, 42 U.S.C. § 7545(o)(1).

corn-based, but can be made from other crops such as soybeans or sugarcane; in the United States, more than 95% of conventional biofuels are derived from corn.[21] Advanced biofuels consist of cellulosic biofuel and biomass-based diesel.[22] However, cellulosic biofuels are still in the research and development stage, thus, the only advanced biofuel readily available is generally biomass-based diesel. This comment focuses on conventional biofuels and often refers to conventional biofuels as "corn-based ethanol."[23]

In the Energy Policy Act of 2005, Congress set a total amount of renewable fuel that had to be implemented each year, starting at four billion gallons in 2006 with a goal of 7.5 billion gallons in 2012.[24] In 2007, the EISA expanded the RFS by increasing the total volume of renewable fuel added, as well as lengthening the program to extend until 2022, when a total of thirty-six billion gallons of renewable fuel is mandated.[25] Congress also broke down the total advanced biofuel requirements by setting fixed volume amounts for cellulosic biofuel and biomass-based diesel; however, biomass-based diesel fuel requirements were only mandated up to 2012 and have since expired.[26] To meet the total renewable fuel requirement for a specific year, the applicable volumes of advanced biofuels must be met, and then the remaining portion of the total renewable fuel standard can be met with conventional biofuels.[27]

21. *Cf.* Powers, *supra* note 6, at 682 ("By the end of 2007, corn ethanol comprised 95% of the biofuels used in the United States."). Congress also generally refers to ethanol and conventional biofuels fairly interchangeably because ethanol is the main conventional biofuel used in the United States. *See* FIRST TRIENNIAL REPORT, *supra* note 3, at 2-1.

22. Energy Independence and Security Act § 201, 42 U.S.C. § 7545(o)(1). The categories are determined by lifecycle GHG emissions. FIRST TRIENNIAL REPORT, *supra* note 3, at 2-2. The lifecycle GHG emissions are the percent reductions in GHG emissions that the biofuel would have in comparison to gasoline. *Id.* Under the RFS, the corn-based conventional biofuel (ethanol) lifecycle GHG emissions percentage indicates fuels within that category will emit 20% fewer GHGs than pure gasoline; whereas to be considered a cellulosic biofuel (switchgrass, algae, etc.), the fuel must emit up to 60% fewer GHGs than pure gasoline. *Id.* at 2–3.

23. The Act defined conventional biofuel as "renewable fuel that is ethanol derived from corn starch." Energy Independence and Security Act § 201, 42 U.S.C. § 7545(o)(1)(F).

24. Energy Policy Act § 1501(a), 42 U.S.C. § 7545(o)(2)(B) (2006) (providing a chart of the applicable volume of renewable fuel to be added each calendar year from 2006 until 2012).

25. *See* FIRST TRIENNIAL REPORT, *supra* note 3, at ix.

26. Energy Independence and Security Act § 202(a)(2), 42 U.S.C. § 7545(o)(2)(B) (2006 & Supp. V 2012).

27. *See* FIRST TRIENNIAL REPORT, *supra* note 3, at 2-2 tbl.2-1.

To understand the breakdown of the mandate, it is helpful to show the fixed volume amounts for a given year that are required to meet the total renewable fuel mandate. With the EISA in 2007, Congress set the total renewable fuel requirement for the year 2014 at 18.15 billion gallons.[28] Of the 18.15 billion gallons, 3.75 billion gallons must come from advanced biofuels.[29] Of the 3.75 billion gallons, 1.75 billion gallons must come from cellulosic biofuel, thus leaving the remaining 2.0 billion gallons of advanced biofuel to come from either cellulosic or biomass-based diesel.[30] The remaining portion of the 2014 requirement may be met by conventional biofuel, or rather corn-based ethanol. Congress did not set a mandate for conventional biofuel.[31] Rather, "[c]orn ethanol is capped at 15 billion gallons from 2015 on, while the other categories of renewable fuel continue to rise until the total RFS reaches 36 billion gallons by 2022."[32] In theory, the entire renewable fuel standard can be filled with advanced biofuels because the statute does not require the use of ethanol to satisfy the renewable fuel requirements;[33] but in reality, the technology for cellulosic and other advanced biofuels is not yet here.[34]

The mandate requires these fixed volume amounts to be blended into the nation's gasoline each year.[35] However, the EISA granted the EPA authority to reduce the fixed volume amounts for each of the renewable fuels if the fuel was not commercially available.[36] The EPA has frequently reduced the standard for the

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28. Energy Independence and Security Act § 202(a)(2), 42 U.S.C. § 7545(o)(2)(B).

29. *Id.* However, due to the slower than predicted development of cellulosic fuels, the EPA proposed that the 2014 volume requirements for advanced biofuels be reduced to 2.20 billion gallons, rather than 3.75. 2014 Standards for the Renewable Fuel Program; Proposed Rule, 78 Fed. Reg. 71,732, 71,732 (Nov. 29, 2013) (codified at 40 C.F.R. pt. 80).

30. Energy Independence and Security Act § 202(a)(2), 42 U.S.C. § 7545(o)(2)(B).

31. RIA, *supra* note 16, at 75.

32. H. COMM. ON ENERGY & COMMERCE, WHITE PAPER: RENEWABLE FUEL STANDARD ASSESSMENT (2013) [hereinafter WHITE PAPER: RFS], *available at* http://energycommerce.house.gov/sites/republicans.energycommerce.house.gov/files/analysis/20130508RFSWhitePaper3.pdf; *see also* NAS: POTENTIAL ECONOMIC AND ENVIRONMENTAL EFFECTS, *supra* note 5, at 11 ("Even with the addition of cellulosic crops, corn will likely comprise a significant portion of biofuel crops.").

33. RIA, *supra* note 16, at 75. However, this is highly unlikely because corn ethanol is currently the cheapest renewable fuel to produce. *Id.* at 135–36; *see also* Powers, *supra* note 6, at 694 n.219.

34. And even if it were, researchers predict "over 40 percent of biofuels to be consumed to meet the mandate in 2022 will be conventional biofuels, most likely corn-grain ethanol." WHITE PAPER: RFS, *supra* note 32, at 26.

35. *See* FIRST TRIENNIAL REPORT, *supra* note 3, at ix.

36. Energy Independence and Security Act § 202(c), 42 U.S.C. § 7545(o)(4)(A) (2006 &

cellulosic biofuel category because the technology is not yet available on a commercial scale to produce enough biofuel to meet the fixed volume mandated by Congress.[37] It is highly unlikely the EPA would ever invoke its authority under this provision to lower conventional biofuels because corn ethanol has proved to be commercially available.[38]

It is also important to note that under the CAA, the EPA Administrator is permitted to waive the mandate categories altogether if the Administrator determines that they would be harmful to the economy or the environment of a state, region, or the nation as a whole.[39] Though states have petitioned the EPA to grant a waiver, none have succeeded in their attempts.[40] The EPA's unwillingness to grant waivers has been attributed to the rigorous standard that the EPA requires a petitioner to meet.[41] To be successful, a petitioner would have to show that the RFS is the only cause of the state's economic or environmental harms, and that the harms were "severe."[42] This standard is nearly impossible to meet because it requires sole, direct proof of causation.[43] The state must show that its "severe" harm is *only* caused by the RFS, which prevents a state from arguing that the RFS is a significant contributor to the harm.[44]

Though Congress set fixed volume amounts for each fuel, it did give the EPA some wiggle room to make adjustments that would help mitigate the environmental effects. Until congressional reform happens, the EPA should use this granted authority to reduce or waive the permitted use of conventional biofuels as an immediate measure to prevent future deterioration of the nation's freshwater resources, which is clearly a severe environmental harm.

Supp. V 2012).

37. *See* FIRST TRIENNIAL REPORT, *supra* note 3, at 2-2 tbl.2-1 n.d.

38. *Cf. U.S. Fuel Ethanol Production Capacity*, ETHANOL PRODUCERS & CONSUMERS, http://www.ethanolmt.org/plants.html (last visited Feb. 18, 2014) (listing existing ethanol facilities and their capacity to produce ethanol).

39. 42 U.S.C. § 7545(o)(7)(A).

40. *See, e.g.*, Powers, *supra* note 6, at 691–92.

41. *Id.* at 691.

42. *Id.* at 691–92.

43. *Id.* at 692.

44. *Id.* ("Although EPA appeared to agree that the RFS will always work in conjunction with other factors, such as gasoline and food prices, to affect the economy and environment, EPA nonetheless held that the waiver requires a demonstration that the RFS, acting alone, is the cause of the alleged harm.").

B. *Opposition to Ethanol Proliferation*

Opponents of ethanol dispute its benefits for a variety of reasons. This comment focuses on the impact of ethanol on the nation's freshwater resources, but there are other concerns with ethanol production as well. Both the petroleum and auto industries argue for a repeal of the mandate because they incur increased costs due to the lack of flexibility in the RFS to adjust to market demand for gasoline and the damage ethanol-blended fuel causes to car parts. The petroleum industry opposes the use of the mandate because it requires refiners to purchase and blend renewable fuel into gasoline so at least 10% of the total fuel is renewable fuel, mainly ethanol.[45] Oil refiners claim this increases production costs and indirectly hurts consumers.[46] Every year the fixed volume of renewable fuel increases, which requires refiners to purchase more than the year before with the hopes that the demand for gasoline will increase, paralleling the increases in renewable fuel.[47] However, the current market demand for gasoline has not increased along with the mandate,[48] thus leaving refiners with excess ethanol they cannot use but are still required to purchase.[49] Auto manufacturers also argue that ethanol damages en-

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45. Javier E. David, *Ethanol Mandate, 'Blend Wall' Loom Large for Refiners*, CNBC.COM (Aug. 11, 2013), http://www.cnbc.com/id/100952221.

46. *Id.* (noting that this may lead to industry pushing higher prices on to consumers because "'[t]he system can't absorb all the ethanol that's mandated'"); *see also Bioenergy: Findings*, ECON. RES. SERVICE, U.S. DEP'T OF AGRIC., http://www.ers.usda.gov/topics/farm-economy/bioenergy/findings.aspx#.UpKzGo3hEzY (last updated May 27, 2012) ("[A]s mandates increase over time, the volumes required will be difficult to absorb into the transportation sector as it is currently structured.").

47. *See* FIRST TRIENNIAL REPORT, *supra* note 3, at ix.

48. *See* David, *supra* note 45 (noting current trends of declining gasoline use). The mandate levels were established in 2007, when demand for oil was high and supply was low. Daniel Yergin, *There Will Be Oil*, WALL ST. J. (Sept. 17, 2011), http://online.wsj.com/news/articles/SB10001424053111904060604576572552998674340 (terming the year 2007 as the "unbridgeable supply demand gap"); *see also* Robert Rapier, *Refiners Hit "Blend Wall" with Ethanol. Now What?*, CHRISTIAN SCI. MONITOR (Mar. 22, 2013), http://www.csmonitor.com/Environment/Energy-Voices/2013/0322/Refiners-hit-blend-wall-with-ethanol.-Now-what ("[T]he passage of the RFS2 coincided with a period of record fuel prices, so US demand for gasoline fell from 142 billion gallons in 2007 to 133 billion gallons by 2012.").

49. Recently, demand for gasoline has decreased due to reasons such as increased fuel-efficiency and economic stress from the recession. *See* David, *supra* note 45. This results in a problem as less gasoline is consumed because demand decreases, but more and more ethanol is being produced to meet the mandate. *Id.* At the end of the year there is an excess of ethanol, which refiners are still required to purchase because of Congress's fixed volume amounts in the RFS. *Id.* Refiners have termed this imbalance the "blend wall" crisis. *Id.* The blend wall will upset the ninety-to-ten gasoline-to-ethanol balance, with etha-

gines, especially in older cars,[50] which will hurt consumers who have to pay costly repair bills.[51]

Another debate that has arisen since the increase in ethanol production is the "fuel versus food" debate.[52] The use of corn to produce ethanol under the RFS diverts crops and crop inputs[53] that could be used for human consumption into producing fuel, thus increasing the price of food.[54] Along with freshwater quality discussed below, other environmental concerns arise during the ethanol production process, such as soil quality,[55] habitat destruction,[56] and loss of biodiversity.[57]

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nol exceeding the 10% ratio. *Id.* To help avoid the blend wall crisis, the EPA approved increasing the amount of ethanol to be blended in each gallon from 10% (E10) to 15% (E15). *E15 (a blend of gasoline and ethanol)*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/otaq/regs/fuels/additive/e15/ (last updated Aug. 2, 2013). This increase allows refiners to take the excess ethanol they were required to purchase and blend up to 15% of it in every gallon of gasoline. *Id.*

50. Gary Strauss, *AAA Warns E15 Gasoline Could Cause Car Damage*, USA TODAY (Nov. 30, 2012, 11:40 AM), http://www.usatoday.com/story/news/nation/2012/11/30/aaa-e15-gas-harm-cars/1735793/.

51. *Id.* E15 is only approved for cars built in 2001 or later, and if consumers are not familiar with numbers on the pump, they may add too high of an ethanol-blend into older cars that cannot handle the fuel. *Id.*

52. *See generally* Brent J. Hartman, *The Renewable Fuel Standard: Food Versus Fuel*, 65 ME. L. REV. 525 (2012) (arguing that food and energy policy need not conflict).

