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Biofuel and Advanced Biofuel

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I.
INTRODUCTION

Early in the 20th Century it was recognized that ethanol was not just for drinking, but could be used to power vehicles. In 1908 ethanol was used to fuel the Model T Ford.[1] In 1925, Henry Ford called ethyl alcohol the fuel of the future. He also believed converting corn into alcohol would help ease the economic crisis for farmers that would later morph into the Great Depression.[2] Thus began the concept of using motor vehicle fuel policy to subsidize farmers. The use of biofuel did not gain traction, but some alcohol fuel production occurred during World War II. In the 1940s the U.S. Army built and operated an ethanol plant in Omaha to produce fuel for the army.[3]

In 1973 the Arab members of the Organization of Petroleum Exporting Countries (OPEC) imposed an embargo on petroleum exports to the United States.[4] This led to Congress developing an interest in supporting a renewable fuel industry.[5] Renewable fuel is defined as "fuel that is produced from renewable biomass and that is used to replace or reduce the quantity of fossil fuel present in a transportation fuel,"6 or "in home heating oil or jet

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1. Cole Gustafson, *History of Ethanol Production and Policy*, N.D. STATE UNIV., http://www.ag.ndsu.edu/energy/biofuels/energy-briefs/history-of-ethanol-production-and-policy (last visited May 20, 2015).

2. Bill Kovarik, *Henry Ford, Charles Kettering and the Fuel of the Future*, 32 AUTOMOTIVE HIST. REV., Spring 1998, at 7, *available at* http://www.environmentalhistory.org/billkovarik/about-bk/research/henry-ford-charles-kettering-and-the-fuel-of-the-future/.

3. Kurt A. Rosentrater, *Evolution of New Processes and Products from Dry Grind Fuel Ethanol Processing*, IOWA STATE UNIV., http://www.ccur.iastate.edu/news/newsletters/2012/may_jun/cutcpresentations/rosentrater_presentation.pdf (last visited May 20, 2015).

4. *Oil Embargo, 1973-1974*, U.S. DEP'T OF STATE, OFFICE OF THE HISTORIAN, https://history.state.gov/milestones/1969-1976/oil embargo (last visited May 20, 2015); *see generally* DANIEL YERGIN, THE PRIZE 606 (1991) (describing the oil embargo and its effects on the global oil market).

5. The development of the ethanol program has been covered in previous publications by this author. *See, e.g.*, Arnold W. Reitze, Jr., *Biofuels—Snake Oil for the Twenty-First Century,* 87 OR. L. REV. 1183 (2008). This article is primarily concerned with developments since 2008 and discusses earlier material only to the extent necessary to place the new developments in context.

6 Clean Air Act § 211(o)(1)(J), 42 U.S.C. § 7545(o)(1)(J) (2014).

fuel."[6] In 1974 the Solar Energy Research Development and Demonstration Act provided support for research and development of conversion of cellulose into fuel.[7] The Clean Air Act (CAA) Amendments of 1977 expanded EPA's authority to regulate fuels.[8] In the 1980s, however, nearly all the limited federal support went to incentivize ethanol production from corn.[9] This resulted in a rapid expansion of ethanol production with over 100 corn alcohol production plants by the mid-1980s. Subsequently, most ethanol plants closed due to a worldwide over supply of petroleum at a relatively low price.[10]

The CAA Amendments of 1990 provided a boost for ethanol production,[11] by requiring the use of oxygenated fuels during the winter in 39 carbon monoxide nonattainment areas. [12] Additional oxygen in fuel, which alcohol can supply, improves combustion.[13] The 1990 CAA Amendments also required the production of reformulated gasoline (RFG) that met specified chemical requirements, including having an oxygen content

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6. *Id.* § 7545(o)(1)(A).

7. Solar Energy Research, Development, and Demonstration Act of 1974, Pub. L. No. 93-473, § 6, 88 Stat. 1431,1434.

8. *See* Clean Air Act Amendments of 1977, Pub. L. No. 95-95, § 222, 91 Stat. 685, 762-63 (codified at 42 U.S.C. § 7511 (1977)). For requirements for fuel and fuel additives, see 40 C.F.R. pt. 79.

9. *See, e.g.*, Energy Security Act, Pub. L. No. 96-294, § 100, 94 Stat. 611, 616 (1980); Surface Transportation Assistance Act, Pub. L. No. 97-424, § 511, 26 Stat. 2097, 2170 (1982); Tax Reform Act of 1984, Pub. L. No. 98-369, § 913, 98 Stat. 494, 1008 (1984);

10. Kovarik, *supra* note 2.

11. Act of Nov. 15, 1990, Pub. L. No. 101-549, § 216, 104 Stat. 2399, 2489 (codified at 42 U.S.C. § 7545 (1990)).

12. *Id.* § 187, 104 Stat. at 2454-58 (codified at 42 U.S.C. § 7545(m) (1990)).

13. Alcohol is a derivative of hydrocarbons in which a hydroxyl group (OH) replaces a hydrogen atom. Ethanol is the alcohol that dominates biofuel production, but methanol and butanol can also be used as fuel. Ethanol (C_2H_5OH) can be made from any biomass feedstock, and is the same chemical that is used in alcoholic beverages. Producing fuel alcohol is a four-step process. First, a carbohydrate (almost always corn in the United States) is reduced to a sugar solution. Next it is fermented to ethanol and carbon dioxide. The ethanol then is removed by distillation to create a ninety-five percent alcohol solution. Finally the water is removed. *See* Hossein Shapouri & Michael Salassi, *The Economic Feasibility of Ethanol Production From Sugar in the United States*, U.S. DEP'T OF AGRIC.1 (July 2006), http://www.usda.gov/oce/reports/energy/EthanolSugarFeasibilityReport3.pdf.

equal to or greater than two percent by weight. RFG was to be used in nine specified severe ozone nonattainment areas and in other severe ozone nonattainment areas that might be subsequently designated. [14]

II.
RENEWABLE FUEL REQUIREMENTS

The Energy Policy Act of 2005 (2005 EPAct) was the first federal law that required motorists to purchase first generation renewable biofuel blends (RFS1), which used corn and soybeans as the feedstock.[15] The EPAct also amended CAA § 211(k) to eliminate the oxygenate requirement for RFG,[16] but added renewable fuel requirements that were codified in a new CAA § 211(o).[17] On May 1, 2007, EPA promulgated regulations to implement the 2005 EPAct.[18] The Energy Independence and Security Act of 2007 (EISA) significantly modified the EPAct's renewable fuel requirements. [19] EISA increased the mandatory use of renewable fuel. The renewable fuel volume requirements were expanded to include all transportation fuel except fuel for

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14. Act of Nov. 15, 1990 § 219, 104 Stat. at 2492-500 (codified at 42 U.S.C. § 7545(k) (1990)).

15. Energy Policy Act of 2005, Pub. L. No. 109-58, § 1501, 119 Stat. 594, 1068. First generation biofuel in the U.S. is dominated by corn-based ethanol, but Brazil makes extensive use of sugarcane-based ethanol. For information concerning the development of Brazil's program, see Vanessa M. Cordonnier, *Ethanol's Roots: How Brazilian Legislation Created the International Ethanol Boom*, 33 WM. & MARY ENVTL. L. & POL'Y REV. 287 (2008); Stephen Sewalk, *Brazil's Energy Policy and Regulation*, 25 FORDHAM ENVTL. L. REV. 652 (2014).; Julia Johnson, Promoting the Sustainability of Biofuels in America: Looking to Brazil (Jan. 2015) (unpublished paper, Duke University), *available at* http://works.bepress.com//julia_johnson1/1.

16. Energy Policy Act of 2005 § 1504, 119 Stat. at 1076. EPA subsequently formally eliminated the oxygenated requirement for RFG on May 8, 2006. *See* Removal of Reformulated Gasoline Oxygen Content Requirement, 71 Fed. Reg. 26,691 (Envtl. Prot. Agency May 8, 2006) (codified at 40 C.F.R. pt. 80).

17. *See* CAA § 211(o), 42 U.S.C. § 7545(o) (2009).

18. *See* Renewable Fuel Standard Program, 72 Fed. Reg. 23,900 (Envtl. Prot. Agency May 1, 2007) (codified at 40 C.F.R. pt. 80).

19. Energy Independence and Security Act of 2007, Pub. L. No. 110-140, § 202, 119 Stat. 1492, 1521-22 (codified at 42 U.S.C. § 7545(o)).

ocean-going vessels.[20] EISA imposed requirements for "second generation" renewable fuel (RFS2), which include cellulosic ethanol, ethanol from crop and animal waste, biomass-based diesel, and other feedstock.[21] Cellulosic biofuel is a subset of advanced biofuel and is defined in the 2007 Energy Act's section 201, which is codified in the CAA's section 211(o)(1), as renewable fuel derived from cellulose, hemicellulose, or lignin derived from renewable biomass. Regulations to implement the 2007 Act were promulgated in 2010.[22] The petroleum industry's subsequent challenge to these regulations was unsuccessful.[23]

EISA's goal is to "move the United States toward greater energy independence and security, to increase production of clean renewable fuels, to protect consumers, to increase efficiency of products, buildings, and vehicles, [and] to promote research on and deploy greenhouse gas capture and storage optionsFalse"[24] As discussed below, the contribution of biofuels to achieve these goals has been modest. The primary accomplishment of the renewable fuel mandate in EISA has been to transfer wealth from the American consumer to the corn-based ethanol industry.[25]

The renewable fuel requirements call for 4 billion gallons of renewable fuel to be used in gasoline in 2006 and the amount increases in steps each year to 36 billion gallons in 2022.[26] Thereafter EPA will set the applicable annual volumes.[27] Renewable fuels include ethanol produced from grain, starch, oilseeds, vegetable, animal or fish materials, sugarcane, sugar

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20. CAA § 211(o)(1)(L), 42 U.S.C. § 7545(o)(1)(L).

21. *Id.* § 7545(o)(1)(B).

22. Changes to Renewable Fuel Standard, 75 Fed. Reg. 14,670 (Envtl. Prot. Agency Mar. 26, 2010) (codified at 40 C.F.R. pt. 80).

23. *See* Nat'l Petrochemical & Refiners Ass'n v. EPA, 630 F.3d 145 (D.C. Cir. 2010), *petition for reh'g en banc denied*, 643 F.3d 958 (D.C. Cir. 2011).

24. Energy Independence and Security Act of 2007, 121 Stat. at 1492.

25. *See* Kelly Christian, *Worth Keeping Around? The United States' Biofuel Policies and Compliance with the World Trade Organization*, 38 GA. J. INT'L & COMP. L. 165, 167 n.6 (2009) (estimating the U.S. financial support for biofuels in 2006 as between $5.5 billion and $7.3 billion).

26. CAA § 211(o)(2)(B)(i)(I), 42 U.S.C. § 7545(o)(2)(B)(i)(I).

27. *Id.* § 7545 (o)(2)(A)-(B).

beets, sugar components, tobacco, potatoes, or other biomass.[28] Renewable fuels also include natural gas from biogas sources, cellulosic ethanol, and biodiesel from plant or animal wastes.[29] EPA periodically approves feedstock and processes that can be used to produce renewable fuel that satisfies the requirements of CAA section 211(o). For example, on December 17, 2012, EPA approved ethanol from grain sorghum as a renewable fuel, and if approved processes are used, it qualifies as an advanced biofuel.[30] Approved fuels and processes are codified at 40 C.F.R. § 80.1426.