53. *See* NAS: POTENTIAL ECONOMIC AND ENVIRONMENTAL EFFECTS, *supra* note 5, at 149 ("As the quantity of resources used in the production of feedstock increases, the quantity of those resources used in the production of other goods (for example, food, livestock feed) decreases . . . ."). When farmers use common agricultural inputs such as land, water, and fertilizers to produce future fuel for cars, fewer resources are available to produce food for human consumption, and if they are available, they come at a higher cost due to increased demand and competition. *Id.*

54. *Id.* at 6. This does not mean that the only rising price is that for corn-on-the-cob. Corn is refined in a variety of ways for many food products, and it is used as an input in livestock production, which is one of the biggest hit markets. *See Bioenergy: Findings*, *supra* note 46 (noting that less than 10% of U.S. corn is used for direct human consumption, but that 40% of U.S. corn is used as animal feed for livestock and poultry); *see also, e.g.*, *Overview of the Renewable Fuel Standard: Stakeholder Perspectives, Day 2: Hearing Before the H. Subcomm. on Energy & Power of the H. Comm. on Energy & Commerce*, 113th Cong. 9–11 (2013) [hereinafter *Hearing: Day 2, RFS Overview*] (statement of Bob Roenigk, Senior Vice President, Nat'l Chicken Council) (preliminary transcript), *available at* http://democrats.energycommerce.house.gov/sites/default/files/documents/Transcript-EP-Renewable-Fuel-Standard-Stakeholder-Perspectives-2013-7-24.pdf (petitioning Congress to repeal the RFS due to increased costs on the inputs used in the chicken industry and the rise in overall food prices globally).

55. Planting corn every year, or even rotating corn with soybeans or other legumes, makes the soil clumpy and hard to manage. Sea Stachura, *Ethanol vs. Water: Can Both Win?*, MINN. PUB. RADIO (Sept. 18, 2006), http://minnesota.publicradio.org/display/web/2006/09/07/ethanolnow. A snowball effect of impacts can happen; "farmers will need to till their fields more often. More tilling means more erosion. And erosion increases runoff." *Id.*

56. Land use changes to grow corn for ethanol damage freshwater resources. Common

Simply put, the RFS has been a controversial program since its inception. Petroleum companies, auto manufacturers, food producers, and environmental advocates have all opposed development of the mandate, which is the leading driver of ethanol expansion. Although its opponents decry the ethanol boom for a variety of reasons, its impacts on the nation's freshwater resources remain highly overlooked. If its impacts continue to be overlooked, key water resources will become depleted or degraded by pollution, which will threaten the continuing viability of biofuel production.[58]

II. ETHANOL PRODUCTION AND THE IMPACT ON FRESHWATER RESOURCES

Because almost the entire conventional biofuels mandate is met by ethanol derived from corn, the increasing amounts of renewable fuel mandated by the RFS inevitably result in expansion of United States corn production.[59] Unfortunately, Congress did not consider how increased ethanol production would affect freshwater resources. This section first gives an overview of the production of ethanol from cultivation to refinement, discussing both the water pollution and water depletion issues throughout the process. The section then reviews the EPA's 2011 findings that biofuel production has relatively "modest" impacts on freshwater resources and argues that the EPA needs to expand the scope of its analysis to see how these findings impact the global energy-water nexus.

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land use changes entail clearing natural vegetation or filling wetlands to have enough acreage of fertile soil. *See* Alex Rindler, *More Corn Ethanol in 2013 Means Environment, Consumers Lose Out*, ENVTL. WORKING GRP. (Aug. 19, 2013), http://www.ewg.org/agmag/2013/08/more-corn-ethanol-2013-means-environment-consumers-lose-out ("From 2008 to 2011, the corn ethanol mandate has contributed to the plowing up of more than 23 million acres of wetlands and grasslands to plant crops—an area the size of Indiana.").

57. FIRST TRIENNIAL REPORT, *supra* note 3, at 3-25 to 3-27.

58. *See* U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-10-116, ENERGY-WATER NEXUS 2 (2009) [hereinafter GAO REPORT] (noting that impacts to water resources from biofuel production need to be assessed because "[w]ater is crucial to many stages of the biofuel life cycle").

59. FIRST TRIENNIAL REPORT, *supra* note 3, at xv.

A. *Water in Ethanol Production*

Water plays a significant role at each stage of ethanol production, from cultivation to refinement. The following section presents this process, indicating where water is used as a direct input or is an indirectly affected output.[60] The most severe impacts are felt at the local and regional levels, which the RFS has failed to consider.

1. Cultivation

Ethanol is made from corn starch.[61] To make enough ethanol for fuel to meet the mandate, a lot of raw corn needs to be produced—billions of bushels per year.[62] Ethanol production begins with cultivation of corn in the fields.[63] This entails clearing land (either by removing natural vegetation, filling wetlands, or displacing other crops) to make room for monocultures[64] of row-crop corn,[65] applying fertilizers and pesticides, and using freshwater for irrigation.[66] Each stage of the process to generate the raw materials for ethanol production can directly or indirectly harm freshwater resources.[67]

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60. *See* MAY WU ET AL., ARGONNE NAT'L LAB., CONSUMPTIVE WATER USE IN THE PRODUCTION OF BIOETHANOL AND PETROLEUM GASOLINE 13 (2008) [hereinafter CONSUMPTIVE WATER USE], *available at* http://www.acs.org/content/dam/acsorg/policy/acsonthehill/briefings/energywaternexus/12-08-anl-water-use-in-bioethanol-gas.pdf.

61. FIRST TRIENNIAL REPORT, *supra* note 3, at 4-3 (describing the two common processes used to convert corn starch into ethanol).

62. *Id.* at 3-5 to 3-6.

63. *See* GAO REPORT, *supra* note 58, at 4.

64. A monoculture is the growing of only one species of crop, grown densely over a large land area. As such, monocultures require increased use of pesticides, since the area would be an ideal location for crop pests and diseases to grow. Monocultures require vast areas of land, and therefore can lead to the destruction of natural habitats.

Vanessa M. Cordonnier, *Ethanol's Roots: How Brazilian Legislation Created the International Ethanol Boom*, 33 WM. & MARY ENVTL. L. & POL'Y REV. 287, 305 (2008).

65. *See* Mary Jane Angelo, *Corn, Carbon, and Conservation: Rethinking U.S. Agricultural Policy in a Changing Global Environment*, 17 GEO. MASON L. REV. 593, 640 (2010). Professor Angelo notes that the amount of corn needed to produce ethanol requires more agricultural land use, which could displace natural land cover and lead to "a loss of ecosystem functions and reduced biodiversity." *Id.* (internal quotation marks omitted); *see also* NAS: POTENTIAL ECONOMIC AND ENVIRONMENTAL EFFECTS, *supra* note 5, at 207.

66. *See* GAO REPORT, *supra* note 58, at 2, 10.

67. *Id.* at 2.

First, growing corn consumes a significant amount of freshwater in some regions of the country, depending on annual rainfall conditions.[68] Some areas of the country have abundantly flowing freshwater, but in many parts of the country, freshwater is dwindling and is not always available when and where it is needed.[69] In a state with little annual rainfall like Nebraska, an average of 865 gallons of freshwater from irrigation sources is consumed, whereas in a state like Ohio that gets more rainfall, an average of only nineteen to thirty-eight gallons of irrigation is consumed.[70] In the United States, the majority of irrigation water comes from aquifers, and the rest from surface waters.[71] If water is withdrawn from an aquifer at a faster rate than it is recharged from rainfall, then the aquifer can become depleted over time,[72] which "is perhaps the most serious water-related impact of energy development."[73] As ethanol demand expands, irrigation needs for

68. JAMES A. BAKER III INSTIT. FOR PUB. POLICY & RICE UNIV., FUNDAMENTALS OF A SUSTAINABLE U.S. BIOFUELS POLICY 72 (2010) ("[W]hile some midwestern regions can satisfy most of the agricultural water requirements with rainfall (for example, in Ohio less than 1 percent of corn grown is irrigated), other regions rely primarily on irrigation, such as in Nebraska, where 72 percent of corn grown is irrigated.").

69. GAO REPORT, *supra* note 58, at 2.

70. *Id.* at 8.

71. CONSUMPTIVE WATER USE, *supra* note 60, at 21 ("In the U.S., 77 percent of the irrigation water used for corn is from such aquifers; the remaining 23 percent comes from surface water.").

72. *Id.* at 57; *see also* FIRST TRIENNIAL REPORT, *supra* note 3, at 4-7 ("In the case of sole source aquifers, ground water depletion may severely impact drinking water availability, because these areas have no readily available alternative freshwater sources.") (citation omitted). Potential depletion of aquifers is a concern nationwide, especially for aquifers that underlie multiple states and supply water to citizens of multiple states. *See generally* Justin Newell Hesser, Comment, *The Nature of Interstate Groundwater Resources and the Need for States to Effectively Manage the Resource Through Interstate Compacts*, 11 WYO. L. REV. 25 (2011). However, critics of these environmental and water quality/quantity concerns argue that the immediate economic benefits of ethanol cultivation and production outweigh the losses in freshwater resources. *See* Steve Amosson et al., *Economic and Policy Implications of Underground Water Use in the Southern Ogallala Region: Impacts of the Ethanol Industry on the Southern Ogallala Region*, *in* OGALLALA AQUIFER PROGRAM 2009 FINAL REPORT 7 (2009), *available at* http://www.ogallala.ars.usda.gov/reportseconomics.php ("[C]omparison of the socioeconomic benefits of using water resources for the production of ethanol versus irrigated crop production indicates that ethanol production generates economic impacts above and beyond that of crop production utilizing an equivalent amount of water. For example, the employment generated by the ethanol plant is 21 to 42 times the amount of the irrigated crops grown in the area using the same amount of water.").

73. CONSUMPTIVE WATER USE, *supra* note 60, at 57. Depletion increases economic stress from resource competition and can lead to legal battles between communities. U.S. ENVTL. PROT. AGENCY, THE IMPORTANCE OF WATER TO THE U.S. ECONOMY PART 1: BACKGROUND REPORT 12-2 to 12-3 (2012) [hereinafter THE IMPORTANCE OF WATER], *available at* http://water.epa.gov/action/importanceofwater/upload/Background-Report-Public-

corn will result in increased withdrawals, which could deplete or reduce availability of water for other competing uses.[74]

Second, clearing natural vegetation to grow the large quantities of corn[75] needed to meet ethanol requirements under the RFS mandate degrades water quality through both soil erosion and chemical runoff.[76] Removing native vegetation increases the likelihood that the soil will erode, causing sedimentation,[77] which physically clogs stream channels, overloads reservoirs with silt, and increases the turbidity (murkiness) of water, which can impair aquatic life and vegetation.[78]

Chemical use is also a controversial aspect of corn cultivation. Corn cultivation requires a lot of fertilizer, herbicide, and pesticide.[79] A study conducted by the Union of Concerned Scientists stated that although corn is grown on less than 23% of agricultural land, it accounts for 40% of United States fertilizer use.[80]

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> In addition to consuming resources in legal battles, these situations represent areas of vulnerability for economic sectors dependent on reliable access to adequate supplies of water. Where water resources are not sufficient to meet competing demands, the likelihood of significant economic impacts to one or more of these sectors is greater.

Id. at 12-3.

74. *See* CONSUMPTIVE WATER USE, *supra* note 60, at 4, 57.

75. Since corn is generally only economical if produced in large quantities, farmers tend to only grow corn on a given piece of land (using the land as a monoculture), which limits nutrients that can be naturally broken down back into the soil to sustain quality. GAO REPORT, *supra* note 58, at 25.

76. *See* Angelo, *supra* note 65, at 606. Greater risks of erosion occur with more intensive use of land, like growing corn, versus natural woodlands or pastures. FIRST TRIENNIAL REPORT, *supra* note 3, at 3-14.

77. *See* Mark Murphey Henry et al., *A Call to Farms: Diversify the Fuel Supply*, 53 S.D. L. REV. 515, 523 (2008). Indirectly, removing native vegetation decreases the quality of topsoil because less diverse organic matter is reintroduced to the soil. Decreased topsoil quality increases the likelihood that the soil will erode. *Id.*; *see also* NAT'L RESEARCH COUNCIL, NAT'L ACAD. SCI., WATER IMPLICATIONS OF BIOFUELS PRODUCTION IN THE UNITED STATES 13 (2008) [hereinafter NAS: WATER IMPLICATIONS OF BIOFUELS PRODUCTION], *available at* http://www.nap.edu/openbook.php?record_id=12039&page+13.

78. NATURAL RES. CONSERVATION SERV., U.S. DEP'T AGRIC., WATER SEDIMENT (2012), *available at* http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1187287.pdf.

79. This comment focuses on synthetic nitrogen and phosphorus fertilizers, but many farmers use animal manure as a fertilizer instead of synthetic fertilizers. RIA, *supra* note 16, at 979 ("Most livestock manure is applied to crops, especially corn, as a source of nutrients.").

80. UNION OF CONCERNED SCIENTISTS, THE ENERGY-WATER COLLISION: CORN ETHANOL'S THREAT TO WATER RESOURCES 2, 4 (2011) [hereinafter ENERGY-WATER COLLISION], *available at* http://www.ucsusa.org/assets/documents/clean_energy/ew3/corn-ethanol-and-water-quality.pdf; *see* RIA, *supra* note 16, at 964–65 ("Of the potential crops for biofuels production, corn has the highest rates of fertilizer and pesticide application,

For instance, Minnesota farmers apply on average more than 140 pounds of nitrogen fertilizer per acre of corn.[81] When it rains, these chemicals run into surface waters, offsetting the balance of nutrients and potentially creating "dead zones" (areas that cannot sustain life) in bodies of water.[82] Moreover, ethanol production damages water resources beyond the area surrounding cornfields. Increased corn production in Corn Belt states created one of the largest dead zones in the Gulf of Mexico.[83] Thus, when looking at water impacts, it must be understood that concentrated corn cultivation does not just have concentrated impacts, but may have impacts thousands of miles away.

Not only do fertilizers contribute to water pollution, but corn production often involves the use of herbicides, like atrazine, that can migrate into drinking water.[84] Atrazine is a chemical herbicide commonly used in corn cultivation to control weeds.[85] Atrazine can be toxic to humans, especially during prime developmental stages, in utero or during puberty, and is often ingested through drinking water.[86] Due to these health risks and its com-

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leading to the concern that higher corn production will result in increased loading of nutrients, pesticides, and sediment to water bodies, including major rivers and estuaries.").

81. Stachura, *supra* note 55. For a chart comparing chemical application necessary for corn production to other crops, see RIA, *supra* note 16, at 322–23 fig.2.4-3 (noting that soybeans require less than ten pounds of nitrogen per acre).

82. *See* Angelo, *supra* note 65, at 606; *see also* FIRST TRIENNIAL REPORT, *supra* note 3, at 3-10. This process is known as "eutrophication." ENERGY-WATER COLLISION, *supra* note 80, at 4. Excess nitrogen and phosphorus enrichment creates algae blooms: algae levels build up and die off, then bacteria consume the algae, reducing the total oxygen level of the water body, leading to the death of other aquatic organisms. *Id.*

83. A report by the National Research Council in 2008 concluded, "excess nutrients and sediment from the high corn-producing Midwest are the primary sources of water quality degradation in the Mississippi River basin and the Gulf of Mexico." FIRST TRIENNIAL REPORT, *supra* note 3, at 3-10; ENERGY-WATER COLLISION, *supra* note 80, at 4. A similar issue is also occurring in the Chesapeake Bay, which has a watershed that spans six states. RIA, *supra* note 16, at 974. Since the RFS, corn production is expanding throughout the watershed. *Id.* at 975. A technical review committee estimated that up to 300,000 new acres of corn could be added to the watershed, which could potentially contribute an additional five million pounds of nitrogen to the Bay. *Id.* This is controversial since the Chesapeake Bay Commission is aiming to reduce nitrogen by ninety million pounds. *Id.*

84. RIA, *supra* note 16, at 957, 983.

85. *Id.* at 983; *see also Atrazine in Water Costs Syngenta*, PESTICIDE ACTION NETWORK (Feb. 6, 2013, 12:19 PM), http://www.panna.org/blog/atrazine-water-costs-syngenta ("More than 76 million pounds are used in this country each year—mostly on corn fields.").

86. The EPA issued a study in 2007 concluding that atrazine is an endocrine disrupter (targets the hormone system) and can impact the health of children during sexual development or if exposed in utero. U.S. ENVTL. PROT. AGENCY, ATRAZINE, CHEMICAL SUMMARY 1 (2007), *available at* http://www.epa.gov/teach/chem_summ/Atrazine_summary.pdf. A key

mon appearance as a pollutant in drinking water sources, atrazine is banned in Europe;[87] however, it is still the most common herbicide used in corn cultivation in the United States.[88] As a result of corn production for ethanol in the Corn Belt, atrazine has been found in both surface and groundwater.[89] In 2010, sixteen Midwest cities brought a class action against Syngenta, a major producer of atrazine, for contamination of public drinking water sources.[90] The cities eventually received millions of dollars in settlement offers to compensate for costs incurred from filtering and monitoring their groundwater resources.[91] Technically, farmers are supposed to monitor the quantity of atrazine they use, but there is no enforcement to prevent individual farmers from overusing it.[92]

Admittedly, current technology can slightly reduce the impact on freshwater from chemicals applied during corn cultivation; however, at present, that technology has not diminished the overall use of chemicals. Biotechnology companies, like Syngenta[93] and Monsanto,[94] have produced technological advancements,

path of exposure occurs from the ingestion of contaminated drinking water. *Id.*

87. Danielle Ivory, *U.S. Congressman Renews Attempts to Ban Controversial Herbicide Atrazine*, HUFFINGTON POST, http://www.huffingtonpost.com/2010/04/23/us-congressman-renews-att_n_549828.html (last updated May 25, 2011, 5:15 PM).

88. RIA, *supra* note 16, at 983–84.

89. GAO REPORT, *supra* note 58, at 11. Concentrations of atrazine tend to spike in surface water during the growing season when the herbicide is applied, but in the long-term it is commonly found in groundwater, where it has leached through the soil from areas of application. RIA, *supra* note 16, at 984.

90. *See* Ivory, *supra* note 87.

91. *Atrazine in Water Costs Syngenta*, *supra* note 85. It is incredibly difficult to clean up polluted groundwater. *See* ENVTL. PROT. AGENCY, EPA 540-K-96 008, GROUND WATER CLEANUP AT SUPERFUND SITES (1996), *available at* http://www.epa.gov/superfund/health/conmedia/gwdocs/brochure.htm. Not only is it costly, but it can also be technically infeasible depending on how far underground the aquifer is situated. *Id.* Most cleanups are paid for by taxpayers through state or federal efforts to restore drinking water sources. *See id.*; David Gutierrez, *Gender Bender Chemical Atrazine Widely Contaminates U.S. Public Water Supply*, NATURALNEWS.COM (Sept. 7, 2010), http://www.naturalnews.com/029675_atrazine_water_supply.html ("In 2009, 44 water utilities in the states of Illinois, Indiana, Iowa, Kansas, Mississippi and Ohio sued the federal government to reimburse them for the costs of atrazine cleanup.").

92. The EPA established a maximum contaminant level for atrazine in the Safe Drinking Water Act, but this just sets a maximum limit on the amount that can be in public drinking water before the EPA will no longer consider the water safe for human consumption. RIA, *supra* note 16, at 982. It does not limit the amount of atrazine that can be used. *Id.* at 983–84.

93. Syngenta has genetically engineered corn kernels that internalize the breakdown process of cornstarch, which aims to "increase ethanol output while reducing the use of water, energy and chemicals in the production process." Andrew Pollack, *U.S. Approves*

such as genetically engineered organisms or improved water-conserving corn kernels, which may be beneficial in the future for reducing water concerns, but the reality is that the currently available cultivation process degrades the nation's freshwater resources.[95]

The RFS harms water resources because the process required to grow the raw corn for ethanol negatively impacts water in the following ways: destroying wetlands, overloading waterways with sediment and nutrients, depleting aquifers, and impairing freshwater resources beyond a point of feasible remediation. Though there have been technological efforts to reduce the impact that corn cultivation has on freshwater resources, the problems persist and will soon increase as corn cultivation expands to meet the fifteen billion gallon mandate level.[96] Unfortunately, the damage that ethanol production causes to water does not end when the farmer has finished harvesting the corn. The refinement and processing of ethanol cause additional harms to water resources.

2. Refinement and Processing

Water is used at various points while refining raw corn grain into ethanol.[97] The harm to water resources depends highly on the planning and location of an ethanol refinement facility.[98] "When a plant is built or expands, operators need to know where they will

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Corn Modified for Ethanol, N.Y. TIMES, Feb. 12, 2011, at B1.

94. Monsanto, another biotech company, developed a genetically modified corn seed that controls pests, allowing farmers to reduce pesticide application. *Genuity VT Triple Pro Corn,* MONSANTO, http://www.monsanto.com/products/Pages/genuity-vt-triple-pro-corn.aspx (last visited Feb. 18, 2014). *But see* Carey Gillam, *Genetically Modified Crops Have Led to Pesticide Increase, Study Finds*, HUFFINGTON POST (Oct. 1, 2012, 9:18 PM), http://www.huffingtonpost.com/2012/10/02/genetically-modified-crops-pesticides_n_1931020.html ("U.S. farmers are using more hazardous pesticides to fight weeds and insects due largely to heavy adoption of genetically modified crop technologies that are sparking a rise of 'superweeds' and hard-to-kill insects, according to a newly released study.").

95. *Cf.* RIA, *supra* note 16, at 28.

96. *See supra* note 32 and accompanying text.

97. CONSUMPTIVE WATER USE, *supra* note 60, at 22 ("Ethanol production requires water for grinding, liquefaction, fermentation, separation, and drying processes."). For a more in-depth description of the actual step-by-step process of ethanol refinement, see GAO REPORT, *supra* note 58, at 5–7.

98. FIRST TRIENNIAL REPORT, *supra* note 3, at 4-7 ("Comprehensive local, state, and regional water planning, as well as state regulatory controls, are critical to ensure that facilities are located in watersheds that can sustain the increased withdrawal without affecting other uses.").

draw their water and where they will dump it."[99] The *Olmsted County Concerned Citizens v. Minnesota Pollution Control Board* case below illustrates some of the potential issues that arise from the location of an ethanol plant, and demonstrates how refining and processing can impact freshwater resources in local communities both before and after a plant is built.

In Olmsted County, Minnesota, MinnErgy, LLC planned to build an ethanol plant.[100] This drew concern from community members because of the quantity of water that was needed to supply the plant's production process and the impact wastewater discharge from the plant could have on the town's drinking water.[101] The plant would consume several hundred million gallons of water per year.[102] MinnErgy, LLC's plan proposed obtaining this supply by drilling two wells into the Jordan aquifer, which was also the county's drinking water source.[103] Citizens were especially worried that water shortages would occur because of an ethanol plant in a neighboring community had damaged water supplies.[104] In the City of Granite Falls, less than 200 miles from Olmsted County, an ethanol plant completely drained the city's aquifer.[105] The citizens were also worried about groundwater contamination because the Jordan aquifer was located under the highly contaminated Galena aquifer, creating the potential for contaminants to "leak down" into the Jordan as its water levels fell from the refinery's withdrawals.[106]

Another issue was possible thermal pollution from wastewater discharge.[107] Under the plan, the plant would discharge heated

99. Stachura, *supra* note 55.

100. Olmsted Cnty. Concerned Citizens v. Minn. Pollution Control Bd., No. A10-539, 2010 WL 4941663, at *1 (Minn. Ct. App. Dec. 7, 2010).

101. *Id.*

102. *Id.* In 2009, the Government Accountability Office reported that the "[c]onversion of corn to ethanol requires approximately 3 gallons of water per gallon of ethanol produced." GAO REPORT, *supra* note 58, at 14; *see also* KEVIN FINGERMAN ET AL., INTEGRATING WATER SUSTAINABILITY INTO THE LOW CARBON FUEL STANDARD 6 (2008), *available at* http://rael.berkeley.edu/node/705 ("Approximately 4 gallons of water are consumed in the production of a gallon of ethanol from conventional feedstocks.").

103. *Olmsted Cnty.*, 2010 WL 4941663, at *1.

104. *Id.* at *5.

105. *Id.*

106. *Id.* But according to recent studies, the Jordan aquifer has declined substantially since *Olmsted* and is at risk of being depleted by 2030. Mark Boswell & Raymond Grumney, *Graphic: A Future of Water Shortages?*, STARTRIBUNE (Feb. 23, 2013, 10:51 PM), http://www.startribune.com/newsgraphics/192537651.html.

107. *Olmsted Cnty.*, 2010 WL 4941663, at *8.

water into Bear Creek at the end of the processing stage.[108] Citizens worried that adding heated water to a cold-water creek would impact trout populations.[109] Despite the citizens' concerns over the county's water resources, the *Olmsted* court upheld the Minnesota Pollution Control Board's ("MPCB") decision to approve the ethanol plant.[110] However, the court largely based its decision on the scientific evidence presented by the MPCB that differentiated the geology[111] and chemical make-up[112] of the aquifer and freshwater resources in Olmsted County with other counties where ethanol plants caused negative freshwater impacts.

Unfortunately this was not the end of water concerns in Olmsted County. By 2012, the water level in White Bear Lake, which overlies part of the Jordan aquifer, had fallen nearly six feet.[113] The water in White Bear Lake comes from the Jordan aquifer below it, but, "[a]s pumping increased, the groundwater in the aquifer became depleted. Then, water from the lake was sucked into the aquifer."[114] The White Bear Lake Restoration Association filed suit against the Minnesota Department of Natural Resources ("DNR"), arguing that DNR issued too many pumping permits for the aquifer, which caused the water level in the lake to recede.[115] Thus, even though the aquifer itself did not experience a decline, over-pumping from municipalities and industry, which includes the ethanol plant, caused the aquifer to drain the lake above it.[116] If the lawsuit is successful, DNR may limit or re-

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108. *Id.*

109. *Id.* "The record indicates that, at most, the temperature of Bear Creek will increase 2.8 degrees Fahrenheit from cooling tower blowdown in the wastewater stream." *Id.* at *9.