Each of the categories of biofuel is required to meet lifecycle requirements based on its GHG emissions compared to 2005 gasoline or diesel, whichever the biofuel is replacing.[31] The lifecycle requirements include the need to consider all stages of production, distribution, and use by the ultimate consumer.[32] The most controversial requirement is that the lifecycle analysis must consider significant indirect emissions from land use changes.[33] For renewable fuel facilities that commence construction after December 19, 2007, a reduction of 20 percent in GHGs is required. Advanced biofuel and biomass-based diesel must achieve a 50 percent reduction; cellulosic biofuel must achieve a 60 percent reduction.[34] EPA, however, may modify these percentage reduction requirements.[35]

The CAA specifies the required annual volume of renewable fuel that must be blended into transportation fuel that is refined, blended, distributed, or imported.[36] EPA has determined that the primary responsibility for compliance falls on refiners and

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28. 40 C.F.R. § 80.1100(a)(1)(A) (2009).
29. *Id.* § 80.1100(a)(1)(B).
30. *See* Renewable Fuels Produced Under the Final RFS2 Program From Grain Sorghum, 77 Fed. Reg. 74,592 (Envtl. Prot. Agency Dec. 17, 2012) (codified at 40 C.F.R. pt. 80).
31. CAA § 211(o)(1)(C), 42 U.S.C. § 7545(o)(1)(C).
32. *Id.* § 7545(o)(1)(H).
33. *Id.*
34. *Id.* § 7545(o)(1)(B), (D), (E); § 7545(o)(2)(A)(i).
35. *Id.* § 7545(o)(4)(A).
36. *Id.* § 7545(o)(3)(B).

importers.[37] The volume of renewable fuel required is based on a party's actual annual gasoline production in relation to the statutory amount of renewable fuel that is required to be blended. [38] The CAA authorizes EPA to modify the requirements through a renewable fuel standard issued each year specifying the volume of renewable fuel required in each biofuel category.[39] Upon the receipt of a petition by a state or any person subject to the renewable fuel requirements, or on its own motion, EPA may modify the volume requirements if the economy or environment of a state, a region, or the United States would be severely impacted, or if there is an inadequate domestic supply of fuel.[40] Advanced biofuels are subject to additional waiver provisions.[41] To obtain a waiver the evidence must demonstrate to a high degree of confidence that the RFS is the cause of harm to the economy or the environment, and the harm must be severe.[42] As discussed below, EPA missed the deadline for issuing production requirements in 2012, 2013, and 2014, and plans to issue 2014, 2015, and 2016 requirements in 2015.[43]

The CAA includes a production credit program that allows an obligated party to over-comply and obtain credits that it can use or trade to another obligated party.[44] To facilitate compliance with the statute's requirement, obligated parties must obtain a Renewable Identification Number (RIN) that is created for the

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37. *See* 40 C.F.R. § 80.1407 (2010); Renewable Fuel Standards Program, 72 Fed. Reg. 23,900, 23,924 (Envtl. Prot. Agency May 1, 2007) (codified at 40 C.F.R. pt. 80); Changes to Renewable Fuel Standards Program, 75 Fed. Reg. 14,670, 14,722 (Envtl. Prot. Agency Mar. 26, 2010) (codified at 40 C.F.R. pt. 80). Obligated parties is defined in CAA § 211(o)(2)(A)(iii). *See* 42 U.S.C. § 7545(o)(2)(A)(iii).

38. 42 U.S.C. § 7545(o)(3)(B)(ii)(II)-(III).

39. *See, e.g.*, Renewable Fuel Standard for 2009, 73 Fed. Reg. 70,643 (Envtl. Prot. Agency Nov. 21, 2008) (promulgating fuel standards for the year 2009 pursuant to Section 211(o) of the Clean Air Act).

40. CAA § 211(o)(7), 42 U.S.C. § 7545(o)(7).

41. *Id.* § 7545(o)(7)(D)-(E).

42. *See* Notice of Decision Regarding State of Texas Request for a Waiver of a Portion of the Renewable Fuel Standard, 73 Fed. Reg. 47,168 (Envtl. Prot. Agency Aug. 13, 2008).

43. *See* Proposed Consent Decree, Clean Air Act Citizen Suit, 80 Fed. Reg. 21,718, 21,718 (Envtl. Prot. Agency Apr. 20, 2015).

44. CAA § 211(o)(5), 42 U.S.C. § 7545(o)(5).

volume of each batch of renewable fuel produced or imported.[45] The values for the various fuels are adjusted based on their energy content relative to ethanol. Corn ethanol is designated 1.0, biobutanol is 1.3, biodiesel (mono alkyl ester) is 1.5, non-ester renewable diesel is 1.7, and cellulosic ethanol and waste derived ethanol is 2.5.[46]

In 2007, EISA separated the required volume of renewable fuel into four overlapping categories with nested volume mandates: renewable fuel, advanced biofuel, cellulosic biofuel, and biomass-diesel. The last three categories are discussed below in section IV. Problems with the program's mandates developed, however, because the growth in advanced biofuel production lagged behind expectations and the growth in fuel consumption for highway transportation slowed. In 2000 ethanol production was 1.125 billion gallons, and in 2011 it was 8.701 billion gallons, a 673 percent increase.[47] Over those twelve years, fuel consumption by highway vehicles increased by only 3.5 percent.[48] This created a "blend wall" because gasohol is limited to a 10 percent blend, which resulted in the law requiring more ethanol to be blended than there is gasoline to blend.[49] For this reason the ethanol industry works to have a 15 percent ethanol mixture (E15) approved by EPA.

In 2010 and 2011 EPA granted partial waivers to allow E15 to be used for model year 2001 and newer vehicles.[50] Lawsuits

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45. Renewable Fuel Standard Program, 72 Fed. Reg. 23,900, 23,929 (May 1, 2007) (codified at 40 C.F.R. pt. 80).

46. *Id.* at 23,909; *see also* 40 C.F.R. § 80.1415 (2014).

47. STACY C. DAVIS ET AL., TRANSPORTATION ENERGY DATA BOOK, at 2-6 tbl.2.4 (33 ed. 2014), *available at* http://cta.ornl.gov/data/tedb33/Edition33_Chapter02.pdf .

48. *Id.* at 2-9 tbl.2.7.

49. *See Final Rule for 2014 Renewable Fuel Standard: The Clock Is Ticking*, 45 Env't Rep. (BNA) 2497 (Aug. 22, 2014) (discussing the blend wall). Renewable requirements in 2022 are 36 billion gallons. In 2011, 21,288 trillion Btu of fuel were consumed by the highway sector. E10 has 112,400 Btu per gallon, which converts to about 190 billion gallons of fuel that contain 19 billion gallons of renewable fuel. *See* DAVIS ET AL., *supra* note 47, at 2-3, tbl.2.1; *id.* at B-5, tbl.B.4. Thus, unless fuel consumption increases substantially or the percentage of renewable fuel increases substantially, the 2022 targets cannot be met.

50. *See* Waiver Application to Increase the Allowable Ethanol Content of

opposing approval of E15 were consolidated into one case, which was dismissed for lack of standing.[51] EPA subsequently approved the first of twenty-four E15 registration applications on April 2, 2012.[52] Auto manufacturers and the petroleum industry protested, claiming that E15 damaged motor vehicles and voided warranties.[53] Another lawsuit challenged the E15 rule through arguments in front of the D.C. Circuit on October 6, 2014, where the plaintiffs claimed that the rule is inadequate to protect consumers from the adverse impacts of using E15.[54]

At the same time that the ethanol industry is trying to sell more ethanol than the petroleum industry can use, some of the categories of advanced biofuels require more of the fuel to be blended than the biofuel industry can produce. In 2010 and 2011 no cellulosic ethanol was produced. EPA reduced the cellulosic ethanol quota in 2010, 2011, and 2012, but it did not reduce the advanced biofuel and renewable fuel quota in those years.[55] This forced the petroleum refiners to purchase RINs to meet their blending requirements, which led the petroleum industry to lobby for the removal of renewable fuel mandates.[56] Moreover,

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Gasoline to 15 Percent, 75 Fed. Reg. 68,094 (Envtl. Prot. Agency Nov. 10, 2010); Waiver Application to Increase Allowable Ethanol Content of Gasoline to 15 Percent, 76 Fed. Reg. 4662 (Envtl. Prot. Agency Jan. 26, 2011).

51. *See* Grocery Mfrs. Ass'n v. EPA, 693 F.3d 169, 180 (D.C. Cir. 2012), *reh'g denied*, 704 F.3d 1005 (D.C. Cir. 2013).

52. *EPA Approves 24 Registration Applications to Produce Ethanol for E15 Blended Gasoline*, 43 Env't. Rep. (BNA), at 881 (Apr. 6, 2012). For information concerning the efforts to market E15, see *E15*, RENEWABLE FUELS ASS'N, http://www.ethanolrfa.org/pages/E15 (last visited June 30, 2015).

53. *Auto Group Calls for Suspension of Sales Of Gasoline Containing 15 Percent Ethanol*, 43 Envt. Rep. (BNA) 3112 (Dec. 7, 2012) [hereinafter *Auto Group Calls for Gas Sales Suspension*].

54. *See* Alliance of Automobile Mfrs. v. EPA, No. 11-1334, 582 Fed. Appx. 1 (Mem.) (D.C. Cir. Oct. 21, 2014) (denying the petition for review in an unpublished opinion).

55. *See* Changes to Renewable Fuel Standard Program, 75 Fed. Reg. 14,670 (Mar. 26, 2010) (codified at 40 C.F.R. pt. 80); 2011 Renewable Fuel Standards, 75 Fed. Reg. 76,790 (Dec. 10, 2010) (codified at 40 C.F.R. pt. 80); 2012 Renewable Fuel Standards, 77 Fed. Reg. 1320 (Jan. 9, 2012) (codified at 40 C.F.R. pt. 80); 2013 Renewable Fuel Standards, 78 Fed. Reg. 9282 (proposed Feb. 7, 2013) (to be codified at 40 C.F.R. pt. 80).

56. *Oil Industry Calls Renewable Fuel Standard 'Unworkable,' Biofuels Group Tout Benefits*, 44 Env't Rep. (BNA) 716 (Mar. 15, 2013).

fraud in the RIN program had a chilling effect on the RIN trading market. [57]

Thirty oil and refining companies that inadvertently purchased fraudulent RINs were subject to enforcement actions brought by EPA.[58] In the spring of 2013, settlements were reached with the 30 refiners and other companies, with the imposition of $3.65 million in penalties.[59] EPA's position that purchasers are responsible if RINs are not valid was subsequently being reconsidered to allow a due diligence affirmative defense.[60] However, there has been no relief from the renewable fuel requirements that the petroleum industry seeks. In another case, EPA proposed a $62 million fine for Absolute Fuels of Lubbock, Texas for generating 48 million fraudulent RINs.[61] Alleged violators of RIN requirements have been indicted for wire fraud, mail fraud, and other crimes.[62] On July 18, 2014, EPA finalized a voluntary quality assurance program in an effort to restore confidence in the program.[63] However, criminal prosecutions continue; on April 7, 2015, three Indiana brothers pleaded guilty to charges that they participated in a scheme to sell $145 million of fraudulent biodiesel incentives.[64] Calls for the repeal of the renewable fuel use requirements are unlikely to succeed because the House Energy and Commerce Committee and the Senate Energy and Natural Resources Committee appear to support the renewable fuels industry.[65]

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57. *EPA's Enforcement of RIN Fraud Violations Starts to Bring Stability Back to the Market*, 44 Env't Rep. (BNA) 1350 (May 3, 2013).

58. *Auto Group Calls for Gas Sales Suspension*, *supra* note 53.

59. *Lawsuit Challenges 13 EPA Settlements Over Fake Renewable Fuel Credits*, 43 Env't Rep. (BNA) 1755 (July 6, 2012).

60. *EPA to Grant Oil Industry Bid for 'Affirmative' Defense in RFS Fraud Rule*, 29 Envtl. Pol'y Alert (Inside EPA) No. 17, at 32 (Aug. 12, 2012).

61. *EPA Proposes $62 Million Fine Alleging Renewable Fuel Certificate Violations in Texas*, 43 Env't Rep. (BNA) 326 (Feb. 10, 2012).

62. *Houston Man Charged With Selling Fake Renewable Credits to Oil Companies*, 45 Env't Rep. (BNA) 1902 (June 27, 2014).

63. *See* RFS Renewable Identification Number (RIN) Quality Assurance Program, 79 Fed. Reg. 42,078, 42,078 (Envtl. Prot. Agency July 18, 2014).

64. *Three Brothers Plead Guilty to Role in $145M Biodiesel Incentive Fraud Scheme*, 46 Env't Rep. (BNA) 1326 (May 1, 2015).

65. *Senate's Support For Biofuels Signals Hurdle To RFS Critics' Repeal Push*, 24 Clean Air Rep. (Inside EPA) No. 1, at 17 (Jan. 3, 2013).

This emboldens the biofuel industry to seek certification for a 30 percent ethanol blend (E30).[66]

Under pressure from the petroleum industry, EPA used its rulemaking process to modify blending requirements.[67] On August 15, 2013, EPA promulgated its 2013 RFS. It required the use of 16.55 billion gallons of renewable fuel. It reduced cellulosic ethanol requirements to 6 million gallons, which is dramatically lower than the EISA requirement of 1 billion gallons.[68] The petroleum industry challenged the regulation in the D.C. Circuit because EPA did not meet the statutory deadline for promulgating the regulation.[69] The petitioners argued that they are harmed by requirements that were issued halfway through the compliance year.[70] The court held, however, that EPA's failure to meet the statutory deadline did not deprive it of authority to promulgate standards or to apply those standards to the entire compliance year.[71]

On November 29, 2013, EPA promulgated a proposed 2014 RFS that reduces the EISA requirement to blend 18.15 billion gallons of renewable fuel to 15.21 billion gallons.[72] It also reduces the requirements for blending advanced biofuels from 2.75 billion gallons under the 2013 rule to 2.2 billion gallons; the biodiesel requirement remained at 1.28 billion gallons.[73] Petroleum industry groups oppose the reduction.[74] Despite its

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66. *Ethanol Sector Urges EPA to Consider E30 As 'Tier III' Certification Fuel*, 30 Envtl. Pol'y Alert (Inside EPA) No. 3, at 30 (Feb. 6, 2013).

67. *EPA Starts RFS Rulemaking As Oil Industry Campaigns For Repeal*, 24 Clean Air Rep. (Inside EPA) No. 24, at 13 (May 23, 2013).