110. *Id.* at *10.

111. *Id.* at *5 ("[T]he record reflects that the Granite Falls plant involved an unmapped, unconfined, sand and gravel aquifer. In contrast, the Jordan Aquifer is a mapped bedrock aquifer . . . . Thus, the prolific nature of the Jordan Aquifer is significantly different from the Granite Falls situation.").

112. *Id.* at *6.

113. Marlys Harris, *Why Is White Bear Lake Shrinking? Angry Residents Blame DNR*, MINN. POST (Nov. 30, 2012), http://www.minnpost.com/cityscape/2012/11/why-white-bear-lake-shrinking-angry-residents-blame-dnr.

114. *Id.*

115. *See* Marlys Harris, *As White Bear Lake Water-Level Studies Begin, a Move to Dismiss Suit Against DNR Is in Judge's Hands*, MINN. POST (July 7, 2013), http://www.minnpost.com/cityscape/2013/07/white-bear-lake-water-level-studies-begin-move-dismiss-suit-against-dnr-judges-han.

116. *Id.*

duce aquifer withdrawals, inhibiting MinnErgy, LLC's future refinement plans.

Olmsted presents a good example of the nexus between ethanol production and state freshwater resources. First, it demonstrates how various concerns, such as water shortages, groundwater contamination, wastewater, and thermal pollution relate to ethanol production. Second, it demonstrates how the future of ethanol production is dependent on the availability of freshwater. Third, it shows how the federal ethanol mandate strains freshwater resources in local communities, lending support to the conclusion that implementing state-based Low Carbon Fuel Standards would be a more energy-water efficient way to incorporate renewable fuel into the nation's transportation fuel. The bedrock of this approach is that no two kernels and no two water molecules are the same. The court alluded to this point in its opinion when comparing the Jordan aquifer to the Granite Falls aquifer and the different geology and chemical make-up of each.[117] There are multiple variables that can diminish both water quantity and quality.[118] Impacts on freshwater differ depending on the location of cultivation, the pests in the region, the source of irrigation and amount of rainfall, the location of the refinery plant, the type of processing, the mode of transportation to fuel-blending sites, and so on.[119] Thus, much of the impact on freshwater resources from ethanol production depends on the location of both cultivation and refinement. Localities across the country have already experienced such degradation and depletion of freshwater, and they are paying the cost in cleanup or possible relocation.[120] As the plaintiffs argued in *Olmsted*, environmental impacts on fresh water "can be a very local problem."[121] "[A]s more biorefineries are built, water availability and consumptive water use would have to be considered locally and regionally to ensure that the water resources will be sustained."[122] The RFS, a national policy, should

117. *Olmsted Cnty.*, 2010 WL 4941663, at *5.

118. *See* FIRST TRIENNIAL REPORT, *supra* note 3, at 4-7.

119. *Id.*

120. *Cf. The Ogallala Depletion: A Societal Issue*, K-STATE RES. & EXTENSION NEWS (Sept. 25, 2013), http://www.ksre.ksu.edu/news/story/Ogallala_depletion092513.aspx (noting that depletion of the Ogallala aquifer from overpumping in Kansas could have a "ripple effect," which "could lead to people moving from the area").

121. Gies, *supra* note 1.

122. NAS: POTENTIAL ECONOMIC AND ENVIRONMENTAL EFFECTS, *supra* note 5, at 276.

not be enforced in a way that exacerbates local freshwater problems from ethanol cultivation or refinement.

B. *The EPA's Findings on Impacts to Freshwater Resources and the Energy-Water Nexus*

Because the RFS is an energy-focused statute,[123] it tends to overlook the water impacts that ethanol production has on the nation's freshwater at local levels; however, "[w]ater security is too important to sacrifice for energy security."[124] Diminishing and contaminating local water resources through cultivation and refinement for the purpose of national energy security may lead to a situation of national freshwater insecurity.[125] Thus, it is important to assess the impact the RFS has on freshwater resources and how these findings come into play in the nation's energy-water nexus.

Congress included a provision in the EISA requiring studies of the environmental and resource conservation impacts of the renewable fuel standard.[126] The study is to be conducted every three years by the Administrator of the EPA, the Secretary of Agriculture, and the Secretary of Energy.[127] If the study concludes that there are negative environmental impacts, the EPA is required to include recommendations to reduce or eliminate these impacts.[128]

The EPA came out with its first triennial report in 2011.[129] The report acknowledged significant environmental impacts, but ultimately concluded that the negative impacts were insufficient to

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123. Meaning, one of the main goals of the RFS is to reduce dependency on foreign oil. FIRST TRIENNIAL REPORT, *supra* note 3, at ix.

124. Conor Shine, *Study: Ethanol Production More Efficient in Minnesota*, MINN. DAILY (Apr. 15, 2009), http://www.mndaily.com/2009/04/15/study-ethanol-production-more-efficient-minnesota (quoting Professor Sangwon Suh, author of a study on the amount of water necessary for ethanol production).

125. *See* Ann E. Drobot, *Transitioning to a Sustainable Energy Economy: The Call for National Cooperative Watershed Planning*, 41 ENVTL. L. 707, 756 (2011) ("The prospect of energy disruption, the realization that our current path leads to increased competition and prioritization among various water users, and the concomitant threat to energy independence, renewable resource development, and national security that accompanies conditions of water scarcity and energy interruption all point to the need to create a 'more sustainable energy economy.'").

126. Energy Independence and Security Act, Pub. L. No. 110-140, § 204(a), 121 Stat. 1492, 1529 (2007).

127. *Id.* The section also contains a list of issues the EPA must address in its report. *Id.*

128. *Id.*

129. *See generally* FIRST TRIENNIAL REPORT, *supra* note 3.

require changing RFS rules and regulations.[130] However, the report did conclude that the environmental impacts, mainly to water resources, were largely a result of corn production for ethanol.[131] Because the EPA concluded the negative impacts were mainly from ethanol use, which is only a portion of the RFS, the EPA argued that the *total* environmental impact of the RFS was limited, and the other renewable fuels in the RFS (advanced biofuels such as cellulosic and biomass-based diesel) could achieve the goals of the EISA without significantly increasing the harms caused by ethanol production.[132]

But the EPA's conclusion is not consistent with reality. The reality is that due to technological roadblocks, the EPA has exercised its authority to reduce the required volume of advanced biofuels every year, allowing corn-based ethanol to make up the majority of the mandate goals.[133] For instance, even though the mandate requires the use of four different types of feedstock, in 2009, ethanol accounted for 95% of the total mandate volume.[134] This continues to be the case because the technology for the other fuels is not yet commercially available, leaving the EPA with no other option than to waive those requirements.[135] Accordingly, 95% of the mandate is causing negative impacts to freshwater resources because 95% of the mandate is met with corn ethanol. The agency seems to disregard this fact in its report. It suggests that implementing conservation and best management practices can offset these negative impacts, and concludes that the overall RFS has the "potential" to meet the goals of the EISA.[136]

Specifically concerning impacts to water, the EPA found that increasing ethanol production to reach the fifteen billion gallon

130. *Id.* at xiv.

131. *Id.* at xv.

132. *Id.* at xiv–xv ("In general, feedstock demand has been met by diverting existing corn production or by replacing other row crops with corn, resulting in limited additional environmental impacts.").

133. *Id.*

134. *Id.* at 3-1.

135. *Id.*; *see also* Richard A. Kessler, *EPA Lowers 2010 US Cellulosic Ethanol Mandate by 94%*, RECHARGE (Feb. 4, 2010), http://www.rechargenews.com/news/biofuels/article1283718.ece (noting that in 2010 the EPA cut the cellulosic mandate from 100 million gallons to 6.5 million gallons, resulting in a 94% reduction).

136. FIRST TRIENNIAL REPORT, *supra* note 3, at xv ("Realizing this potential will require implementation and monitoring of conservation and BMPs, improvements in production efficiency, and implementation of innovative technologies at the commercial scale.").

mandate may result in an 18% increase in nitrogen loads to surface waters[137] and a 2.8% increase to groundwater,[138] exacerbated eutrophication,[139] a 1.6% increase in sediment loads to surface waters and wetlands,[140] an increased risk of bacteria and viruses in surface and groundwater,[141] depleted aquifers,[142] and increased stress on aquatic life.[143] The EPA ultimately referred to these issues as "modest" impacts that could be fixed by improving agricultural practices at the source of cultivation.[144] However, the report then goes on to say that these practices' improvements to environmental quality will not only be slow, but their effectiveness will depend entirely on the "willingness" of cultivators and refiners to adopt conservation practices.[145]

In September of 2012, the EPA released a study that attempted to "value" water, but was unable to come up with a solid value for a commodity that is so essential to every aspect of life.[146] Water is essential not only to life, but also to the economy, mainly as a necessary component for all forms of energy production.[147] This is essentially the energy-water nexus: "The dependence of the economy upon a reliable supply of energy is clear. The reliability of this supply depends, at least in part, upon the nation's water resources."[148] This is especially true for biofuels, which rely on water in every aspect of the production process from feedstock cultiva-

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137. *Id.* at 3-13.
138. *Id.* at 3-14.
139. *Id.* at 3-10 to 3-11.
140. *Id.* at 3-15.
141. *Id.* at 3-16.
142. *Id.* at 3-20.
143. *Id.*
144. *Id.* at 6-10 to 6-11.

> These practices include: (1) controlled application of nutrients and pesticides through proper rate, timing, and method of application; (2) controlling erosion in the field (e.g., reduced tillage, terraces, grassed waterways); and (3) trapping losses of soil at the edge of fields or in fields through practices such as cover crops, grassland and riparian buffers, controlled drainage for tile drains, and constructed/restored wetlands.

Id. at 3-4.

145. *Id.* at 3-4 to 3-5.
146. THE IMPORTANCE OF WATER, *supra* note 73, at 2-14.
147. *Id.* at 12-1 to 12-2 ("[A] significant amount of economic activity is either directly or indirectly dependent upon water as a factor of production."); *see also* Drobot, *supra* note 125, at 715–28.
148. THE IMPORTANCE OF WATER, *supra* note 73, at 12-2 (describing the interdependency existing between water and energy).

tion to refinement.[149] In its report, the EPA concluded that "the surge in production of certain crops for biofuels may place additional stress on agricultural water supplies."[150]

Though the EPA's conclusions in both reports appear to be contradictory, they can actually be reconciled when considered in terms of scope. The EPA's determination that the impacts to water are modest is likely a result of the fact that the impacts identified are occurring in local communities and regions,[151] as was seen in Olmsted County, Minnesota.[152] For instance, some communities may experience depleted drinking water sources, some may experience health side effects caused by herbicides, and others may experience impacts to aquatic life from eutrophication or thermal pollution.

However, the importance of freshwater resources has a much larger scope. The global economy, especially the energy sector, is dependent on adequate freshwater quality and quantity.[153] If freshwater resources slowly degrade in quality or are depleted in quantity, the immediate impacts are going to be experienced only by those local communities. Over time, however, the aggregate of these impacts will affect the global economy, which could have major repercussions for the United States as a whole, because "neither the nation nor its economy is insulated from the challenges others may face in managing their water resources."[154] The EPA concluded that "many countries around the world struggle with much more dire water supply issues" than the United States.[155] This does not mean that the United States is insulated from these effects, though, because "international water security may have implications for the U.S. Globalization has linked economies worldwide, and water shortages in other nations could create supply chain disruptions for U.S. firms and consumers."[156] International water shortages could lead to political instability and

149. GAO REPORT, *supra* note 58, at 6.
150. THE IMPORTANCE OF WATER, *supra* note 73, at 5-22.
151. *See* FIRST TRIENNIAL REPORT, *supra* note 3, at 4-6 to 4-7.
152. *See supra* notes 100–16 and accompanying text.
153. THE IMPORTANCE OF WATER, *supra* note 73, at 12-2.
154. *Id.* at 3-32.
155. *Id.* at 3-31 to 3-32.
156. *Id.* at 3-32.

"will hinder the ability of key countries to produce food and generate energy, . . . hobbling economic growth."[157]

Thus, the EPA's assessment of the environmental impacts from the RFS should have factored in its separate findings that water is an essential component of the global economy, especially the energy sector. For ethanol specifically, under the current regulatory approach, the cycle of water dependency becomes a lose-lose endgame—a catch-22—for both fuel production and water resources. Ethanol production is highly dependent on freshwater, and in turn, ethanol degrades water quality and quantity. Over time, the aggregate of these impacts may become irreversible, increasing the cost of energy production and possibly inhibiting biofuel production altogether.

Despite the EPA's reluctance to acknowledge these long-term effects between energy and freshwater caused by ethanol production, the catch-22 situation can be avoided if the RFS is reformed to address these issues.

C. *The Nexus at the State Level*

Whatever the impact is to a local town, the EPA suggests that these localized impacts can be mitigated if proper measures are taken.[158] The EPA concludes that "[c]onservation practices, if widely employed, can mitigate these [water quality] impacts."[159] The EPA recommends that federal agencies, along with industry representatives, "develop, implement, and monitor best management and conservation practices and policies that will minimize negative environmental impacts."[160] However, the extent of potential impacts on freshwater resources is dependent upon local and regional factors, such as community water demands, droughts, regional rainfall, and so on.[161] Due to the region-specific impacts, the appropriate conservation practices to employ are best determined by state and local agencies, not the federal government. State agencies have a focused expertise on the specific water resources within their state. Transferring regulation of ethanol

157. *Id.*
158. *Id.* at 6-6.
159. *Id.*
160. *Id.* at 6-13 (emphasis omitted).
161. *See infra* notes 228–38 and accompanying text.

production to states would permit greater flexibility to address negative environmental impacts and to employ conservation practices that are state and region specific, not national.

The National Academy of Sciences came out with a report in 2008 that assessed national implications of biofuel production on water.[162] Similar to the EPA's 2011 report conclusions,[163] the National Academy of Sciences' report concluded that within five to ten years, an increase in biofuel production will likely not affect aggregate national water use, but there are likely to be significant regional and local impacts where water resources are stressed.[164] It is not only important for policymakers to think about where the feedstocks should be grown, but also where to locate the biorefineries.[165] "Careful siting and design of biorefineries will minimize conflicts between different water uses as well as ensuring that the waste streams from plants cause the least possible harm to the environment and human health."[166]

Similarly, the Government Accountability Office report from 2009 on the energy-water nexus states:

> The extent to which increased biofuel production will affect the nation's water resources will depend on . . . which areas of the country they are produced in. . . . [I]ncreases in cultivation in areas that are highly dependent on irrigated water could have greater impacts on water availability than if the corn is cultivated in areas that primarily produce rainfed crops.[167]

Along with location, feedstock choice is a key consideration to determine the effect on a local or regional water resource because of displacement.[168] If a state decides to increase corn production for

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162. *See generally* NAS: POTENTIAL ECONOMIC AND ENVIRONMENTAL EFFECTS, *supra* note 5.

163. *See supra* notes 129–45 and accompanying text.

164. NAS: WATER IMPLICATIONS OF BIOFUELS PRODUCTION, *supra* note 77, at 3.

165. *See* FINGERMAN ET AL., *supra* note 102, at 17.

166. *Id.* ("For each 1 million gallons per year of production capacity, corn ethanol plants use enough water to support a town of approximately 5,000 people.").

167. GAO REPORT, *supra* note 58, at 7.

168. There are two ways to acquire more land for corn production: (1) use existing farmland and displace other crops and (2) convert more land into farmland. *See, e.g.*, *Living on Earth, Corn Ethanol Challenged*, PUB. RADIO INT'L (Feb. 22, 2013), http://www.loe.org/shows/segments.html?programID=13-P13-00008&segmentID=4 ("So you can get that extra land two ways, one is you get it from crop switching, and that's what we've done in the United States—we're growing less cotton, less sorghum, a little bit less wheat, and we're growing more corn. And so we've shifted the mix of acres around the country.") (statement by Wallace Tyner, Energy Economist at Purdue University).

ethanol by displacing land normally used for a thirstier crop, like alfalfa, then implementing a corn-ethanol biofuels program will not have as grave an effect on the state's water resources because less irrigation is needed for corn than alfalfa.[169] Due to these variables, it is important for a state to assess, on a case-by-case basis, what impact a specific feedstock will have on the water resources in the region.

States have the expertise and flexibility to implement policy changes that can mitigate the impacts ethanol production has on state water resources. Thus, a reformed RFS that transfers the ethanol market to the states will avoid putting the nation in a catch-22 by addressing not only local impacts to freshwater resources, but also the long-term global energy-water concerns that will arise if freshwater resources are depleted or degraded to an extent that impedes future biofuel production.

III. BRINGING THE RFS TO WATER AND MAKING IT DRINK

There have been multiple attempts at repealing the RFS, as well as attempts to limit the EISA to a degree that would make the mandated amounts unenforceable.[170] None of the presented bills aimed at repealing or reforming the RFS argued the need to solve the freshwater problems ethanol production causes. In fact,

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169. *See* FINGERMAN ET AL., *supra* note 102, at 5 fig.4.

170. The Renewable Fuel Standard Repeal Act was introduced on June 20, 2013, but died in committee. S. 1195, 113th Cong. (2013) (as reported to the S. Comm. on Env't & Pub. Works, June 20, 2013). The bill contained simple language striking the RFS: "Section 211 of the Clean Air Act (42 U.S.C. 7545) is amended by striking subsection (o)." *Id.* § 2. One bill, the Renewable Fuel Standard Elimination Act, attempted to repeal the RFS and the entire regulatory scheme created along with it in less than sixty words. H.R. 1461, 113th Cong. (2013) (as reported to the H. Comm. on Energy & Commerce, Apr. 10, 2013). Other bills did not necessarily attempt to repeal the RFS, but did attempt to injure it. On July 24, 2012, the Renewable Fuel Standard Flexibility Act was introduced into the Senate. S. 3428, 112th Cong. (2012) (as reported to the S. Comm. on Env't & Pub. Works, July 24, 2012). The bill attempted to amend the CAA to waive the renewable fuel standard when corn inventories were low, but it died in committee. *Id.* § 2. The Domestic Alternative Fuels Act of 2013, which also died in committee, attempted to replace ethanol with natural gas by permitting natural gas-based fuels to satisfy the RFS mandates. H.R. 1959, 113th Cong. (as reported to the H. Comm. on Energy & Commerce, May 14, 2013). The Leave Ethanol Volumes at Existing Levels Act, introduced in April of 2013, aimed to sustain the same volume requirement—7.5 billion gallons—every year. H.R. 1469, 113th Cong. (2013) (as reported to the H. Comm. on Energy & Commerce, Apr. 10, 2013). The RFS Reform Act of 2013 was presented in April of 2013. HR. 1462, 113th Cong. (2013) (as reported to the H. Comm. on Energy & Commerce, Apr. 10, 2013). This bill aimed to reduce the applicable volume requirements and to prohibit ethanol-blended fuel above 10%. *Id.* §§ 103, 201.

many of these bills also included language that eliminated the EPA's ability to consider the environmental impacts of biofuels production altogether.[171] The irony is that one of the reasons the RFS was passed was to combat air pollution.[172] Unfortunately, in attempting to reduce air pollution, the RFS had an indirect negative effect on another important part of the environment—water. Thus, two environmental problems now need to be addressed; but all bills aiming to "fix" the problem ignore this underlying concern and focus on immediate industry benefits. Lobbyists in the petroleum industry, which fears the blend wall and does not want to be forced to purchase ethanol, drive most of the proposed bills.[173] The ethanol industry disagrees with this argument, claiming that the oil industry is just upset over losing market share.[174]

The oil and the ethanol industry argue that the law is either a failure or a success by focusing on market share and economic impacts to each industry. Though both industries understand that change needs to happen, the earlier reform efforts take the wrong approach. Past efforts ignore the RFS's impact on water resources when measuring its success. Because the law still has potential, especially with cellulosic biofuels, legislation should not aim to repeal the RFS, but rather to reform it.

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171. *See, e.g.*, H.R. 1469 at § 2(j)(1) ("(1) ENVIRONMENTAL AND RESOURCE CONSERVATION IMPACTS.—Section 204(b) of the Energy Independence and Security Act of 2007 (Public Law 110-140) is repealed.").

172. FIRST TRIENNIAL REPORT, *supra* note 3, at xiv.

173. *See generally Oil Groups Continue Lobbying Against RFS*, BIOFUELSCHAT.COM (Apr. 24, 2013), http://biofuelschat.com/topics/oil-groups-continue-lobbying-against-rfs. Jack Gerard, President and CEO of the American Petroleum Institute, the largest petroleum lobbying group, argued in a hearing before Congress on June 22, 2013, that the RFS is "fundamentally broken." *Overview of the Renewable Fuel Standard: Stakeholder Perspectives, Day 1: Hearing Before the H. Subcomm. on Energy & Power of the H. Comm. on Energy & Commerce*, 113th Cong. 20 (2013) [hereinafter *Hearing: Day 1, RFS Overview*] (statement of Jack N. Gerard, President and CEO, Am. Petroleum Inst.) (preliminary transcript), *available at* http://democrats.energycommerce.house.gov/sites/default/files/documents/Transcript-EP-Renewable-Fuel-Standard-Stakeholder-Perspectives-2013-7-23.pdf).

174. *Hearing: Day 1, RFS Overview*, *supra* note 173, at 25 (statement of Bob Dinneen, President and CEO, Renewable Fuels Ass'n). "It is the only policy we have to moderate gasoline prices at the pump. . . . [T]here is no need to legislate changes to a program that is working as designed . . . ." *Id.*

A. *The Federal Mandate's Failure to Reduce GHG Emissions*

Congress should reform the RFS to phase out the volume requirements for both conventional and advanced biofuels. Since its enactment in 2005, the air quality benefits of the RFS have been controversial and hard to measure. It is nearly impossible to compare the RFS' benefits of lower GHG emissions to the RFS' drawbacks of impaired water quality and availability. GHGs have essentially the same effect anywhere they are emitted, whereas the effects to water differ depending on the source and location of the water.[175] Furthermore, while easy and cheap to produce, corn ethanol has not achieved its anticipated reductions in greenhouse gas emissions.[176]

Corn ethanol has created a "carbon debt,"[177] meaning that it produces more carbon dioxide than it absorbs in the atmosphere. This conclusion contradicts a main goal of the RFS, to reduce CO_2 emissions by having no net increase when the renewable fuel is burned. In 2010, the EPA issued its Regulatory Impact Analysis ("RIA").[178] The report concluded that corn ethanol is not achieving the GHG reductions that it was initially expected to achieve.[179]

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175. FINGERMAN ET AL., *supra* note 102, at 13.

176. *See* Powers, *supra* note 6, at 670 (noting one study that found the United States policy for biofuels will double GHG emissions over thirty years).

177. *Hearing: Day 2, RFS Overview*, *supra* note 54, at 44 (statement of Scott Faber, Vice President of Gov't Affairs, Envtl. Working Grp.).

178. *See generally* RIA, *supra* note 16. Section 203 of the EISA promulgates an impact analysis study:

> The Secretary of Energy, in consultation with the Secretary of Agriculture and the Administrator of the Environmental Protection Agency, shall enter into an arrangement with the National Academy of Sciences under which the Academy shall conduct a study to assess the impact of the requirements described in section 211(o) of the Clean Air Act on each industry relating to the production of feed grains, livestock, food, forest products, and energy.

Energy Independence and Security Act § 203(a), Pub. L. No. 110-140, 121 Stat. 1492, 1529 (2007).

179. RIA, *supra* note 16, at 483. There are two reasons this is happening. The first is that Congress included an exemption in the EISA, which has led the EPA to "grandfather" in ethanol facilities constructed prior to December of 2007 that do not achieve the statutory 20% reduction in GHGs. *Id.* at 146. Many old ethanol facilities are powered by fuel such as coal, which emits high amounts of GHGs. *Id.* at 146–48. When ethanol is produced in a facility that is powered by a high carbon emitting fuel like coal, the GHGs emitted during its production exceed the CO_2 absorbed during the corn's growth. *Id.* at 483. The second reason stems from land use changes. In order to grow corn, one needs to clear a lot of land (commonly heavily vegetated land with productive soil). *Id.* Vegetation (plants, trees and even soil) helps to absorb CO_2, so when land is cleared, less CO_2 is removed from the atmosphere. *Id.*

The RIA states that "[i]t takes approximately 14 years for the annual GHG benefits of corn ethanol compared to gasoline to pay back the initial GHG releases from land clearing."[180] Thus, corn ethanol takes at least fourteen years to break even and achieve no net gain in GHGs.[181] Waiting fourteen years to see any benefit in GHG reductions is a ridiculous qualification for calling corn a "renewable fuel," especially when there are other second-generation biofuels, like cellulosic algae or switchgrass, that are more efficient and less harmful to freshwater resources.[182] "Efforts to mitigate greenhouse gas emissions should not leave other problems in their wake."[183] These unintended costs and the lack of GHG reductions demonstrate that corn ethanol is not only harmful, but also inefficient as a renewable fuel. The policy needs to change.

B. *Encourage Innovation in Other Renewable Fuels*

At a hearing before Congress on June 22, 2013, Representative Ed Whitfield, Chairman of the House Subcommittee on Energy and Power, said that a goal of reform should be to "align the [RFS] program with current energy realities."[184] Along with energy realities, it is pertinent to align the program with current environmental realities, mainly, freshwater resources.

Phasing out the volume requirements for both conventional and advanced biofuels will not necessarily kill the entire RFS. Though advanced biofuels have not been demonstrated to have as negative an impact on freshwater resources (if any at all), and what impact they do have is generally offset by the benefits in greenhouse gas reduction,[185] the volume requirements should be

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180. *Id.* at 483.

181. *Id.* at 484 tbl.2.6-2.

182. *See* NAS: WATER IMPLICATIONS OF BIOFUELS PRODUCTION, *supra* note 77, at 15 ("A perennial crop of cellulosic biomass such as switchgrass would hold soil and nutrients in place and require lower fertilizer and pesticide inputs, thus reducing water quality impacts.").

183. FINGERMAN ET AL., *supra* note 102, at 16.

184. *Hearing: Day 1, RFS Overview*, *supra* note 173, at 4 (statement of Rep. Ed Whitfield, H. Subcomm. on Energy & Power).