68. *See* 2013 Renewable Fuel Standards, 78 Fed. Reg. 49,794 (Aug. 15, 2013) (codified at 40 C.F.R. pt. 80).

69. *See* Monroe Energy, LLC v. EPA, 750 F.3d 909, 911 (D.C. Cir. 2014).

70. *Id.* at 914.

71. *Id.* at 919.

72. *See* 2014 Standards for the Renewable Fuel Standard Program, 78 Fed. Reg. 71,732 (proposed Nov. 29, 2013) (to be codified at 40 C.F.R. pt. 80).

73. *EPA Trims 2014 Renewable Fuel Mandate To 15.21 Billion Gallons, Citing Blend Wall*, 44 Env't Rep. (BNA) 3448 (Nov. 22, 2013).

74. *See, e.g.*, *Renewable Fuel Standard*, RENEWABLE FUELS ASSOCIATION, http://www.ethanolrfa.org/pages/renewable-fuel-standard (last visited May 26, 2015) (stating that "Big Oil [groups] . . . have teamed up with allies . . . to repeal the RFS, but the U.S. biofuels sector and [its] supporters . . . are gearing up to fight back.").

political power, the industry has been unable to convince the Congressional supporters of biofuels to provide relief.[75] On May 6, 2014, the D.C. Circuit ruled against the petroleum industry, holding EPA reasonably decided that the advanced biofuel quota did not need to be reduced because it could be achieved by using carryover 2012 RINs and by using non-ethanol renewable fuels such as biodiesel.[76]

In October 2014, EPA extended the compliance deadline for the 2013 renewable fuel standards for the third time.[77] For 2014, EPA proposed requiring the use of 15.21 billion gallons of renewable fuel, including 13 billion gallons of corn ethanol and 1.28 billion gallons of biodiesel—well below the renewable fuel statutory requirement of 18.15 billion gallons.[78] In August 2014, the final 2014 renewable fuel standard was sent to the White House Office of Management and Budget for pre-publication review. However, at the end of 2014, neither the 2014 nor the 2015 RFS had been promulgated; therefore RFS, biofuel producers, oil and gas refiners, and other entities subject to the RFS rule had no opportunity to make adjustments to comply with the 2014 calendar year RFS targets.[79] On April 20, 2015, EPA promulgated a proposed consent decree to address a lawsuit titled *American Fuel & Petrochemical Manufacturers, et al. v. EPA*.[80] EPA agreed to propose action to deal with the renewal fuel obligations under CAA § 211(o) for calendar year 2015 by June 1, 2015 and take final action by November 30, 2015.[81] On May 29, 2015, EPA proposed a multi-year fuel standard (RFS) for 2014, 2015, and 2016 that sets goals for the production of cellulosic biofuel, biomass-based diesel, advanced biofuel, and

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75. *See AFPM Says Growing House Support For RFS Reform May Boost Senate Push*, 30 Envtl. Pol'y Alert (Inside EPA) No. 26, at 35 (Dec. 25, 2013).

76. *Monroe Energy*, 750 F.3d at 917-18.

77. *EPA Extends 2013 RFS Compliance Deadline For Third Time as 2014 Final Rule Delayed*, 45 Env't Rep. (BNA) 2252 (Aug. 1, 2014).

78. *Administration Still 'Committed to Biofuels' Despite Proposed Reduction, McCarthy Says*, 45 Env't Rep. (BNA) 980 (Apr. 4, 2014).

79. *Refiners' Association to Sue EPA Over Delay in Issuing Renewable Fuel Standard for 2015*, 45 Env't Rep. (BNA) 3508 (Dec. 5, 2014).

80. *See Proposed Consent Decree, Clean Air Act Citizen Suit,* 80 Fed. Reg. 21,718, 21,718 (Apr. 20, 2015).

81. *Id.*

total renewable fuel.[82] It calls for the ethanol portion of total renewable fuel in 2016 to be just below 12 billion gallons, which is substantially below the biofuel industry's expectations.[83] As the rule is reviewed by the Office of Management and Budget, the biofuel industry continues its efforts to increase the biofuel targets.[84]

III.
THE ADVERSE EFFECTS OF USING ETHANOL AS FUEL

Modern monoculture agriculture provides the benefits of increased yields and economies of scale, but it also entails adverse environmental impacts. Using corn and other food crops for biofuel and biodiesel production exacerbates the adverse environmental impacts that are associated with commodity crop agriculture. Much of the adverse environmental impact of ethanol use is attributable to corn production, which is discussed below. However, since neither farmers nor food consumers pay for these negative externalities, there is little incentive to effectively control them. The 2013 corn crop of 13.99 billion bushels set a new production record that was 700 million bushels higher than the previous record set in 2009. An estimated 4.9 billion bushels of corn was used to produce about 13.8 billion gallons of ethanol, which is about one-third of the crop. [85] The ethanol industry, however, says that on a net basis only 22 percent of the crop is used for ethanol because ethanol production results in the production of a high-energy animal feed byproduct.[86] In 2014, corn production increased again with an estimated 14.2 billion bushels.[87] Five million bushels of corn

82. *EPA's Proposed Multi-Year RFS Raises Fuel Goals But Spurs Broad Attacks*, 26 Clean Air Rep. (Inside EPA) No. 12, at 14 (June 4, 2015).

83. *Id.*

84. *Groups Aim to Sway Outcome of Multi-Year RFS as OMB Begins Review*, 26 Clean Air Rep. (Inside EPA) No. 11, at 12 (May 21, 2015).

85. Susanne Retka Schill, *Ethanol Industry Examines Implication of Record Corn Crop*, ETHANOL PRODUCER (Nov. 11, 2013), http://www.ethanolproducer.com/articles/10438/ethanol-industry-examines-implications-of-record-corn-crop.

86. *Id.*

87. U.S. DEP'T OF AGRICULTURE, CROP PRODUCTION: 2014 SUMMARY 3

were used to produce ethanol fuel, which is claimed to be enough food to feed the entire population of the Western Hemisphere outside the United States.[88]

EISA's section 204 requires the EPA Administrator to report to Congress every three years on present and likely future impacts on the environment. The first report was released December 2011.[89] The report examines the five stages of the biofuel supply chain: feedstock production, feedstock transport and distribution, biofuel production, biofuel distribution, and biofuel use.[90]

The United States in 2014 produced more than 58 percent of the world's ethanol and Brazil produced about 25 percent.[91] Ethanol production dominates biofuel production in the U.S. through 187 cornstarch processing facilities,[92] located primarily in Iowa, Nebraska, Minnesota, Indiana, and Illinois.[93] The two methods used to produce ethanol through fermentation of cornstarch are dry milling and wet milling, with the former method the most common.[94] Dry milling involves grinding corn, adding water to the meal and cooking it, and then allowing the mixture to ferment. Wet milling involves separating the corn's germ, fiber, and gluten. The corn meal, corn gluten meal, and corn gluten feed are sold as co-products and the remaining mash is processed to create biofuel.[95] As discussed below, these processes have associated pollution problems, but the most

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(2015), *available at* http://www.usda.gov/nass/PUBS/TODAYRPT/cropan15.pdf.

88. *See* James Conca, *It's Final—Corn Ethanol Is of No Use,* FORBES, Apr. 20, 2014, http://www.forbes.com/sites/jamesconca/2014/04/20/its-final-corn-ethanol-is-of-no-use/ (last visited June 20, 2015).

89. *See* U.S. ENVTL. PROT. AGENCY, EPA/600/R-10/183F, BIOFUELS AND THE ENVIRONMENT: FIRST TRIENNIAL REPORT TO CONGRESS (Dec. 2011) [hereinafter BIOFUELS AND THE ENVIRONMENT EPA REPORT].

90. *Id.* at 2-8.

91. *World Fuel Ethanol Production*, RENEWABLE FUELS ASS'N, http://www.ethanolrfa.org/pages/World-Fuel-Ethanol-Production (last visited June 20, 2015).

92. *U.S. Fuel Ethanol Plant Production Capacity*, U.S. ENERGY INFO. ADMIN. (Oct. 23, 2014), http://www.eia.gov/petroleum/ethanolcapacity/?rc=email.

93. BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 4-3.

94. *Id.* at 4-3.

95. *Id.*

important adverse impacts are associated with the production of the corn feedstock.

A. *Air Pollution*

Ethanol-blended fuel when combusted produces little, if any, reduction in conventional air pollutant emissions, and its use even increases emissions of some pollutants.[96] Ethanol added to gasoline increases the fuel's Reid Vapor Pressure (RVP), a measure of volatility, which increases evaporative VOC that leads to ozone formation, especially in the summer.[97] However, a study released in 2014 shows that in Sao Paulo, Brazil the ozone levels decreased as drivers shifted from using ethanol to using gasoline.[98] For this reason the ethanol industry successfully lobbied for relief from volatility limits imposed on gasoline. EPA provides a one-pound RVP waiver for E10, but did not provide it for E15 when it authorized its use, which created a new problem for the ethanol industry.[99]

The production of ethanol results in increased emissions of nitrogen oxides (NO_x), particulate matter (PM), and hazardous air pollutants (HAPs), especially ethanol and acetaldehyde.[100] Biodiesel combustion results in decreases in particulate, carbon monoxide, and hydrocarbon emissions compared to petroleum diesel, but results in the increased release of nitrogen oxides and increased ozone formation.[101] The California Air Resources Board (CARB) has found biodiesel blends of five percent or more

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96. David Biello, *Want to Reduce Air Pollution? Don't Rely on Ethanol Necessarily,* SCIENTIFIC AM., Apr. 18, 2007, http://www.scientificamerican.com/article/reduce-air-pollution-do-not-rely-on-ethanol/.

97. *See* Am. Petroleum Inst. v. EPA, 52 F.3d 1113, 1115-16, 1119 (D.C. Cir. 1995) (citing Renewable Oxygenate Requirement for Reformulated Gasoline, 59 Fed. Reg. 39,258, 39,259 (Envtl. Prot. Agency Aug. 2, 1994)).

98. *Academics' Study Raises Questions On Ethanol's Ozone Reduction Benefits*, 25 Clean Air Rep. (Inside EPA) No. 10, at 18 (May 8, 2014).

99. *EPA Urged To Boost E15 By Expanding Or Eliminating Fuel Vapor Waiver*, 24 Clean Air Rep. (Inside EPA) No. 4, at 34 (Feb. 14, 2013).

100. BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 4-6, 6-9*; see also Ethanol Mandate Means Higher Nitrogen, Particulate Emissions, Oil Industry Asserts*, 44 Env't. Rep. (BNA) 1586 (May 31, 2013).

101. *Id.* at 6-9.

results in an increase in nitrogen oxide emissions (NO_x) from heavy-duty vehicles.[102]

Emissions of PM, sulfur oxide and nitrogen oxide are produced by stationary combustion engines and from the electric generation needed to produce ethanol.[103] A number of ethanol plants avoid more stringent air pollution control requirements by acquiring permits as minor sources. This means less arduous permitting requirements apply, and the facilities may avoid the need to install the best available control technology. Nevertheless, many gas-fired ethanol plants exceeded their minor source permit limits.[104] EPA promulgated regulations on May 1, 2007 that made it easier for ethanol plants to avoid the CAA's new source review construction permits and fugitive emissions requirements by changing the definition of major source from 100 tons per year (tpy) of any criteria pollutant to 250 tpy.[105] This action made it easier for ethanol plants to qualify as minor sources. The Natural Resources Defense Council petitioned EPA to reconsider its decision to allow increases in air pollution from ethanol facilities, but on May 2, 2008, EPA denied the petition.[106]

The production of corn and soybean feedstock also emits air pollutants primarily from the gasoline and diesel power equipment used for cultivation and harvesting. Approximately fourteen gallons of diesel fuel is used per acre for tillage, harvesting and hauling corn.[107] Ammonia emissions increase due to the increased use of fertilizer. Irrigation requires an estimated 4.6 kWh per acre, and in the Midwest the power usually comes

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102. *Revised Draft California Biodiesel Rules Draw New Industry Criticism*, 25 Clean Air Rep. (Inside EPA) No. 25, at 23 (Nov. 6, 2014).

103. BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 4-6, 6-5.

104. *Activists Threaten Suit Over EPA Plans For Relaxed Ethanol Permits*, 17 Clean Air Rep. (Inside EPA) No. 10, at 18 (May 18, 2006).

105. *See* Treatment of Certain Ethanol Production Facilities Under the "Major Emitting Facility" Definition, 72 Fed. Reg. 24,060, 24061 (Envtl. Prot. Agency May 1, 2007) (codified at 40 C.F.R. pt. 51-52, 70-71).

106. *EPA Denies Environmental Group's Petition To Reconsider Final Rule on Ethanol Plants*, 39 Env't Rep. (BNA) 893 (May 9, 2008).

107. BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 3-22.

from coal-fired plants.[108] The emissions are conventional pollutants and usually released in rural areas. These emissions are only related to ethanol production to the extent that corn production increases.[109] If biofuel production is based on the use of second-generation biofuels, it can result in lower air emissions than from the use of corn.