185. *See* GAO REPORT, *supra* note 58, at 12 (describing how the process of using agricultural residues for cellulosic ethanol does not require excess water or nutrient inputs because it is a byproduct of other crop harvests). *But see* FIRST TRIENNIAL REPORT, *supra* note 3, at 6-4 tbl.6-2 (concluding that cellulosic ethanol facilities use more than five gallons of water per gallon of ethanol versus corn ethanol, which uses three gallons of water

phased out of the federal mandate in order for states to take the lead in forcing the oil industry to produce cleaner, "renewable" fuel. During the phase-out, further holistic studies can take place to evaluate such things as the impact of cellulosic biofuel production on water and soil in particular regions. This type of approach is key to avoiding the unintended localized consequences that arose from the fast and furious life of the ethanol industry.[186]

C. *Empower Local and State Governments to Make an Educated Decision Regarding Ethanol Production*

The RFS spurred a national boom in ethanol production,[187] but resulted in negative impacts on a local level.[188] This boom is an artificial market the RFS itself created[189] and, unfortunately, the costs to the nation's freshwater resources as a result of this artificial industry cannot be ignored any longer. The federal government should not mandate the nationwide use of a fuel that has impacts that are most poignantly felt at a local level. Phasing out the federal mandate levels, and permitting the states to pick up portions of the ethanol and cellulosic markets, will allow for a better local assessment of the costs and benefits of biofuel production on freshwater resources.

Remediation and litigation to restore water quality or appropriate water resources are costs that are paid for by local communities and municipalities.[190] Not only does the federal mandate not take into account these cross-system impacts—an act for air

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per gallon of ethanol). The National Academy of Sciences attributes some greenhouse gas reduction potential to cellulosic biofuels relative to conventional biofuels. *See* NAS: POTENTIAL ECONOMIC AND ENVIRONMENTAL EFFECTS, *supra* note 5, at 202 ("GHG emissions from a given piece of land producing cellulosic biofuels are expected to be lower than those from lands producing corn-gain ethanol or soybean biodiesel.").

186. *See* FIRST TRIENNIAL REPORT, *supra* note 3, at 6-5 ("[N]o attempt was made to create a common scale to compare the impacts across environmental impacts. For example, the maximum negative impact for water quality is not comparable to the maximum negative impact for air quality.").

187. *See* Powers, *supra* note 6, at 681; Gies, *supra* note 1.

188. Gies, *supra* note 1.

189. Sarah Gonzalez, *Goodlatte Introduces New Bill to Alter RFS*, AGRI-PULSE.COM (Apr. 10, 2013), http://www.agri-pulse.com/Goodlatte-introduces-new-bil-to-alter-RFS-041 02013.asp (quoting Representative Bob Goodlatte of Virginia: "The federal government's creation of an artificial market for the ethanol industry has quite frankly triggered a domino effect that is hurting American consumers, energy producers, livestock producers, food manufacturers, and retailers.").

190. *See supra* note 91 and accompanying text.

pollution with consequences on water pollution—but it also does not address the difference between the national scale of the benefit and the local scale of the consequences. The following proposed RFS reform attempts to address these issues in order to take into account the RFS' impact on water resources while preserving its goals: to reduce both foreign oil dependency and GHG emissions.

IV. A PROPOSAL FOR REFORMING THE RFS

Any reform to the RFS must consider the relationship between the federal government and state governments. "Responsible policy-making requires that we consider the effect of our consumption patterns on resources elsewhere, as well as those within the state."[191] A successful program for conventional biofuels would engage the federal and state governments in a cooperative federalism relationship.[192] Congress should amend the RFS to phase out the mandate's fifteen billion gallon conventional biofuels cap, along with the advanced biofuel mandate levels. Thus, the oil industry will no longer have to purchase and incorporate a specific amount of ethanol to blend into gasoline each year. But the oil industry is not off the hook because it will have to adhere to stricter state targets to keep market share.

Removing the mandated volume requirements does not destroy the entire RFS. The RFS contains valuable GHG reduction initiatives, such as providing research and development grants to institutions engaging in cellulosic biofuel development.[193] The proposed reformed RFS would also provide the EPA with a new authoritative position to issue tradable permits.[194] The renewable fuel industry will be forced to continue to innovate to produce commercially available cellulosic biofuels for the oil industry to blend with gasoline.

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191. FINGERMAN ET AL., *supra* note 102, at 12.

192. For an explanation of "cooperative federalism" in general, see Robert L. Glicksman, *Climate Change Adaption: A Collective Action Perspective on Federalism Considerations*, 40 ENVTL. L. 1159, 1169 n.42 (2010) ("[C]ooperative federalism is a system of shared authority between the federal and state governments. Typically, Congress delegates broad regulatory authority to a federal agency . . . to delegate program implementation to states that satisfy certain requirements. . . . Further, to ensure adequate state implementation, the federal government retains oversight authority.").

193. Energy Independence and Security Act § 230, 42 U.S.C. § 17034 (2006 & Supp. V 2012).

194. *See infra* text accompanying notes 245–47.

The key to improving water resources across the nation and increasing biofuel production is state regulation, because the effects of the corn ethanol industry on water resources vary by location and are felt at the local level.[195] The states have the local expertise to study non-air pollution impacts associated with water use and contamination. Under the reformed RFS, the federal government should not be an advocate for corn ethanol, but should not foreclose a state's ability to engage in an expansion of ethanol production and consumption if the state adopts a Low Carbon Fuel Standard ("LCFS"), which is considered the state-level version of the RFS. The main difference between the RFS and a LCFS is mandating volumes versus targeting percent reductions.[196] The RFS sets actual amounts (in billions of gallons) of renewable fuel that the oil industry must incorporate under the theory that forcing a certain amount of renewable fuel to be used every year will lead to reductions in GHGs. A LCFS instead sets a targeted percent reduction in GHGs for an entire state every year.

California initiated the first LCFS program in 2007 to combat climate change at a state level.[197] The LCFS aims to capture the full measure of carbon for the fuel that the state consumes. "[T]he state uses a 'life cycle analysis,' taking into account all of the carbon emissions that are generated in not only the production and refining of the fuel but also in transporting it to market."[198] To do this, an average "carbon intensity" calculation[199] uses gasoline or diesel fuel as a baseline and any fuels that have a lower "carbon intensity" (pollute less than the baseline) generate credits.[200] If

195. *See supra* Part II.C.

196. *Clean Energy & Climate Change—Regulations*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/region9/climatechange/regulatory.html (last visited Feb. 18, 2014).

197. Exec. Order No. S-01-07 (Cal. 2007) (effective 2011), *available at* http://www.arb.ca.gov/fuels/lcfs/eos0107.pdf. California's LCFS is not preempted by the federal RFS because the CAA has a provision that permits the state of California to receive a "waiver of preemption" if it enacts air emissions standards that are stricter than those of the federal government. Other states may choose to adopt California's standards or the federal standards. *California Waivers and Authorizations*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/otaq/cafr.htm (last visited Feb. 18, 2014).

198. Ann Carlson, *Breaking News: Ninth Circuit Upholds California's Low Carbon Fuel Standard*, LEGAL PLANET (Sept. 18, 2013), http://legal-planet.org/2013/09/18/breaking-news-ninth-circuit-upholds-californias-low-carbon-fuel-standard/.

199. CAL. CODE REGS. tit 17, § 95485 (2012).

200. ICF INT'L, CALIFORNIA'S LOW CARBON FUEL STANDARD: COMPLIANCE OUTLOOK FOR 2020, at 4 (2013) [hereinafter COMPLIANCE OUTLOOK FOR 2020], *available at* http://www.ceres.org/resources/reports/california2019s-low-carbon-fuel-standard-compliance-out

the fuels exceed the baseline carbon intensity, then they generate a deficit.[201] Regulated parties, such as refiners, are required to have a net zero balance between credits and deficits.[202] To sell fuel in California, fuel refiners must reduce total carbon intensity by 10%.[203] "Currently, California allows fuels with a carbon intensity of 97.96. That intensity level . . . must go down to 89 by 2020."[204] The California Air Resources Board ("CARB") calculated the carbon intensity of conventional corn-based ethanol between 73.21 and 95.66, depending on how it is produced and where it is transported from,[205] but overall, CARB considers corn ethanol to be a renewable fuel.[206] Thus, corn ethanol would not be banned; if it was sustainably produced under state regulation, it could be used to meet LCFS goals. It would be a state's decision based on its assessment of the particular ethanol fuel sold within the state.

California is permitted to deviate from the national RFS and impose its own regulatory scheme because of an exemption they were given in the Clean Air Act.[207] If the oil industry wants to sell

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look-for-2020.

201. *Id.*

202. *Id.* ("Credits can be banked and traded without limitations, and credits do not lose value.").

203. *Id.* at 1.

204. *Lowering Ethanol's Footprint*, GROWTH ENERGY (Aug. 29, 2013), http://www.growthenergy.org/news-media/ethanol-in-the-news/lowering-ethanols-footprint/.

205. Since the LCFS takes into account the emissions from the fuel used to refine the blend, as well as the emissions produced to transport the blend, a barrel of ethanol-blended gasoline from Oregon can have a completely different carbon intensity than a barrel from North Dakota. *See* Carlson, *supra* note 198. In 2009, ethanol producers brought a dormant commerce clause challenge, claiming that the ethanol provisions of the LCFS facially discriminated against out-of-state ethanol and were also preempted by the federal RFS. Rocky Mountain Farmers Union v. Goldstene, 843 F. Supp. 2d 1071, 1078 (Cal. 2011). On September 18, 2013, the Ninth Circuit upheld the LCFS calculation, recognizing the importance of taking into account GHG emissions from the entire "ethanol pathway." Rocky Mountain Farmers Union v. Corey, 730 F.2d 1070, 1089–90 (9th Cir. 2013). Taking a police power stance, the court held that the LCFS's life cycle analysis approach did not violate the Dormant Commerce Clause because "if an out-of-state ethanol pathway does impose higher costs on California by virtue of its greater GHG emissions, there is a non-discriminatory reason for its higher carbon intensity value." *Id.* The court also provided a list of state concerns that factored into California's police power protectionism. *See id.* at 1106. The Ninth Circuit acknowledged the importance of permitting a state to more strictly regulate negative impacts imposed by national markets on the citizens of the state: "California and its citizens have chosen to acknowledge and account for the ill effects of their fuel consumption." *Id.*

206. COMPLIANCE OUTLOOK FOR 2020, *supra* note 200, at 12.

207. Clean Air Act § 209, 42 U.S.C. § 7543 (2006). Other states can either follow the federal government, or adopt and implement California's standards. *Id.* § 177, 42 U.S.C. § 7507 (2006).

fuel at gas stations in California, they must meet California's strict requirements. Currently, refiners have to purchase the biofuel required by the RFS, and, if they want to sell in California, their fuel must meet California's GHG reduction standard. Though the LCFS got off to a rocky start,[208] it has proven fairly successful. Within two years of going into effect, roughly 2.14 billion gallons of gasoline and seventy-seven million gallons of diesel have been displaced by renewable fuels, reducing emissions by 2.8 million metric tons.[209] "[T]he industry expects to comfortably meet those LCFS targets for 2020."[210] In theory, oil companies could have refused to sell their fuel to California if they did not want to meet the state's stricter standards; but in reality, no refiner would want to lose such a large market of consumers. The effect of the LCFS so far has led to the development of cleaner fuel blends and cleaner transportation technology.[211]

The benefit of the LCFS is that it is a state regulatory scheme that permits California to impose regulations in a manner consistent with their impact on resources within the state itself, whereas the federal RFS looks only at reducing overall air pollution on a national level and ignores local freshwater impacts. Though California's LCFS still does not consider impacts to water resources in its definition of "renewable fuels," it is a turn in the right direction because it synchronizes state problems with state

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208. In 2009, ethanol producers brought a dormant commerce clause challenge, claiming that the ethanol provisions of the LCFS facially discriminated against out-of-state ethanol and were also preempted by the federal RFS. *Goldstene*, 843 F. Supp. 2d at 1078. The trial court held for the ethanol producers, ruling that the LCFS discriminated against out-of-state producers and initiated an injunction to stop the implementation of the LCFS. *Id.* at 1105. However, on September 18, 2013, the Ninth Circuit reversed and lifted the injunction. *Corey*, 730 F.3d at 1089–90. The Ninth Circuit upheld the LCFS, ruling that the LCFS's life cycle analysis approach did not violate the Dormant Commerce Clause, *id.* at 1078, and acknowledged "California and its citizens have chosen to acknowledge and account for the ill effects of their fuel consumption." *Id.* at 1106.

209. *California Exceeds Low-Carbon Fuel Standard*, PHYS.ORG (May 1, 2013), http://phys.org/news/2013-05-california-low-carbon-fuel-standard.html.

210. Antony Ingram, *Low Carbon Fuel Standard Proving More Successful Than Predicted*, GREEN CAR REP. (June 13, 2013), http://www.greencarreports.com/news/1084792_low-carbon-fuel-standard-proving-more-successful-than-expected.

211. *See* SONIA YEH & JULIA WITCOVER, U.C. DAVIS, INST. OF TRANSP. STUD., STATUS REVIEW OF CALIFORNIA'S LOW CARBON FUEL STANDARD 1 (2014), *available at* http://www.its.ucdavis.edu/research/publications/publication-detail/?pub_id=2008; *see also California Exceeds Low-Carbon Fuel Standard*, *supra* note 209 ("Eileen Tutt, executive director of the California Electric Transportation Coalition (CalETC), said the LCFS is doing 'exactly what it was designed to do—open the way for new fuels and technologies to compete fairly in the marketplace.'").

initiatives. It is a regulatory scheme that provides flexibility for state governments to reduce air pollution and mitigate localized impacts to freshwater resources.

Interestingly, in implementing the LCFS, CARB was obligated to consider non-climate implications, such as impacts on other systems like water.[212] Researchers at California Berkeley conducted the state's study.[213] The researchers examined the potential effects of expanded biofuel production under the LCFS on water resources.[214] The report concluded that "biofuel production in California could either increase or decrease the sustainability of the state's water resource use."[215] Despite the findings, CARB's final rule did not include a measure of biofuel impacts on water resources in defining acceptable renewable fuels.[216] The Berkeley researchers did, however, include some policy options for incorporating water sustainability into the LCFS:

> [1.] Determine a "price" for water in Global Warming units and add it to [the GHG analysis]
> [2.] Charge a tax on water use for biofuel production
> [3.] Establish a go/no-go rule for maximum water consumption for all fuels allowed under the LCFS
> [4.] Categorize counties/regions in California based upon their scarcity of water, establishing go/no-go rules for each county/region.[217]

Though California has yet to adopt any of these policies into its LCFS, under the reformed RFS, states that choose to sell ethanol-blended fuel at their pumps, or allow the production and refinement of ethanol within their borders, should be required to adopt one or more of the policy options above, depending on how involved the state is in the ethanol industry. States would have the option to continue to use or produce conventional biofuels, but only if they adopt a policy that incorporates impacts to state water resources. Allowing states to choose from a list of options offers flexibility to the states to assess which option is most feasible and most likely to protect specific state water resources.[218]

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212. FINGERMAN ET AL., *supra* note 102, at 3.
213. *Id.* at 1.
214. *Id.*
215. *Id.*
216. *See generally* CAL. CODE REGS. tit 17, § 95485 (2012).
217. FINGERMAN ET AL., *supra* note 102, at 17.
218. One argument against a state-based regulatory scheme is that the fuel industry would have to comply with a patchwork of legislation depending on which states they op-

A. *Regulating the Fuel Sold Within State Borders*

Currently there are only a few states that have a LCFS or are contemplating implementing one.[219] However, none of the Corn Belt states are contemplating a LCFS.[220] Under a reformed RFS, all states with a hand in the ethanol industry (through cultivation, refinement, or selling fuel blended with ethanol at pumps) should be required to implement a LCFS.[221] No expansion of any aspect of corn cultivation or refinement should be permitted prior to the implementation of a LCFS. Every state that sells fuel blended with ethanol[222] would have to adopt policy option one. By requiring states to value their freshwater resources numerically, the calculus would inject water issues into the overall fuel policy.

Under policy option one, the LCFS would require the state to determine a *reasonable* number "value" for the water resources in the state that would be impacted by ethanol production. This value would then be converted to air emission units and added to the

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erate in. But this argument is not consistent with the culture of energy and environmental regulation. Both environmental regulation and energy production have historically been under the realm of state regulation. For instance, with hydraulic fracturing, oil and gas companies must comply with various state drilling laws, only some of which specifically pertain to hydraulic fracturing, see generally Francis Gradija, *State Regulations, Litigation, and Hydraulic Fracturing*, 7 ENVTL. & ENERGY L. & POL'Y J. 47 (2012), as well as local municipality regulations. *See Current High Volume Horizontal Hydraulic Fracturing Drilling Bans and Moratoria in NY State*, FRACTRACKER.ORG, http://www.fractracker.org/map/ny-moratoria/ (last visited Feb. 18, 2014) ("[N]umerous municipalities in New York State started passing resolutions indicating that they are open to high volume hydraulic fracturing.").

219. *Low Carbon Fuel Standard*, CENTER FOR CLIMATE AND ENERGY SOLUTIONS, http://www.c2es.org/us-states-regions/policy-maps/low-carbon-fuel-standard (last visited Feb. 18, 2014).

220. *Id.*

221. The EPA should also give states a deadline to implement a LCFS, and if the LCFS is not enacted by the deadline then the EPA should impose one. This idea is similar to the state and federal regulation under the Clean Air Act Nonattainment Program.

> Under Section 110 of the Act the states were required to submit a state implementation plan ("SIP") designed to attain the NAAQS within three years of EPA's approval of the SIP. However, if the state failed to submit a plan demonstrating attainment within the prescribed period, then EPA was to promulgate a federal implementation plan ("FIP") designed to ensure attainment by the statutory deadline.

ROBERT A. WYMAN ET AL., THE AMERICAN LAW INSTITUTE, THE CLEAN AIR ACT NONATTAINMENT PROGRAM 479, 482 (1989).

222. Currently Maine is the only state with legislation banning the sale of ethanol blended gasoline. Ari LeVaux, *The One Issue Republicans and Democrats Can Agree On*, SLATE (July 12, 2013), http://www.slate.com/articles/news_and_politics/food/2013/07/renewable_fuel_standard_repeal_how_states_are_chipping_away_at_the_corn.html.

"carbon intensity" equation. A value will be assigned for water usage,[223] such as the quantity withdrawn for a corn growers irrigation source, and for impairments to water resources, such as discharging wastewater from an ethanol refinery into a local river. In each state LCFS, a value will be assigned at both the ethanol cultivation stage and the refinement stage. By assigning a numeric value at both stages of production, the impact to freshwater resources nationwide will be considered in cases where the corn is bought from one state, refined in another state, and sold in a third state. Higher numeric values would be assigned to activities that have a greater impact on the water source. For instance, clearing a forest that borders a river used for city drinking water downstream in order to grow 200,000 acres of corn for ethanol may result in a high value of impact, but it will depend on an assessment of various factors, such as the quantity of fertilizer or pesticide to be used, the conservation practices on the field bordering the river, whether irrigation for the corn is going to come from withdrawals from the river, and so on.

The assessment would have to be a case-by-case analysis by the state water agency and would have to include individual water sources that are either directly or indirectly impacted by ethanol production in that state. Though the value would be a state determination, the EPA should issue guidance that helps a state evaluate the impact. The EPA would also exercise oversight in this process so as to avoid a "race to the bottom" scenario where states attempt to attract industry by having lax environmental regulations. Putting a value on the water used in ethanol production provides a holistic, cross-system perspective of ethanol production's impact on both water and air.

In 2013, California only permitted fuels with a carbon intensity below 97.96 to be sold in the state.[224] To explore how a LCFS incorporating water impacts would work, imagine that Refinery Z wants to sell fuel in California in 2013. It must have a net zero balance of credits and deficits by the end of the year. Thus, Refinery Z must blend its pure gasoline with a renewable fuel to generate credits (otherwise its pure gasoline will generate deficits).

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223. For an example of a study that determined an emission factor for the volume of water, see Yasutoshi Shimizu et al., *The CO_2 Emission Factor of Water in Japan*, 4 WATER 759, 768 (2012), *available at* http://www.mdpi.com/2073-4441/4/4/759.

224. *See Lowering Ethanol's Footprint*, *supra* note 204.

Its fuel needs to consider both the GHG impacts from life cycle analysis and the impact to water where it is produced.

Fuel / Feedstock	Carbon Intensity (gCO_2e/MJ)
Ethanol, conventional	95.66
Ethanol, CA corn	80.70; decreasing to 70.70 in 2016
Ethanol, Low CI Corn	73.21
Ethanol, Sugarcane	73.40; decreasing to 67.38 by 2020
Ethanol, Cellulosic	21.30 [a]
Renewable Gasoline	25.00 [b]
Compressed natural gas	68.00
Biogas, landfill	11.56
Electricity, marginal [c]	30.80; decreasing to 26.32 by 2020
Hydrogen [d]	39.42

[a] The average of CARB pathways for ethanol from farmed trees and forest ways

[b] Estimated carbon intensity based on stakeholder consultation.

[c] Includes the energy economy ratio (EER) of 3.4 for electric vehicles

[d] Includes the EER of 2.5 for fuel cell vehicles

The table above is California's LCFS carbon intensity chart.[225] Refinery Z decides to blend its fuel with conventional ethanol, which has a carbon intensity of 95.66. However, the number 95.66 does not account for the ethanol's water impact value. Under the reform, this consideration would have to be included in the LCFS.

Refinery Z could buy its ethanol from Ethanol Plant Y, located in California. Plant Y uses recycled wastewater to cool the plant and treats all wastewater before discharging it. The California Department of Water Resources ("CDWR") gives Plant Y a water impact value of 1. Plant Y buys its corn from Corn Cultivator X in Missouri. Corn Cultivator X uses many best management practices, like rotating its corn crop with nitrogen fixing legumes to reduce the amount of nitrogen runoff into nearby waterways. The Missouri Department of Natural Resources gives Cultivator X a water impact value of 1. If Refinery Z blends its pure gasoline

225. *See* COMPLIANCE OUTLOOK FOR 2020, *supra* note 200, at 12 ex.5.

with conventional ethanol from Ethanol Plant Y, its carbon intensity would be: 95.66 + 1 (the water impact value from Plant Y) + 1 (the water impact value from Cultivator X) = 97.66.

Alternatively, Refinery Z could buy its ethanol from Ethanol Plant A, also located in California. Plant A uses freshwater from the Sacramento River to cool the refinery and then discharges it untreated down river. The CDWR gives Plant A a water impact value of 3. Ethanol Plant A buys its corn from Corn Cultivator B in Texas. Corn Cultivator B exceeds the average pesticide use per acre, creates lots of runoff, and uses inefficient irrigation practices, withdrawing water from aquifers in dry seasons. The Texas Commission on Environmental Quality gives Cultivator B a water impact value of 4. If Refinery Z blends its pure gasoline with conventional ethanol from Ethanol Plant Y, its carbon intensity would be: 95.66 + 3 (the water impact value from Plant A) + 4 (the water impact value from Cultivator B) = 102.66.

Accordingly, Refinery Z would blend its gasoline with ethanol from Ethanol Plant Y in order to generate credits under the LCFS system and stay below the 97.96 threshold. The California LCFS already encourages refineries to find, develop, or invest in renewable fuels that begin with a lower carbon intensity, such as cellulosic fuels.[226] If a cross-system numeric valuation between GHG emissions and water impact is added, it would create a market effect that encourages refineries and corn growers to reduce their impacts on water resources to avoid receiving high water impact values that limit the marketability of their product.[227] It will also encourage ethanol plants and cultivators to find ways to reduce their water value impact number to stay competitive and marketable as a blend option for the oil refining industry.

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226. For a list of California's feedstock fuels and their corresponding carbon intensities, see *id.*

227. One could argue that refineries would instead avoid considering ethanol's impact to water by importing fuels from other countries that do not have this required valuation policy. While it is true that the imported ethanol will not have a water value impact number, it is unlikely that imported fuel will fall below the state's targeted GHG carbon intensity. This is because a fuel transported from a distance generally has a carbon intensive transportation process. *See supra* note 205.

B. *Regulating the Actual Production of Ethanol Within State Borders*

For a state that produces ethanol, either at the cultivation stage or the refinement stage, a reformed RFS should require the state's LCFS to incorporate at least one of policy options two through four.

Under policy option two, states could tax withdrawals of state water resources used in ethanol production. For instance, to address seasonal rainfall variations, withdrawals for irrigation or refinement cooling can have a varied tax that correlates with rainfall. Water is often plentiful in one season, but scarce in another.[228] Rainfall also varies each year.[229] State and local agencies are better attuned to the issues in their area and can implement flexible plans and responses for unexpected weather patterns.[230] Though many states have water management plans that help preserve water resources,[231] including a variable tax in a state LCFS can reduce stress on water resources during seasonal variations by enticing those who need to withdraw water to come up with ways to reduce their water use when it is scarce.[232] For instance, states could implement a tax on water use during dry seasons to force irrigators to implement conservation practices or

228. RIA, *supra* note 16, at 985.

229. *See, e.g.*, FINGERMAN ET AL., *supra* note 102, at 4.

230. *Cf.* Brian R. Giaquinto, Comment, *Picking Up the Pace: Revitalizing a Private, Market-Driven Solution to Rising Costs and Environmental Policy*, 7 LIBERTY U. L. REV. 369, 394–95 (2013) (discussing how "states can develop programs that are targeted specifically for that region" rather than adopting the "one-size-fits-all approach of the federal governmental regulation.").

231. *E.g.*, MINN. ENVTL. QUALITY BD., 2010 MINNESOTA WATER PLAN (2010), *available at* http://www.eqb.state.mn.us/documents/2010_Minnesota_Water_Plan.pdf; LOWER COLO. RIVER AUTH., WATER MANAGEMENT PLAN FOR THE LOWER COLORADO RIVER BASIN (1989, amended 2010), *available at* http://www.lcra.org/water/water-supply/water-management-plan-for-lower-colorado-river-basin/Documents/lcra_wmp_june2010.pdf; WATER COUNCIL, GEORGIA COMPREHENSIVE STATE-WIDE WATER MANAGEMENT PLAN (2008), *available at* http://www.georgiawatercouncil.org/Files_PDF/water_plan_20080109.pdf.