B. *Net Energy*

A theoretical benefit from the use of renewable fuel is that its combustion leads to lower GHG emissions, particularly CO_2, than combustion of fossil fuel having equivalent energy. Ethanol has about two-thirds the energy of an equal volume of gasoline, so more of it needs to be combusted to power motor vehicles. [110] The lower energy content therefore results in a ten percent ethanol blend having a two to three percent decrease in miles per gallon (mpg) compared to pure gasoline.[111]

A CO_2 reduction benefit is dependent on renewable energy having significantly more energy than the fossil fuel energy used to produce it. For ethanol, its input carbon from corn produces no net atmospheric CO_2 increase when combusted. But, the fossil fuel energy used to produce ethanol releases CO_2 that nullifies GHG reduction benefits. However, some ethanol plants purify their CO_2 emissions and sell them to the carbonated beverage industry or to food processors for flash freezing.[112] Output-input studies are used to evaluate the net energy from using ethanol as fuel. These studies are heavily influenced by assumptions concerning corn yields per acre, the energy requirements for fertilizer manufacture, the amount of fertilizer applied to corn fields, the energy embodied in farm machinery, the efficiency of

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108. *Id.* at 3-24.

109. *Id.*

110. Gasoline contains about 125,000 Btu per gallon, and ethanol contains about 84,600 Btu per gallon. *See* DAVIS ET AL., *supra* note 47, at B-5, tbl.B.4.

111. BRENT D. YACOBUCCI, CONG. RESEARCH SERV., RL33290, FUEL ETHANOL: BACKGROUND AND PUBLIC POLICY ISSUES 6 (2006).

112. U.S. ENVTL. PROT. AGENCY, EPA/600/R-10/183A, BIOFUELS AND THE ENVIRONMENT: FIRST TRIENNIAL REPORT TO CONGRESS (PRELIMINARY DRAFT) 4-7–4-8 (Jan. 2011).

the ethanol conversion process selected, and the energy inputs attributable to the co-products produced.[113]

A difficult issue is the need to account for the variation in carbon dioxide sequestration when renewable crops are used for ethanol. Corn is regrown in a short time and sequesters roughly the same amount of carbon as is released from burning the ethanol, but if forest products are used, the time for regrowth can be many years.[114] Converting land to produce corn-based ethanol increases GHG emissions.[115] A study published in 2008 stated that the conversion of forest and grassland to new cropland doubled the GHG emissions attributable to corn-based ethanol.[116] CAA section 211(o)(12) makes it clear that the renewable fuel requirements do not affect other regulatory requirements aimed at controlling carbon dioxide or any other greenhouse gas.[117]

In 2005, David Pimentel of Cornell University and Tad W. Patzek of the University of California, Berkeley published an important study on the net energy of ethanol production.[118] Using conservative assumptions of the efficiency of the process, their study concluded that a negative energy ratio of 0.84 was obtained, compared to gasoline's energy ratio of a negative value of 0.76, because of the energy needed to produce motor vehicle fuel from petroleum.[119] The energy to produce the corn feedstock accounts for nearly half of ethanol's energy input.[120]

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113. HOSEIN SHAPOURI ET AL., U.S. DEP'T OF AGRIC., AER-721, ESTIMATING THE NET ENERGY BALANCE OF CORN ETHANOL 4 (1995).

114. *EPA Advisers Struggle To Agree On CO2 Accounting Method For Biomass*, 29 Envtl. Pol'y Alert (Inside EPA) No. 3, at 39 (Feb. 8, 2012).

115. *Key Scientist Faults Industry Push To Limit EPA's RFS Lifecycle GHG Study*, 19 Clean Air Rep. (Inside EPA) No. 24, at 30 (Nov. 27, 2008).

116. Timothy Searchinger *et al., Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change*, 319 SCIENCE 1238 (2008).

117. 42 U.S.C. § 7545(o)(12) (2009).

118. *See* David Pimentel & Tad W. Patzek, *Ethanol Production Using Corn, Switchgrass, and Wood; Biodiesel Production Using Soybean and Sunflower*, 14 NAT. RESOURCES RES. 65 (2005).

119. *Id.* at 72; Roel Hammerschlag, *Ethanol's Energy Return on Investment: A Survey of the Literature 1990-Present*, 40 ENVTL. SCI. & TECH. 1744, 1744, 47 (2006).

120. Pimentel & Patzek, *supra* note 118, at 66.

The ethanol industry expanded rapidly in the past decade in response to government mandated demand and massive subsidies. Ethanol facilities built in the 21st century use far less energy than a typical plant built years earlier, but older facilities continue to produce ethanol. Nevertheless, efficiency in ethanol production continues to increase as new facilities are brought on-line. Argonne National Laboratory's GREET model shows dry distillers grains produce a gallon of ethanol using 27,576 Btu and wet milling producers use 16,435 Btu per gallon. A gallon of ethanol contains 84,600 Btu.[121]

The United States Department of Agriculture reported that if data from the best production practices and state of the art processing technology is used, ethanol will provide sixty-seven percent more energy than is needed for its production.[122] A 2006 National Academy of Science publication concluded that ethanol yields twenty-five percent more energy than is required for its production.[123] EPA estimates the renewable fuel program mandated by EISA will reduce CO_2 emissions by 138 million metric tons by 2022.[124]

The CAA requires ethanol to have lifecycle GHG emissions 20 percent lower than GHG emissions from conventional petroleum;[125] advanced biofuels must have GHG emissions at least 50 percent less than baseline lifecycle GHG emissions, and cellulosic ethanol must meet a 60 percent standard.[126] The increased energy efficiency of the production process has resulted in the EPA certifying many renewable fuels as meeting the statutory renewable fuel GHG reduction requirements.[127] EPA has found that ethanol produced from cornstarch meets the

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121. DAVIS ET AL., *supra* note 47, at B-5 tbl.B.4.

122. RANDY SCHNEPF, CONG. RESEARCH SERV., RL32712, AGRICULTURE-BASED RENEWABLE ENERGY PRODUCTION 10 (2006), *available at* http://fpc.state.gov/documents/organization/68294.pdf.

123. *See* Jason Hill et al., *Environmental, Economic, and Energetic Costs and Benefits of Biodiesel and Ethanol Biofuels*, 103 PROC. NAT'L ACAD. SCI 11,206 (2006), *available at* http://www.pnas.org/content/103/30/11206.full.pdf.

124. BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 2-3.

125. Clean Air Act § 211(o)(2)(A)(i), 42 U.S.C. § 7545(o)(2)(A)(i) (2009).

126. *Id.* § 7545(o)(1)(D)-(E).

127. *See* 40 C.F.R. § 80.1426 tbl.1 (2014).

20 percent requirement, ethanol from sugarcane and biodiesel meets the 50 percent standard, and cellulosic ethanol and cellulosic diesel meets the 60 percent threshold applicable to cellulosic biofuels.[128]

C. *Water*

The increasing demand for ethanol will require expanding the use of scarce water resources if increased production is to be achieved. Nearly 60 percent of the world's water is used for agriculture; adding water for crops to be used as fuel stresses this limited resource.[129] It requires as much as 30 gallons of water to produce enough corn ethanol to drive an average car one mile.[130] The petroleum industry argues that to produce a barrel of ethanol from corn requires about 50,000 gallons of water, but producing a barrel of oil using fracking technology requires 50 gallons.[131] Increasing the production of corn and soybeans could increase the pressure on ground water resources if more land is irrigated.[132] Increasing corn production in the Midwest will have little effect on water use, but increasing production in the Great Plains could increase the demand for groundwater because, for example, in Nebraska over 85 percent of the irrigation water comes from underground aquifers.[133] Water demand per gallon of ethanol is about 142 gallons as a national average, but in more arid parts of the country the amount of water required to obtain a gallon of ethanol is estimated at over 300 gallons.[134] In Nebraska where 40 percent of the soybean crop is irrigated, it may require 4,000 gallons of water to produce biodiesel equivalent in energy to a gallon of

128. BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 2-3.

129. *See Irrigation Water Use*, U.S. GEOLOGICAL SURVEY, http://water.usgs.gov/edu/wuir.html (last updated Mar. 17, 2014).

130. UNION OF CONCERNED SCIENTISTS, THE ENERGY-WATER COLLISION: MANAGING THE RISING TIDE OF BIOFUELS 1 (2010), *available at* http://www.ucsusa.org/assets/documents/clean_energy/biofuels-and-water.pdf.

131. Steven Oberbeck, *Oil Exec: Alternative Energy Use May Improve Our Industry's Image*, SALT LAKE TRIB., Feb. 1, 2013, at C4.

132. BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 3-20.

133. *Id.* at 3-20, 3-38.

134. *Id.* at 3-18.

gasoline.[135] After the corn is produced, the ethanol production process requires additional water with older facilities using four to six gallons of water and newer facilities using three gallons of water to produce a gallon of ethanol.[136] Biodiesel facilities use about three gallons of water to produce a gallon of biodiesel, and newer facilities use less.[137]

Corrosion from pipes and storage facilities used for ethanol creates water pollution problems that increase when higher concentrations of ethanol are produced.[138] The 2007 EISA partly addressed this by giving EPA the power to consider water pollution impacts when deciding whether to ban or restrict the use of a fuel.[139]

Commodity crop agriculture is a major source of nutrient and pesticide pollution, and nutrients are the third most common cause of river and stream impairment.[140] Corn production uses more fertilizer and pesticides than any other major crop, resulting in high lifecycle environmental impacts per unit of energy from ethanol.[141] Nutrients are used at much lower rates for soybean production.[142] Nutrients from fertilizer release nitrogen (N) and phosphorus (P) to the environment through surface water transport and leaching, resulting in loss of biodiversity, eutrophication of fresh and coastal waters, and elevated levels of nitrate and nitrite in drinking-water wells.[143] Excess nutrients and sediment from corn-producing areas in the Midwest are the primary cause of water quality degradation in

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135. *Id.* at 3-19.

136. *Id.* at 4-8.

137. *Id.* at 4-9.

138. *ASTSWMO Suggests Methods To Assess USTs, Biofuels Compatibility*, 30 Envtl. Pol'y Alert (Inside EPA) No. 14, at 39 (July 10, 2013).

139. *See* Energy Independence and Security Act of 2007, Pub. L. No. 110-140, sec. 208, § 211(c)(1), 121 Stat. 1492, 1531.

140. *See It's Time to Put a Price Tag on the Environmental Impacts of Commodity Crop Agriculture*, 43 Envtl. L. Rep. (Envtl. Law Inst.) 10,130, 10,131 (Feb. 2013).

141. *See* Hill et al., *supra* note 123, at 11,208; BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 3-9.

142. BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 81, at 3-9.

143. *Booming Corn Production for Ethanol Fuel Could Boost Nutrient Pollution, Report Says,* 38 Env't Rep. (BNA) 1576 (July 20, 2007).

the Mississippi River Basin and the Gulf of Mexico.[144]

Pesticides move through the ecosystem in a similar manner. Atrazine is the most common herbicide used on cornfields, and it is a hormone disrupter in wildlife as well as a potential threat to human health.[145] It is responsible for about one percent of the waters EPA identifies as threatened or impaired.[146] The pesticides used in corn production are more harmful and used in larger quantities than those used for soybean production.[147] These impacts are attributable to growing corn regardless of whether the corn is for fuel, but expanded production to meet the ethanol demand increases the environmental impact of corn production. Proper application of pesticides and nutrients as well as erosion control can reduce the adverse environmental impacts, but there is evidence that proper nutrient management to mitigate nitrogen loss to waterways is not adequate.[148] Nutrients also contaminate ground water used for public and private drinking water. EPA estimates that producing 15 billion gallons of corn-based ethanol a year will result in a 2.8 percent increase in nitrogen leaching to ground water.[149]

Sediment pollution may also increase from increased corn production although EPA has difficulty in quantifying the impact because of the many variables that determine soil loss. A specific concern is the erosion caused by removing corn stover from fields to produce cellulosic ethanol.[150] Using perennial grasses for fuel reduces erosion by almost two orders of

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144. BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 3-10.

145. For more information on atrazine, see *Integrated Risk Information System: Atrazine*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/NCEA/iris/subst/0209.htm (last updated Oct. 31, 2014); Caroline Cox, *Atrazine: Toxicology*, J. PESTICIDE REFORM, Summer 2001, at 12, 12-20, *available at* http://www.pesticide.org/get-the-facts/pesticide-factsheets/factsheets/atrazine.

146. BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 3-16.

147. *Weighing Pesticide Use in Biofuel Production*, Beyond Pesticides (Sept. 13, 2007, 8:58 AM), http://www.beyondpesticides.org/dailynewsblog/?p=184.

148. *See* BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 3-4.

149. *Id.* at 3-14.

150. *Id.* at 3-15. Corn stover consists of the leaves and stalk of the corn plant that are left in the field after harvest. *Id.* at 3-16.

magnitude compared to corn or soybean production.[151]

Wastewater effluent from ethanol facilities is high in biochemical oxygen demand (BOD) and can contain ammonia-nitrogen and phosphorus.[152] Biodiesel production results in wastewater containing organic residues, residuals from water softening and treatment, as well as solvents and conventional pollutants like BOD, suspended solids, oil, and grease.[153]

D. *Land Use*

Agricultural land devoted to corn production has increased substantially due to the demand created by CAA mandates as well as by federal and state subsidies. In 2014, 91.6 million acres of corn and 84.1 million acres of soybeans were planted, up 11 percent in one year.[154] In 2000, 72.7 million acres were harvested for corn and 72.7 million acres were harvested for soybeans.[155]

The increases in land planted in corn and soybeans are much smaller than the increase in production because of a substantial increase in yield per acre in the past half century, but the tradeoff is the increase in energy, fertilizer, and pesticides needed to obtain the higher yields.[156] Demand for corn and soybeans to be used for fuel results in marginal lands being converted to produce these crops. This is expected to lead to additional increases in soil erosion, water pollution from the use of pesticides and fertilizer, and adverse impacts to wildlife habitat.[157] More than 23 million acres of Native grasslands,

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151. *Id.* at 3-35.

152. *Id.* at 4-7, 4-10, 6-8.

153. *Id.* at 4-7, 4-10.

154. *USDA Forecasts Record-High Corn and Soybean Production in 2014. Cotton Production Also Up from 2013*, U.S. DEP'T OF AGRIC. (Aug. 12, 2014), http://www.nass.usda.gov/Newsroom/2014/08_12_2014.asp .

155. *Crop Production: Major Crops Grown in the United States*, U.S. Envtl. Prot. Agency, http://www.epa.gov/oecaagct/ag101/printcrop.html#major (last visited May 26, 2015).

156. BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 3-3.

157. *See generally* REBECCA BROOKE ET AL., UNIV. OF MICH., CORN ETHANOL AND WILDLIFE (2009), *available at* http://www.nwf.org/pdf/wildlife/01-13-10-corn-ethanol-wildlife.pdf (analyzing the impact of increased ethanol production on wildlife and habitat in four Midwestern states.); C. Ford Runge, *The Case Against Biofuels: Probing Ethanol's Hidden Costs*, YALE ENV'T 360

prairie potholes, and sensitive wetlands are threatened.[158]In 2014 environmentalists claimed that 23 million acres of grasslands and wetlands were converted to agriculture in four years, partly driven by the renewable fuel standard.[159] The United States Census Bureau shows an increase in corn acreage of 2.876 million acres and a soybean acreage increase of 1.935 million acres from 2008 to 2010.[160] The RFS2 regulation allows corn, corn stover, soybean, and perennial grasses to be grown on land that was in agricultural production prior to December 19, 2007, but prescribes conversion of land to produce renewable feedstocks. But this does not prevent the re-cultivation of land placed in the Department of Agriculture's Conservation Reserve Program, which pays farmers to set aside cropland to conserve wildlife habitat, control erosion, and protect water quality. [161] Woody biomass used for cellulosic ethanol production has legal restrictions concerning its source. Woody feedstock can only be grown on forest plantations that were in production on December 19, 2007. Residue harvesting and thinning to obtain woody biomass can occur only on non-federal forestland.[162]

Current annual crop-based biofuel production is 20 gallons of fuel per acre using corn as the feedstock, 50 gallons per acre using soybeans, 150 gallons per acre using canola, 650 gallons per acre using palm, and 2,000 to 5,000 gallons per acre using algae.[163] The International Energy Agency in 2011 reported that biofuels supply two percent of the global fuel supply and use

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(Mar. 11, 2010), *available at* http://e360.yale.edu/feature/the_case_against_biofuels_probing_ethanols_hidden_costs/2251 (stating that despite strong evidence that using food crops to produce ethanol is harmful to the environment, half of the U.S. corn crop will soon go to biofuel production.).

158. *EPA Sidesteps Environmental Harm Claims In Denying RFS Waiver Request*, 23 Clean Air Rep. (Inside EPA) No. 24, at 33 (Nov. 22, 2012); Stephanie Paige Ogburn, *Losing Ground,* HIGH COUNTRY NEWS, Mar. 19, 2012, at 3, 3.

159. *Industry, Environmental Groups Urge Reform of Renewable Energy Standard*, 44 Env't Rep. (BNA) 346 (Feb. 8, 2013).

160. U.S. CENSUS BUREAU, STATISTICAL ABSTRACT OF THE UNITED STATES: 2012, at 551 tbls.859 & 860 (2012).

161. BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 3-2, 3-8.

162. *Id.* at 3-2.

163. CHESAPEAKE BAY COMM'N & THE COMMONWEALTH OF PA., NEXT GENERATION BIOFUELS: TAKING THE POLICY LEAD FOR THE NATION 18 (2008).

approximately 74.1 million acres for the feedstock production. To produce 27 percent of the global fuel will require expanding the land devoted to feedstock production to 247.1 million acres.[164]

The CAA requires a lifecycle analysis of GHG emissions in order for a fuel to meet the GHG reduction requirements applicable to the various categories of renewable fuel. The analysis requires significant emissions from land use changes to be included.[165] Land use change impacts can be difficult to quantify but are important in determining whether the lifecycle biofuel emissions are lower than fossil fuel emissions.[166] This results in petroleum and biofuel producers seeking to have EPA produce its land use evaluations using methodology favorable to their industries.[167]

The analysis of environmental impacts stemming from biofuel consumption includes the need to consider indirect emissions such as those from land use changes.[168] Using corn and soybeans for fuel in the United States results in reductions of exports of these commodities. This leads to land conversion to agriculture use in other parts of the world, particularly in Latin America, China, and the Pacific Rim.[169] A 2008 study found that land conversion of natural ecosystems to cropland would release an estimated 17 to 420 times as much carbon dioxide as the biofuels can reduce per year by displacing petroleum fuel.[170]

E. *Cost of Food*

The mandated use of ethanol for fuel and the billions of dollars provided in government subsidies benefits the corn

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164. *Biofuels Use Can Cut Annual Carbon Dioxide By 2.1 Gigatons in 40 Years, IEA Reports*, 42 Env't Rep. (BNA) 857 (Apr. 22, 2011).

165. Clean Air Act § 211(o)(1)(H), 42 U.S.C. § 7545(o)(1)(H) (2012).

166. *See Lifecycle Analysis of Biofuel Emissions Considered Likely to Hinge on Land Use*, 39 Env't Rep. (BNA) 1581 (Aug. 8, 2008); *EPA Plans to Count Fertilizer GHG Emissions in RFS Despite Industry Fears*, 19 Clean Air Rep. (Inside EPA) No. 16, at 18 (Aug. 7, 2008).

167. *Oil, Biofuel Groups Push Competing Overhauls for RFS GHG Calculations*, 24 Clean Air Rep. (Inside EPA) No. 13, at 35 (June 20, 2013).

168. CAA § 211(o)(1)(H), 42 U.S.C. § 7545(o)(1)(H).

169. BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 5-7.

170. *Id.* at 5-10.

producers and to a lesser extent soybean farmers, but livestock and poultry farmers complain that the demand for corn-based ethanol increases their costs for feed corn. Some food consumer groups also believe ethanol production raises food prices. The National Council of Chain Restaurants in 2012 claimed the renewable fuel standard costs restaurant chains up to $3.2 billion a year.[171] Restaurant owners have joined the petroleum industry in calling for a repeal of the renewable fuel standard.[172] Corn in Iowa sold for about $1.90 to $2.75 per bushel from 2002 to 2006.[173] In June 2013, corn prices averaged about $6.97 a bushel and then dropped to about $4.37 in 2014.[174] It is not easy to separate the increase in corn prices from other factors, such as the increase in fossil fuel cost and the drought that in 2012 led to lowered crop yields.[175] Nevertheless, it is difficult to argue, as ethanol producers do, that a massive increase in demand doesn't affect prices.[176] Moreover, the increasing demand for ethanol could increase the demand and price for sorghum, barley, and oats as well as other grains that could be used to make ethanol. The demand for soybeans for biodiesel contributed to the price rising from $0.15 per pound in the 1990s to over $0.30 per pound in 2010.[177]

To meet the renewable fuel mandate imposed by Congress, the ethanol industry is seeking to have the percentage of ethanol in

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171. *Restaurants Seek Repeal of Fuel Standard, Cite Annual Costs of Up to $3.2 Billion*, 43 Env't Rep. (BNA) 3038 (Nov. 30, 2012).

172. *Restaurants, Poultry Producers Urge Repeal Of Renewable Standard as Food Prices Rise*, 44 Env't Rep. (BNA) 2205 (July 26, 2013).

173. U.S. DEP'T OF AGRIC., NAT'L AGRIC. STATISTICS SERV., IOWA AGRICULTURAL STATISTICS BULLETIN 51 (2006), *available at* http://www.nass.usda.gov/Statistics_by_State/Iowa/Publications/Annual_Statistical_Bulletin/2006/06_51.pdf.

174. U.S. DEP'T OF AGRIC., NAT'L AGRIC. STATISTICS SERV., AGRICULTURAL PRICES 9 (2014), *available at* http://usda.mannlib.cornell.edu/usda/nass/AgriPric//2010s/2014/AgriPric-06-27-2014.pdf.

175. *Ethanol Has Been Boon to Agriculture, Producers Tell House Committee*, 44 Env't Rep. (BNA) 1298 (May 3, 2013); Bryan Walsh, *When the Rains Stop,* TIME, Aug. 6, 2012, at 36, 36.

176. *Corn Crop, RIN Prices Show Standard On Renewables Working, Industry Says*, 44 Env't Rep. (BNA) 2714 (Sept. 13, 2013).

177. Graham Noyes, *From the Dump to the Pump: The Current State of Waste to Biofuels*, NAT. RESOURCES & ENV'T , Winter 2014, at 15, 17.

fuel increased, which will continue the trend of using food for fuel.[178] Groups such as the National Chicken Council, the National Pork Producers Council, the Grocery Manufacturers Association, and the National Restaurant Association oppose the increase.[179] The National Chicken Council sued EPA in the D.C. Circuit challenging the ethanol requirements, but the court unanimously held that they did not have standing.[180] The Grocery Manufacturers Association also filed a petition to review EPA's approval of the introduction of gasoline containing 15 percent ethanol (E15), but the D.C. Circuit also dismissed that case, holding the petitioner did not have standing.[181]

IV.
ADVANCED BIOFUELS

The Energy Independence and Security Act of 2007 (EISA)[182] continued the federal effort to encourage the use of renewable fuel primarily through modification of the blending requirements found in the CAA's section 211(o).[183] The renewable fuel requirements in 2014 call for 18.15 billion gallons to be used in 2014 and volume increases to 36.0 billion gallons in 2022.[184] In 2022, 15 billion gallons will be conventional renewable fuel. Advanced biofuel that must be blended goes from 3.75 billion gallons in 2014 to 21.0 billion gallons in 2022.[185] Sixteen million gallons of advanced biofuel in 2022 will be cellulosic biofuel.[186] Biomass-based diesel must be at least 1 billion gallons in 2012

178. *Facing Backlash, Ethanol Advocates Ready Push for EPA to Back E20*, 35 Envtl. Pol'y Alert (Inside EPA) No. 11, at 33 (May 21, 2008).

179. *Livestock Industry, Activists Ramp Up Ethanol Opposition with EPA*, 20 Clean Air Rep. (Inside EPA) No. 4, at 10 (Feb. 19, 2009).

180. Nat'l Chicken Council v. EPA, 687 F.3d 393, 397 (D.C. Cir. 2012).

181. Grocery Mfrs. Ass'n v. EPA, 693 F.3d 169, 180 (D.C. Cir. 2012), *reh'g denied*, 704 F.3d 1005 (D.C. Cir. 2013).

182. Energy Independence and Security Act of 2007, Pub. L. No. 110-140, 121 Stat. 1492.

183. See Clean Air Act § 211(o), 42 U.S.C. § 7545(o) (2012); *see also supra* Part II.

184. 42 U.S.C. § 7545(o)(2)(B)(i)(I).

185. *Id.* § 7545(o)(2)(B)(i)(II).

186. *Id.* § 7545(o)(2)(B)(i)(III).

and thereafter.[187] Thus the growth in the use of biofuels is expected to come from the use of advanced biofuels. Achieving the production goals for advanced biofuels by scaling up new technologies by more than 500 percent in eight years is a difficult task.