232. GREAT LAKES COMM'N, LITERATURE REVIEW OF THE INFLUENCE OF WATER RATE STRUCTURES AND PRICE ON WATER USAGE AND ASSOCIATED BENEFITS 1 (2011), *available at* http://www.glc.org/wateruse/watervalue/pdf/Task%202%20Literature%20Review%20-%20final.pdf (noting that "the price of water can influence its usage and promotes water conservation" after compiling consumption and conservation behavior studies on the effect of pricing water during the annual dry season in three California water districts).

better structure their growing season to align with a sustainable water use plan.[233]

Under policy options three and four, states can preserve water quality by establishing "go/no-go" rules on a seasonal basis or on a location basis. For instance, if applied on a seasonal basis, the state would only permit corn growing during certain times of the year to encourage farmers to rotate their corn crops with other plants. Rotating corn crops with nitrogen-fixing crops, like soybeans, reduces the necessary amount of chemical fertilizer, which can pollute waterways through runoff during rainfall.[234] Growing continuous corn also increases populations of pests and reduces soil quality, resulting in overall reduced corn yields per acre over time.[235] This leads farmers to engage in a downward spiral as they increasingly apply pesticides and fertilizers to maintain yields.[236] A state policy that inhibits corn growing year round and forces farmers to rotate corn with other crops would prevent this downward spiral. As for a location-based assessment, prior to implementing or expanding ethanol production, state agencies would analyze the state's water resources at a county or regional level. For areas that are water scarce and where water resources are in danger of depletion, the agency can establish a temporary moratorium (a "no-go" rule), prohibiting further biofuels production.

Transferring the EPA's waiver and reduction authority for conventional biofuels to the states would also help mitigate impacts to water resources, such as a drought, that occur only in certain areas of the country. In times of drought, competition for water between agriculture, industry, and residential use becomes an issue. The Midwest states experienced one of the worst droughts on record in 2012, which wiped out much of the corn crop.[237] This put

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233. For example, researchers at the University of Florida found that the timing of seeding and harvesting was key to reducing water demand in Florida, a state which is known for long dry periods during the year. DAVID WRIGHT ET AL., UNIV. FL., DEP'T OF AGRONOMY, SS-AGR-85, FIELD CORN PRODUCTION GUIDE 3 (rev. ed. 2011), *available at* http://edis.ifas.ufl.edu/pdffiles/AG/AG20200.pdf ("Non-irrigated corn may do best from late April planting if normal rainfall occurs in July and August. Non-irrigated corn is at risk each year since dry periods of three weeks or longer often occur.").

234. RIA, *supra* note 16, at 956. ("Continuous corn loses significantly more nitrogen annually than a corn-soybean rotation.")

235. *Id.* at 957.

236. *Id.*

237. Bryan Walsh, *Rising Temperatures and Drought Create Fears of a New Dust Bowl*, TIME SCI. & SPACE (July 5, 2012), http://science.time.com/2012/07/05/rising-tempera tures-and-drought-create-fears-of-a-new-dust-bowl; *see also* Carey Gillam, *U.S. Drought Creates*

stress on Midwest states that were struggling to allocate dwindling water reserves between corn growers and citizens.[238] One hundred and fifty state governors and members of Congress petitioned the EPA to waive the federal ethanol mandate for 2012, but the Agency refused.[239] Ethanol industry leaders had strong voices during this time, as they had to produce the ethanol for petroleum companies to meet the federal mandate.[240] Meanwhile, state water resources were at risk of depletion.[241] A federal mandate with across-the-board requirements became devastating for half the country's water resources.[242] Localized or regionalized agricultural risks such as droughts can be better addressed by the states because states are more in-tune with an area's natural resources. A reformed RFS should confer the waiver and reduction provisions from the EPA to the state agency in charge of implementing the LCFS. A state would be more attuned and able to waive the fuel requirement during times of drought if it were straining state water resources.[243] Therefore, the EPA would no longer have to make a waiver or reduction determination that would impact the ethanol industry nationwide. States could issue waivers that affect only the local industry, based on local considerations.

However, there must be limits to a state's waiver authority. A state should only be permitted to waive required policy option one (the numeric valuation of ethanol's water impact), and should not

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Water Woes for Great Plains States, HUFFINGTON POST (Sept. 27, 2012, 12:34 PM), http://www.huffingtonpost.com/2012/09/27/us-drought-water-woes_n_1919820.html (noting that agriculture accounts for 70% of all freshwater use in the plains states).

238. *Id.*

239. *Hearing: Day 1, RFS Overview*, *supra* note 173, at 55 (statement of Rep. Jerry McNerney, Member, H. Comm. on Energy & Commerce).

240. *See, e.g.*, *id.* at 31–34 (statement of Michael McAdams, President, Advanced Biofuels Ass'n).

241. Sandra Postel, *More Water Stress than Meets the Eye*, NAT'L GEOGRAPHIC—WATER CURRENTS (Oct. 9, 2013), http://newswatch.nationalgeographic.com/2013/10/09/more-water-stress-than-meets-the-eye/ (noting that during the 2012 drought, Texas irrigators "pumped more groundwater to make up for the rainfall deficit," which led to the largest annual decline in twenty-five years of groundwater that sixteen counties rely on).

242. *See Severe Drought Shows Stupidity of Corn Ethanol Mandate*, ECOWATCH (Aug. 3, 2012, 8:40 AM), http://ecowatch.com/2012/08/03/drought-corn-ethanol/ (arguing that the RFS is a risky federal policy that Congress should restrain because it forces large amounts of corn into ethanol production and exacerbates food insecurity and hunger in times of severe drought while degrading the environment).

243. For a discussion on the benefits of state regulation for environmental policies, see Giaquinto, *supra* note 230, at 380 ("[S]olutions must be tailored to fit different environmental conditions among the regions of the nation.").

have the authority to waive policy options two through four (the proposed LCFS ethanol production options). The reasoning for this limitation is because preserving water resources—and not reducing air emissions—becomes the primary concern during a drought. By waiving the carbon intensity threshold, a state with a drought could allow imported fuel from other states or countries; and though imported fuel sold in the state would have a higher carbon intensity, it does not strain the state's freshwater resources because ethanol producers within the state are not vying for water rights to meet a mandated demand.

Interstate impacts on water resources from ethanol production, such as eutrophication in the Gulf of Mexico caused by Midwest corn cultivation,[244] need to be addressed in a reformed RFS. State LCFS programs for conventional biofuels could reduce impacts to state water resources, but there is still an issue when problems span state boundaries. The federal RFS would not only need to phase out mandated volume amounts, but also include provisions that address interstate water quality issues caused by corn ethanol production.

Another potential provision in the reformed RFS, would address interstate pollution through a pollution-trading program to limit the application of fertilizers and pesticides used on cornfields for ethanol production.[245] The EPA can set maximum amounts of fertilizer and pesticide allowed per state and assign tradable permits for these maximums.[246] This would incentivize cultivators and refiners to take further measures to limit their pollution or the amount of water they use. It would also give growers the opportunity to make a profit by selling their tradable

244. *See supra* note 83 and accompanying text.

245. The idea of cap-and-trade is straightforward. A total amount of allowable pollution is set (the cap). Those subject to the cap are allocated allowances (in sum equal to the cap) that allow them to pollute (typically one ton of pollutant per allowance, with the total number of allocated allowances equal to the cap). Emitters may meet their allocated amount in one of three ways. They may use all of their allowances. They may cut their pollution to levels below the amount they have been allocated and trade/sell the excess allowances to those who need them. Or they may pollute in excess of the amount of allowances allocated and make up the difference by purchasing allowances from those emitters who don't need all of theirs.

Ann E. Carlson, *Designing Effective Climate Policy: Cap-and-Trade and Complementary Policies*, 49 HARV. J. LEGIS. 207, 209 (2012) (footnotes omitted).

246. The maximum amounts could be established based on the state's current and projected corn production.

permits to other growers who apply more than their allocated amount of fertilizer.[247] A pollution-trading program would not only provide flexibility to the ethanol industry, but also preserve state autonomy by allowing the states to allocate the tradable permits within their state.

In the reformed RFS, the role of the EPA with respect to conventional biofuels should be two-fold: oversight of state LCFS plans and administration of a pollution-trading program for chemical application on cornfields for ethanol production. The oversight role should include detailed review and approval of state LCFS plans by a specified deadline, or otherwise the implementation of a federal LCFS plan in that state.

In essence, the cooperative interaction between the federal and state governments plays out as follows: (1) The state engages in a detailed analysis of the extent of the ethanol industry within its borders (cultivation, refinement, and/or sale); (2) The state water quality department reviews the impact on freshwater resources from ethanol production within its borders; (3) Using EPA water impact valuation guidelines with state expertise regarding specific freshwater resources, the state assigns numerical values to different impacts of production; (4) Using California's LCFS as a guideline, the state proposes its LCFS plan with the appropriate policy options outlined in this reform and then submits it to the EPA for approval; (5) The EPA approves the state's LCFS or rejects it with recommendations for improvement; (6) Once implemented, the state may continue to expand its ethanol industry so long as it complies with the LCFS; (7) Meanwhile, EPA develops the pollution-trading program and states submit bids for tradable permits; (8) The oversight role should also include review and approval of state LCFS plans by a specified deadline or else the im-

247. A similar program was enacted in the 1990s to combat acid rain, which is caused by sulfur dioxide ("SO_2") emissions. The SO_2 pollution-trading program is touted as an "enormous success" in both emissions reductions and cost-effectiveness. *See* Holly Doremus & W. Michael Hanemann, *Of Babies and Bathwater: Why the Clean Air Act's Cooperative Federalism Framework Is Useful for Addressing Global Warming*, 50 ARIZ. L. REV. 799, 802 (2008). Designing a pollution-trading program similar to the acid rain program—but for chemical and fertilizer use by corn growers—has the potential to reduce negative interstate water quality impacts caused by nutrient-loads. For guidance on implementing a pollution trading permit program for nutrients in water bodies, see U.S. ENVTL. PROT. AGENCY, WATER QUALITY TRADING TOOLKIT FOR PERMIT WRITERS (2007), *available at* http://www.epa.gov/npdes/pubs/wqtradingtoolkit_fundamentals.pdf.

plementation of a federal LCFS plan in that state, where the EPA chooses the appropriate policy options.

CONCLUSION

The ethanol industry's paraded assumption that "[n]o beaches have been closed due to ethanol spills"[248] may be true when read literally, but the implication that ethanol is not dangerous to water is misleading. As presented in Part II, from cultivation to refinement, ethanol production harms freshwater resources. The current RFS will continue to exacerbate this harm. The RFS mandate permits fifteen billion gallons of ethanol to be blended into gasoline. Domestic production, almost all of which comes from corn, is expected to meet this target by 2015.[249] The increased demand for corn ethanol that the RFS creates will continue to impact both water quality and quantity, which will in turn affect the nation's energy independence.

The RFS's aim to promote United States energy independence by mandating a homegrown domestic fuel resulted in unintended consequences to the nation's freshwater resources. These consequences are seen at local and regional levels. Local communities and states are sacrificing a vital resource to fulfill the unsustainable demand for ethanol that the federal RFS is pursuing in the name of energy security. Freshwater is not only vital to sustain life on Earth, it is indispensable in the ethanol production process. This energy-water nexus between ethanol and water will put the nation in a catch-22 as freshwater resources become less available, either by degradation or depletion, and the nation becomes less energy independent.

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248. Gies, *supra* note 1.

249. FIRST TRIENNIAL REPORT, *supra* note 3, at 3-6. One area that this comment does not address is importing ethanol from other countries into the United States. The RFS currently allows ethanol imports to be counted under the mandate if blended by the fuel refiner in the United States. Most of the ethanol that is imported into the United States comes from Brazil and is made from sugarcane, not corn. *Id.* at 5-4. The impact that future imports will have on the amount of ethanol produced within the United States is uncertain due to multiple global economic and political influences. *Id.* at 5-3 ("U.S. biofuel imports and exports will also be influenced by trade policy, including tariffs and other incentives in the United States and other countries."). Including the impact of imports on United States corn ethanol production would include assumptions beyond the scope of this comment, which focuses on the impact of the nation's water resources from domestic ethanol production.

To avoid putting the nation in a catch-22, Congress should reform the RFS to take into account ethanol production's impact on freshwater resources. The reform should phase out the mandated biofuel volume requirements. Once phased out, ethanol will not cease to exist; instead state agencies will be the dominant regulators of ethanol. States should then be required to implement a LCFS that contains policy provisions to mitigate the impact of ethanol production on the state's water resources. The waiver and reduction authority currently held by the EPA should be transferred to the state agencies in charge of implementing the LCFS to further mitigate damage in times of drought. Though the market for ethanol will be a state-run regulatory program, the EPA will still play a dominant role in issuing guidance, providing oversight of state LCFS programs, and regulating interstate pollution impacts from ethanol production. By transferring authority of ethanol regulation from the federal government to the states, the impacts of ethanol production on freshwater resources can be addressed at the level where they are caused.

Not only are barrels and bushels more intertwined than ever, they are both intricately tied to freshwater. To avoid a catch-22, the RFS needs to be reformed to protect freshwater resources and promote energy independence. This policy decision cannot be delayed any longer.

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