Advanced biofuel is a subset of renewable fuel. It is ethanol not derived from corn that has fifty percent or less lifecycle greenhouse gas (GHG) emissions than the gasoline or diesel it is replacing.[188] Advanced biofuel can be produced from sugarcane, sugar beets, raw sugar, cane molasses, other molasses, wheat grain, sweet sorghum, Jerusalem artichokes, and other grains.[189] It also may include ethanol produced from waste, biomass-based diesel, biogas from renewable biomass, butanol or other alcohols produced from renewable biomass, and fuel derived from cellulosic ethanol.[190] EPA has modeled various biofuel production processes for compliance with the GHG reduction requirements including evaluation of international land-use changes. It has also designated permissible feedstock and production processes that will qualify a fuel as advanced biofuel.[191] EPA continues to identify and add approved pathways for other fuels.[192] For example, in 2013 EPA approved barley as a conventional biofuel and an advanced biofuel if it utilizes specified processing technologies.[193] Barley growers are protesting the requirements

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187. *Id.* § 7545(o)(2)(B)(i)(IV).

188. *Id.* § 7545(o)(1)(B)-(C); *see also* Identification of Additional Qualifying Renewable Pathways Under the Renewable Fuel Standard Program, 78 Fed. Reg. 14,190 (Envtl. Prot. Agency Mar. 5, 2013) (codified at 40 C.F.R. §§ 80.1401, 80.1426).

189. United Nations Conference on Trade and Development, *Challenges and Opportunities for Developing Countries in Producing Biofuels* 4, UNCTAD/DITC/COM/2006/15 (Nov. 27, 2006).

190. CAA § 211(o)(1)(B), 42 U.S.C. § 7545(o)(1)(B).

191. Changes to Renewable Fuel Standards Program, 75 Fed. Reg. 14,670, 14,677 (Envtl. Prot. Agency Mar. 26, 2010).

192. *See, e.g.*, Supplemental Determination for Renewable Fuels Produced Under the Final RFS2 Program From Canola Oil, 75 Fed. Reg. 59,622 (Envtl. Prot. Agency Sept. 28, 2010) (finding that canola oil biodiesel meets the biodiesel-based diesel and advanced biodiesel GHG reduction thresholds).

193. *EPA Finds Barley's Lifecycle GHG Emissions Qualify Feedstock under RFS*, 24 Clean Air Rep. (Inside EPA) No. 15, at 30 (July 18, 2013).

imposed by EPA, however.[194] Barley has an advantage over corn-ethanol because it can be grown in the winter as well as the summer, and if fertilizer is used efficiently the crop can reduce erosion and nitrogen leaching from the field.[195] In April 2014, there were 36 applications pending for advanced fuel approval, but it takes an average of two years for EPA to process an application.[196] The renewable fuel standards only apply to liquid fuels, but the Biomass Crop Assistance Program includes solid pellets made of plant and wood material used as fuel as "advanced biofuel."[197]

The major challenge for advanced ethanol producers is to lower costs. Corn-based ethanol is far less costly to produce in the United States than ethanol from other food feed stock. The Department of Agriculture in 2006 estimated the costs of production of ethanol per gallon (excluding capital costs) at $0.81 for Brazil sugarcane, $2.35 for sugar beets, $1.27 for molasses, $3.48 for United States raw sugar and $1.03-$1.05 for corn-based ethanol.[198] Capital costs for a 40 million gallon per year plant are estimated at $1.30 per gallon for a corn-based ethanol facility; $1.63-$1.68 for a sugarcane or sugar beet feedstock facility, and $1.03-$1.10 for a cane beet juice or cane beet molasses plant.[199] The costs of food-based biofuel can continue to be reduced through improved technology, but there are limits to such improvements because the cost of feedstock is a major part of the production cost and these costs continue to increase. For example, the price per ton for sugar beets increased from $34.70 in 2000/01 to $66.60 in 2012/13.[200] The cost of soybeans went

194. *Biofuel Advocates Raise Doubts on EPA GHG Analysis of Barley for RFS*, 24 Clean Air Rep. (Inside EPA) No. 18, at 23 (Aug. 29, 2013).

195. CHESAPEAKE BAY COMM'N & THE COMMONWEALTH OF PA., *supra* note 163, at 5, 16.

196. *Biofuel Producers Fear Further Delays During Review of Renewable Fuel Pathways*, 45 Env't Rep. (BNA) No. 14, at 982 (Apr. 4, 2014).

197. Biomass Crop Assistance Program, 75 Fed. Reg. 66,202, 66,216 (Dep't of Agric. Oct. 27, 2010).

198. U.S. DEP'T OF AGRIC., THE ECONOMIC FEASIBILITY OF ETHANOL PRODUCTION FROM SUGAR IN THE UNITED STATES, at iv (2006), *available at* http://www.usda.gov/oce/reports/energy/EthanolSugarFeasibilityReport3.pdf.

199. *Id.* at 33.

200. U.S. DEP'T OF AGRIC., SUGARBEET: PRICE PER TON, BY STATE AND

from $5.54 per bushel in 2006 to $9.56 in 2010.[201] The cost of advanced biofuels has been dropping, however, and in 2014 cellulosic ethanol can be produced to sell at $2.15 per gallon.[202]

A. *Ethanol From Cellulose*

Cellulosic ethanol is the most promising second-generation biofuel, but the cost of production limits its viability, though costs are declining.[203] In order to qualify for a renewable identification number for cellulosic ethanol, production must meet requirements that include lifecycle greenhouse gas emissions, as determined by the Administrator, "that are at least 60 percent less than the baseline lifecycle greenhouse gas (GHG) emissions" from gasoline or diesel, whichever the fuel is replacing.[204] In June 2012, the first tradable renewable identification number was issued to Blue Sugars for cellulosic ethanol production, but the company went bankrupt in 2013.[205] The CAA requires 0.1 billion gallons of cellulosic biofuel to be used in the year 2010 and its use to increase in steps to 16.0 billion gallons in 2022.[206] The administrator of EPA is given limited power in CAA section 211(o)(4) to modify the advanced biofuel and cellulosic requirements concerning the mandated percentages of GHG reductions. Section 211(o)(7)(A) allows the

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UNITED STATES (2014), *available at* http://www.ers.usda.gov/datafiles/Sugar_and_Sweeteners_Yearbook_Tables/World_and_US_Sugar_and_Corn_Sweetener_Prices/TABLE12.XLS (last updated Aug. 13, 2014).

201. *Soybeans & Oil Crops: Related Data & Statistics*, U.S. Dep't of Agric., Econ. Research Serv., http://www.ers.usda.gov/topics/crops/soybeans-oilcrops/related-data-statistics.aspx#.U8blBShbq0s (last visited Sept. 21, 2014).

202. Kristi Theis, Nat'l Renewable Energy Lab., *At $2.15 a Gallon, Cellulosic Ethanol Could Be Cost Competitive*, CONTINUUM, Fall 2013, at 5, 5-6, *available at* http://www.nrel.gov/docs/fy13osti/58775.pdf.

203. *See id.* at 6.

204. Clean Air Act § 211(o)(1)(C), (E), 42 U.S.C. § 7545(o)(1)(C), (E) (2012).

205. Susanne Retka Schill, *Blue Sugars Claims First Cellulosic RIN, Extends Petrobras Deal*, ETHANOL PRODUCER MAG. (July 3, 2012), http://www.ethanolproducer.com/articles/8919/blue-sugars-claims-first-cellulosic-rin-extends-petrobras-deal; Susanne Retka Schill, *Western Biomass Up for Sale; Blue Sugars Files Bankruptcy*, ETHANOL PRODUCER MAG. (May 16, 2013), http://ethanolproducer.com/articles/9872/western-biomass-up-for-sale-blue-sugars-files-bankruptcy.

206. CAA § 211(o)(2)(B)(i)(III), 42 U.S.C. § 7545(o)(2)(B)(i)(III).

Administrator to modify the utilization requirements to prevent harm to the economy, the environment, or because of inadequate production.[207] This power has been used to adjust production requirements; in 2012, the industry produced only 20,069 gallons of fuel.[208] An alternative approach proposed by EPA to deal with the industry's performance is to change the definition of cellulosic ethanol to allow more fuels to qualify as cellulosic biofuels.[209] Technical amendments to the RFS to clarify the number of cellulosic biofuel identification numbers for fuels of varying cellulosic content were promulgated on July 8, 2014.[210]

Ethanol produced from cellulose or other non-food inputs is a promising source of biofuels. It can be produced from trees and forest residues, although there is no commercial production of fuel from woody biomass except for the use of pulp and saw mill wastes to produce heat, steam, and electricity.[211] Fast growing woody crops such as hybrid willow and poplar have the potential to be feedstock for cellulosic fuel. [212] Another potential feedstock is perennial grass, such as switchgrass or Giant Miscanthus. Switchgrass is a perennial Midwest and Southeast grass with nearly three times the yield of hay. Giant Miscanthus is a native of Asia that has some use as a fuel in Europe. The advantage of perennial grasses is that they are not normally irrigated and therefore require less water, fertilizer, and pesticides than most crops, and their extensive root system reduces soil erosion and provides habitat for wildlife.[213] Some of the plants approved for

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207. *Id.* § 7545(o)(7)(A).

208. Bruce Barcott, *Turning Grass into Gas,* ONEARTH, Fall 2013, at 44, *available at* http://archive.onearth.org/articles/2013/08/are-cellulosic-biofuels-the-holy-grail-of-green-fuels.

209. *Refiners Fight EPA Plan to Expand RFS 'Pathways' for Cellulosic Biofuels*, 25 Clean Air Rep. (Inside EPA) No. 14, at 26 (July 3, 2014).

210. *See* RFS Pathways II, and Technical Amendments to the RFS Standards and E15 Misfueling Mitigation Requirements, 79 Fed. Reg. 42,128, 42,128 (Envtl. Prot. Agency July 18, 2014).

211. BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 3-47.

212. Jessica J Huang, Life Cycle Analysis of Hybrid Poplar Trees for Cellulosic Ethanol, (May 11, 2007) (unpublished B.S. thesis, Massachusetts Institute of Technology), *available at* http://dspace.mit.edu/handle/1721.1/40429.

213. David Biello, *Grass Makes Better Ethanol than Corn Does*, SCIENTIFIC AM. (Jan. 8, 2008), http://www.scientificamerican.com/article/grass-makes-better

renewable fuel production by EPA, such as giant reed and napier grass, are invasive species that other government agencies are trying to control.[214] Agricultural residues not specifically grown for food such as corn stover can be used to produce cellulosic ethanol, although the use of corn stover for fuel could lead to increases in soil erosion.[215] A 2007 lifecycle study found that the energy requirements for cellulosic fuel production are low for switchgrass and hybrid poplar feedstock when compared to corn crops. Other experts claim cellulosic ethanol has a 100 percent energy gain, compared to the 34 percent energy gain for corn.[216] Utilizing non-food inputs is important because if all of the United States corn harvest is devoted to ethanol production it would offset about 25 percent of national gasoline demand.[217]

An advantage of using cellulosic feedstock is that it can be grown on marginal or degraded land that can provide increased regional agricultural income without utilizing land used for food production.[218] Moreover, cellulosic feedstocks require less pesticides and fertilizer than corn-based ethanol.[219] However, demand for cellulosic ethanol could result in adverse impacts on forests if they were cut to produce fuel or converted to plantations of fast growing trees. Other environmental concerns include the potential for soil erosion, soil quality degradation, loss of wildlife habitat, the introduction of non-native plant

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-ethanol-than-corn/; BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 3-34.

214. *EPA Eyes Reporting to Quell Invasive Species Fears over New RFS Fuels*, 30 Envtl. Pol'y Alert (Inside EPA) No. 14, at 37 (July 10, 2013).

215. BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 81, at 3-15.

216. SCHNEPF, *supra* note 122, at 14 (referring to a 1999 Argonne National Laboratory study).

217. About 40 percent of the corn crop was used in 2012 used to produce 13.2 billion gallons of ethanol. *See* Colin A. Carter & Henry I. Miller, *Corn for Food, Not Fuel*, N.Y. TIMES (July 30, 2012), http://www.nytimes.com/2012/07/31/opinion/corn-for-food-not-fuel.html. This is about 10 percent of the 130.9 billion gallons of gasoline used in the U.S. for highway vehicles in 2012. *See* DAVIS ET AL., *supra* note 47, at 2-13, tbl.2.11. Therefore, the entire crop would only produce enough ethanol for 25 percent of fuel used by highway vehicles, or less if the lower energy value of ethanol was considered.

218. *See* David Tilman et al., *Carbon-Negative Biofuels from Low-Input High-Diversity Grassland Biomass*, 314 Science 1598, 1598 (Dec. 8, 2006).

219. *Id.* at 1598, 1600.

species, and nutrient releases to water bodies.[220] For example, if corn stover is used for fuel, the benefits of using this material for soil conditioning and erosion control is lost. As cellulosic biofuel production expands, other industries may be adversely affected. The paper industry, for example, is concerned that non-corn biofuel producers will compete for the raw material used to manufacturer paper.[221]

Using plant cellulose and extracting the sugars to make ethanol is more difficult than obtaining sugar from grains.[222] To convert cellulosic biomass to ethanol involves either a biochemical or a thermochemical process. The biochemical process involves pretreatment to release hemicellulosic sugars that are then turned into sugars using hydrolysis.[223] Usually the steam helps break apart the glucose molecule.[224] This is followed by enzymatic hydrolysis, which uses enzymes to break cellulose chains down to fermentable sugar. The sugars are fermented into ethanol and the lignin is recovered and used to provide the heat energy needed for the process.[225] Thus, cellulosic ethanol could be produced using less nonrenewable energy than corn-based ethanol.[226]

The thermochemical process uses heat and chemicals to produce syngas, which is carbon monoxide and hydrogen. The syngas is mixed with a catalyst and reformed into ethanol and other liquid coproducts.[227] Then the lignin is separated from the

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220. CHESAPEAKE BAY COMM'N & THE COMMONWEALTH OF PA., *supra* note 163, at 25-29; BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 3-5.

221. *Non-Corn Biofuels Group Fear Broad RFS Waiver Precedent*, 25 Envtl Pol'y Alert (Inside EPA) No. 15, at 35 (July 16, 2008).

222. U.S. Dep't of Energy, *Ethanol Feedstocks*, ALT. FUELS DATA CTR., http://www.afdc.energy.gov/fuels/ethanol_feedstocks.html (last visited June 6, 2015).

223. CHESAPEAKE BAY COMM'N & THE COMMONWEALTH OF PA., *supra* note 163, at 11-12; U.S. Dep't of Energy, *Ethanol Production and Distribution*, ALT. FUELS DATA CTR., http://www.afdc.energy.gov/fuels/ethanol_production.html (last visited June 6, 2015) [hereinafter *Ethanol Production and Distribution*].

224. *See* CHESAPEAKE BAY COMM'N & THE COMMONWEALTH OF PA., *supra* note 163, at 10.

225. *See Ethanol Production and Distribution*, *supra* note 223.

226. *See id.*

227. *Id.*

mixture, which may be burned for power production. At this point the sugar is treated in the same way as corn-based alcohol production. Yeast is added and allowed to ferment. Then the alcohol is separated from the fermented mash, and a by-product called "stillage" is left. The ethanol is dehydrated to produce fuel-grade ethanol.[228]

On July 7, 2011, the Department of Energy announced a $105 million loan guarantee for the development of a commercial-scale cellulosic ethanol plant called Liberty in Emmetsberg, Iowa. It will utilize 770 tons per day of corn cobs, leaves, and husks to produce 25 million gallons of ethanol a year.[229] The plant, a joint venture by POET of Sioux Falls, South Dakota and Royal DSM, a Dutch company, will use the enzymatic hydrolysis process.[230] This process was first used on a commercial scale in the Beta Renewables plant in Crescentino, Italy that opened in 2013. The Iowa plant opened on September 3, 2014, and a similar plant built by the same company opened in Brazil on the same date.[231] To make the enzymes used in biofuels, the Danish company Novozymes obtained $28.4 million through the American Recovery and Reinvestment Act to build a $200 million plant in Blair, Nebraska.[232]

The most important legal issue concerning the use of cellulosic ethanol is that its production has not matched the requirements mandating its use. In 2012, there was no commercial scale production in the United States, but EPA continued to mandate its use by refiners.[233] Because the amount of cellulosic ethanol

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228. CHESAPEAKE BAY COMM'N & THE COMMONWEALTH OF PA., *supra* note 163, at 11.

229. *DOE Announces Conditional Loan Guarantee for Development of Cellulosic Ethanol Plant*, 42 Env't Rep. (BNA) 1573 (July 15, 2011); U.S. Energy Info. Admin., *Commercial-Scale Cellulose Ethanol Plant Opens*, TODAY IN ENERGY, http://www.eia.gov/todayinenergy/detail.cfm?id=17851 (Sept. 5, 2014) [hereinafter *Commercial-Scale Cellulose Ethanol Plant Opens*].

230. *Commercial-Scale Cellulose Ethanol Plant Opens*, *supra* note 229.

231. *Id.*; *see also Cellulosic Ethanol*, POET, http://poet.com/cellulosic (last visited June 21, 2015).

232. *Administration Pushes Biofuel Tax Incentives Despite 'To-Do' List Exclusion, Vilsack Says*, 43 Env't. Rep. (BNA) 1473 (June 8, 2012).

233. *EPA Sets Ambitious 2012 RFS Targets, Rejects Oil Sector Fear Over Goals*, 23 Clean Air Rep. (Inside EPA) No. 1, at 12 (Jan. 5, 2012).

required substantially exceeded the amount produced, the D.C. Circuit vacated the 2012 blending requirements, but upheld EPA's requirements for advanced biofuels because the volume required could come from sugarcane ethanol imports and biodiesel production.[234] For 2013, EPA regulations called for 810,185 gallons of cellulosic ethanol to be blended, which is well below the statutory 1.0 billion gallons.[235] EPA's 2014 proposed rule called for 17 million ethanol-equivalent gallons of cellulosic biofuel, but, as previously discussed, EPA has had serious problems in finalizing the rule.[236] EPA is also attempting to expand the amount of cellulosic renewable fuel by approving new fuels as qualifying for RFS credit. In 2014 EPA reclassified millions of gallons of advanced biofuel as "cellulosic ethanol," including compressed and liquefied natural gas from landfills and wastewater treatment plants.[237] This increased the amount of cellulosic ethanol to over 18 million gallons by late 2014.[238] But scaling up cellulosic ethanol production from nearly zero to 16 billion gallons in a decade is nearly impossible. In the first few years of the cellulosic mandate, many business had severe financial problems, and many failed.[239]

EPA's hope for expanded cellulosic ethanol use is based on new commercial-scale cellulosic ethanol plants that came online in 2013 with a combined capacity of nearly 88 million gallons per year,[240] though they are not likely to produce at that level.[241] The INEOS Bio Indian River BioEnergy Center in Florida, with an 8 million gallon per year capacity, and the KiOR facility in Mississippi, with an 11 million gallon per year capacity, are the

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234. Am. Petroleum Inst. v. EPA, 706 F.3d 474, 481 (D.C. Cir. 2013).

235. *EPA Further Reduces 2013 Cellulosic Fuel Blending Requirement to 810,185 Gallons*, 45 Env't Rep. (BNA) 1245 (Apr. 25, 2014).

236. *See supra* notes 77-79 and accompanying text.

237. *See* RFS Pathways II; Technical Amendments to the RFS Standards and E15 Misfueling Mitigation Requirements, 79 Fed. Reg. 42,128, 42,128 (Envtl. Prot. Agency July 18, 2014).

238. *Cellulosic Ethanol Exceeds Projections by EPA; Industry Fears Rule Changes*, 45 Env't Rep. (BNA) 3343 (Nov. 21, 2014).

239. Barcott, *supra* note 208, at 46.

240. *Cellulosic Ethanol Producers Look to 2013 as Turning Point for Industry*, 43 Env't Rep. (BNA) 2749 (Oct. 26, 2012).

241. U.S. Energy Info. Admin., *supra* note 229.

first commercial-scale facilities to be registered as renewable fuel producers by EPA.[242] The KiOR operation uses a new technology that turns woodchips into a drop-in fuel that can be used without modification of the vehicle. The challenge will be to do so profitably.[243] Other plants include the Alpena Biorefinery in Alpena, Michigan; Fiberight LLC in Blairstown, Iowa; Fulcrum Bioenergy in Reno, Nevada; and POET/DSM in Emmetsburg, Iowa. Abengoa Bioenergy plans to begin production of 25 million gallons a year of cellulosic biofuel made from corn stover and switch grass at its Hugoton, Kansas plant in October 2014.[244] Another plant under development is a 30-million gallon per day DuPont facility in Nevada, Iowa.[245]

B. *Biodiesel*

Biomass-based diesel is defined as renewable fuel that has lifecycle GHG emissions 50 percent or less than petroleum-based diesel.[246] Agri-biodiesel is defined at IRC section 40A(d)(2) as biodiesel derived solely from virgin oils, including esters derived from virgin vegetable oils from corn, soybeans, sunflower seeds, cottonseed, canola, crambe, rapeseeds, safflower, flaxseed, rice bran, mustard seeds, and camelina, and from animal fats.[247] Jatropha is also beginning to be used as a biodiesel feedstock because it can be grown in tropical and semi-arid regions. There is no significant commercial-scale biodiesel production in the United States from any oil seed feedstock other than soybeans,

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242. *Proposal Would Require 16.55 Billion Gallons of Renewal Fuels in 2013 Gasoline Supply*, 44 Env't Rep. (BNA) 275 (Feb. 1, 2013).

243. Tory Newmyer, *Mississippi's Great Green Hope,* FORTUNE, Apr. 8, 2013, at 98.

244. *Biofuels Makers Threaten to Flee U.S. if EPA Lowers Renewable Fuel Standard*, 45 Env't Rep. (BNA) 2926 (Oct. 10, 2014).

245. U.S. Energy Info. Admin., *supra* note 229. The DuPont facility is currently delayed due to labor shortage for construction. *See* Gavin Aronsen, *Labor Shortage Delays DuPont Plant Completion,* AMES TRIB., Jan. 9, 2015, http://amestrib.com/news/labor-shortage-delays-dupont-plant-completion.

246. Clean Air Act § 211(o)(1)(C)-(D), 42 U.S.C. § 7545(o)(1)(C)-(D) (2012); *see also id.* § 13220(f). Biodiesel is defined in the regulations as a mono-alkyl ester that meets ASTM D 6751. *See* 40 C.F.R. § 80.1401 (2014).

247. 26 U.S.C. § 40A(d)(2) (2012).

however.[248] About 30 percent of the United States soybean oil production in 2013 was to be used to produce biodiesel.[249]

In Europe large amounts of palm oil is used to produce biodiesel, but it cannot be used in the United States because it cannot meet the 50 percent or less GHG emissions requirement.[250] The use of palm oil is strongly opposed by environmentalists because of the industry's record of rainforest destruction, endangered species habitat destruction, pollution, and its exploitation of workers. Its use is nevertheless rapidly expanding.[251] Europe produces about 60 percent of the world's biodiesel. Germany is the world's largest producer of biodiesel, primarily from rapeseed (canola).[252] About ten percent of the world's biodiesel is produced by the United States, Brazil, Argentina, and Thailand.[253]

The aggregate capacity for producing biodiesel in the United States in 2014 is approximately 4.2 billion gallons a year from 171 facilities.[254] Most of the biodiesel is made from virgin vegetable oils such as soybeans. The other type of biodiesel is made from non-virgin vegetable oils or animal fats, such as used oil from restaurants. Biodiesel is produced through a chemical reaction process to produce fatty acid methyl esters, not through the biological fermentation used to produce ethanol. To produce biodiesel from soybean oil, it is mixed with alcohol and a catalyst, such as caustic soda, and boiled at about 160° Fahrenheit to create an ester. After boiling, the glycerin created by the process is allowed to settle and is then separated from the mixture. The excess alcohol and the catalyst are removed, and the clear amber-colored biodiesel is ready to be used or mixed

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248. BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 3-1.

249. Jeremy Martin, Union of Concerned Scientists, *Biodiesel Update: Now with More Soy*, THE EQUATION (Jan. 2, 2014), http://blog.ucsusa.org/biodiesel-update-now-with-more-soy-360.

250. *Environmental Groups, Industry at Odds Over EPA's Analysis of Palm Oil as Renewable Fuel*, 43 Env't Rep. (BNA) 1147 (May 4, 2012).

251. *See, e.g.*, E. Benjamin Skinner, *Asia's Bitter Harvest,* BUSINESS WEEK, Aug. 2013, at 60 (discussing the human toll of the palm oil boom).

252. John Venema, *The Rise and Fall of Biodiesel*, GREENERPRO, http://www.greenerpro.com/BiodieselFuture.html (last visited June 7, 2015).

253. BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 5-2.

254. Monroe Energy, LLC v. EPA, 750 F.3d 909, 918 (D.C. Cir. 2014).

with conventional diesel fuel.[255] A five percent biodiesel (B5) blend is similar to conventional diesel and is compatible with the fuel supply system and motor vehicle engines.[256] Biodiesel is the most common distillate substitute, but it is not considered a "drop-in" fuel.[257]

Renewable diesel is produced using chemical processes that differ from those used to produce biodiesel, and the end product is not an ester. Renewable diesel is chemically similar to petroleum diesel, or jet fuel, and is considered "drop-in" fuel.[258] Renewable diesel production is at about 225 million gallons per year or about one-fourth the 2012 biodiesel production. Renewable diesel was produced commercially in the United States from only one facility, but a second facility was completed in 2013.[259]

Biomass-based diesel is a subset of advanced biofuel. It includes both biodiesel and renewable diesel.[260] The CAA's renewable fuel mandates require 0.5 billion gallons of biomass-based diesel to be used in 2009, and the amount increases to 1.0 billion gallons in 2012.[261] For subsequent years, EPA specifies the volume required to be sold or dispensed to consumers through regulations promulgated after coordination with the

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255. *See generally* J. VAN GERPEN ET AL., NAT'L RENEWABLE ENERGY LAB., BIODIESEL PRODUCTION TECHNOLOGY 75-77 (2004), *available at* http://www.nrel.gov/docs/fy04osti/36244.pdf (covering the technology used to produce biodiesel, which is the renewable fuel most currently available that is also non-toxic and biodegradable.)

256. HANNU JAASKELAINEN, COMPATIBILITY OF BIODIESEL WITH PETROLEUM DIESEL ENGINES, *available at* https://www.dieselnet.com/tech/fuel_biodiesel_comp.php (last modified May 12, 2014); *Diesel Engine Updates for Biofuel Compatibility*, TRIANGLE BIOFUELS INDUS., INC., http://www.trianglebiofuels.com/diesel-engine-updates-for-biodiesel-compatibility (Aug. 11, 2009).

257. Robert Rapier, *The Lowdown on Making Jet Fuel and Diesel from Biomass*, BIOFUELS DIGEST (Aug. 31, 2012), http://www.biofuelsdigest.com/bdigest/2012/08/31/the-lowdown-on-making-jet-fuel-and-diesel-from-biomass/.

258. *Id.*

259. Nicholas Zeman, *Valeros Renewable Diesel Plant Nears Start-Up*, ENR TEX. & LA. (Apr. 22, 2013), http://texas.construction.com/texas_construction_projects/2013/0422-valero8217s-renewable-diesel-plant-nears-start-up.asp.

260. Clean Air Act § 211(o)(1)(D), 42 U.S.C. § 7545(o)(1)(D) (2012) (referring to 42 U.S.C. § 13220(f)).

261. CAA § 211(o)(2)(B)(i)(IV), 42 U.S.C. § 7545(o)(2)(B)(i)(IV).

Secretary of Energy and the Secretary of Agriculture.[262] An EPA rule required the production of 1.28 billion gallons of biomass-based diesel in 2013.[263] Biodiesel RIN generation was 2.71 billion gallons in 2013, however, which is significantly above the amount EPA expected.[264]

For a biomass-based producer to have its production count toward the annual production volume requirement, it must either be biodiesel that meets the pathway requirements of 40 C.F.R. § 80.1414, or be approved by EPA following a petition requesting the fuel be certified as a renewable fuel pursuant to 40 C.F.R. § 80.1416. If biodiesel is produced from soybean oil; oil from annual cover crops; algal oil; biogenic waste oils, fats, or grease; non-food grade corn oil; or canola oil by trans-esterification then it meets the pathway requirements. An approved fuel is assigned a Renewable Identification Number (RIN) for each batch produced. The gallons produced are adjusted pursuant to 40 C.F.R. § 1415 to reflect their energy value in relation to ethanol, which is designated as one. Biodiesel has an equivalence value of 1.5. Therefore, a 100-gallon batch of biodiesel would receive a RIN for 150 gallons. Biomass-based diesel must be blended into petroleum-based diesel with each obligated party responsible for using an amount of biofuel equal to its diesel production divided by the industry's diesel production times the amount of biofuel required to be used nationwide for the year.[265] RINs above the quantity needed by a blender can be considered a tradable credit and sold. This has allowed fraudulent schemes to flourish because criminals sell RINs that have no corresponding manufactured biofuel.

On December 18, 2013, EPA issued a notice of violation to two biodiesel companies that had allegedly sold 33.5 million fraudulent RINs, which left the refiners a massive shortfall.[266]

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262. *Id.* § 7545(o)(2)(B)(ii).

263. *See* 2013 Biomass-Based Diesel Renewable Fuel Volume, 77 Fed. Reg. 59,458, 59,458 (Envtl. Prot. Agency Sept. 27, 2012).

264. Monroe Energy, LLC v. EPA, 750 F.3d 909, 918 (D.C. Cir. 2014).

265. *See* 40 C.F.R. § 80.1407 (2014) (providing the formula to calculate Renewable Volume Obligations).

266. *EPA Invalidation of RFS Credits Spurs Debate Over 2014 Biodiesel Target*, 25 Clean Air Rep. (Inside EPA) No. 1, at 21 (Jan. 2, 2014).

Most of the fraud with the RIN program involves biodiesel, not ethanol.[267] EPA had not finalized an affirmative defense for innocent purchasers.[268] This resulted in the market for diesel RINs drying up because RIN buyers of invalid instruments face liability based on a no fault standard.[269]

Biomass-based diesel is more environmentally friendly than petroleum diesel. It does not contain sulfur or toxic metals. Soybean-based diesel results in one percent of the nitrogen, 8.3 percent of the phosphorus, and 13 percent of the pesticide releases per unit of energy gained in comparison to ethanol produced from corn.[270] A National Renewable Energy Laboratory report that focused on engine emissions, not lifecycle emissions, found that emissions of conventional pollutants from diesel engines do not increase even when a 20 percent biodiesel blend (B20) is used, except for a small change on the order of + or – 0.5 percent in NO_x emissions.[271] The energy required to produce biodiesel usually comes from natural gas-fired boilers that release pollutants similar to other industrial processes fueled by natural gas.[272] Many feedstocks used for biodiesel production can be used for food, so there could be a conflict with food consumers as biodiesel markets expand.

The environmental benefits of using biodiesel apply only to the net energy of biodiesel after the energy used to produce the feedstock and convert it to fuel is subtracted. Soybean diesel is claimed in an NAS report to have a positive net energy balance providing 93 percent more energy than is required to produce it.[273] Other scholars disagree that biofuels provide a net energy gain. Pimentel and Patzek found that if soy oil is used for

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267. *Oil Industry Wants Biodiesel 'Loophole' Closed in RIN Quality Assurance Rule*, 45 Env't Rep. (BNA) 1061 (Apr. 11, 2014) [hereinafter *Oil Industry Wants Biodiesel 'Loophole' Closed*].

268. *Id.*

269. *Id.*

270. Hill et al., *supra* note 123, at 11,207.

271. R.L. MCCORMICK ET AL., NAT'L RENEWABLE ENERGY LAB., EFFECTS OF BIODIESEL BLENDS ON VEHICLE EMISSIONS, at iii (2006), *available at* http://www.nrel.gov/docs/fy07osti/40554.pdf.

272. BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 4-7.

273. *See* Hill et al., *supra* note 123, at 11,206.

biodiesel production, the net energy loss is eight percent even after allowing credit for the soy meal that is produced in the process.[274] The work of Dr. Delucchi at the University of California indicates that biodiesel use results in higher lifecycle greenhouse gas emissions than does conventional diesel if emissions of N_2O from soy fields and changes in land use are considered.[275] His study also shows that using lifecycle analysis, convention pollutant emissions (nitrogen dioxide, non-methane organic compounds, sulfur dioxide and particulate matter) are significantly higher for biodiesel than for reformulated gasoline.[276] EPA, however, in its regulations for biodiesel discussed above, recognizes a reduction in GHGs that meets the statutory 50 percent GHG reduction requirement.[277] However, the CAA allows the Administrator to adjust the percentage reductions required by the statute for lifecycle GHG emissions to a lower percentage.[278]

Biodiesel is unlikely to be commercially viable without subsidies. Commercial biodiesel production began in the United States in 2001 and in ten years the industry's output had increased 100 times.[279] More than 200 plants produce biodiesel.[280] This rapid expansion occurred because of subsidies and mandatory purchase requirements. In 2009, estimated soybean biodiesel production costs were about $3.50 per gallon, which means the business of biodiesel production at this time may not be sustainable without external support.[281] In 2011,

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274. Pimentel & Patzek, *supra* note 118, at 72.

275. Mark A. Delucchi, Lifecycle Analyses of Biofuels 17 (May, 2006) (unpublished draft manuscript), *available at* http://www.its.ucdavis.edu/research/publications/publication-detail/?pub_id=151.

276. *Id.* at 24-26.

277. 40 C.F.R.§ 80.1426, tbl.1 (2014).

278. Clean Air Act § 211(o)(4), 42 U.S.C. § 7545(o)(4) (2012).

279. U.S. ENERGY INFO. ADMIN., BIOFUELS ISSUES AND TRENDS 14 (2012), *available at* http://www.eia.gov/biofuels/issuestrends/pdf/bit.pdf [hereinafter BIOFUELS ISSUES AND TRENDS].

280. *Oil Industry Calls Renewable Fuel Standard 'Unworkable,' Biofuels Group Tout Benefits*, 44 Env't Rep. (BNA) 716 (Mar. 15, 2013).

281. Robert Wisner, *Biodiesel Economics – Costs, Tax Credits, and Co-Product*, AGMRC RENEWABLE ENERGY NEWSL. (June 2009), http://www.agmrc.org/renewable_energy/biodiesel/biodiesel-economics-costs-tax-credits-and-co-

wholesale prices for Iowa's biodiesel ranged from about $4.50 to nearly $6.00 per gallon.[282] This is more than the June 22, 2015 average retail price of highway petroleum-based diesel, which is $2.86 including taxes.[283] Determining the cost of producing biodiesel is difficult. The technology used varies, and plants are often small and don't disclose their costs. The estimated cost of soy biodiesel was nearly $6.00 a gallon in 2009 with the cost of soybeans accounting for 75 to 83 percent of the total cost.[284] With roughly half the biodiesel in the United States being produced from soybean oil, the increasing cost of this input means cost reduction will be a challenge. In comparison, the average cost for petroleum-based diesel in the United States in October 2013 was about $2.87.

V.
OTHER BIOFUELS

The Energy Policy Act of 2005 established a "Sugar Cane Ethanol Program" within EPA so that farmers and ethanol producers in Florida, Louisiana, Texas, and Hawaii could obtain federal support for projects to develop ethanol production from cane sugar. In all, $36 million was authorized.[285] Sugarcane, however, is unlikely to be used in the United States for fuel because the federal government controls support the price of sugar, which is almost double the world price.[286] In 2007, EISA amended CAA section 211(o)(1) to include sugar as an advanced biofuel, which could assist the sugar industry's quest for subsidies.[287] The Farm Bill of 2008 continues the preexisting

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product.

282. BIOFUELS ISSUES AND TRENDS, *supra* note 279, at 18.

283. *Gasoline and Diesel Fuel Update*, U.S. ENERGY INFO. ADMIN., http://www.eia.gov/petroleum/gasdiesel/ (June 22, 2015) (click on the "Full History" link next to "U.S. On-Highway Diesel Fuel Prices" to download the Excel spreadsheet; then click on the Data 1 tab; then scroll to Column B, Row 1113).

284. Robert Wisner, *supra* note 281.

285. Energy Policy Act of 2005, Pub. L. No. 109-58, § 208, 119 Stat. 594, 656-57.

286. Shapouri & Salassi, *supra* note 13, at 19-20.

287. Clean Air Act § 211(o)(1)(B)(ii)(II), 42 U.S.C. § 7545(o)(1)(B)(ii)(II)

subsidy for the sugar industry, but does not appear to offer any new programs aimed at biofuel production from the sugar industry.[288] EPA, however, recognizes sugarcane as a feedstock for ethanol production.[289] Sugarcane-based ethanol is exported to the United States from Brazil, which has far lower costs for ethanol production.[290] On January 1, 2012, the United States eliminated the import tariff on ethanol, which encourages importation of ethanol.[291] In 2013, the United States imported 348 million gallons of sugarcane-based ethanol from Brazil, but imports were down in 2014 by 83 percent.[292] The United States also exports ethanol to Brazil because the different production schedules for the feedstock used in ethanol production means that during seasons of low domestic production in each country imports can be used to stabilize the supply.[293]

One of the more promising feedstocks for long-term biofuel development is simple-cell algae. Algae requires little land to produce commercial quantities of oil compared to other feedstock, and it can produce 55 times the oil produced by soybeans from a given acreage. [294] To meet half the nation's transportation fuel requirements from soybean-based biodiesel would require three times the arable land in the United States,

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(2012); 40 C.F.R. § 80.1100(a)(1)(A) (2015).

288. Food, Conservation, and Energy Act of 2008, Pub. L. No. 110-234, 122 Stat. 923.

289. CAA § 211(o)(1)(B)(ii)(II), 42 U.S.C. § 7545 (o)(1)(B)(ii)(II); 40 C.F.R. § 80.1401.

290. *See generally* Vanessa M. Cordonnier, *Ethanol's Roots: How Brazilian Legislation Created the International Ethanol Boom*, 33 WM. & MARY ENVTL. L. & POL'Y REV. 287 (2008) (discussing Brazil's rise of sugarcane-based ethanol production and the international trade thereof).

291. *U.S. Biofuel Policy*, SUGARCANE.ORG, http://sugarcane.org/global-policies/policies-in-the-united-states/us-biofuel-policy (last visited June 13, 2015).

292. RENEWABLE FUELS ASS'N, 2014 U.S. ETHANOL EXPORTS AND IMPORTS: STATISTICAL SURVEY 6 (2015), *available at* http://www.ethanolrfa.org/page/-/rfa-association-site/studies/2014%20U.S.%20Export-Import%20Report.pdf?nocdn=1; *U.S. Ethanol Imports from Brazil Down in 2013*, U.S. ENERGY INFO. ADMIN (May 5, 2014), http://www.eia.gov/todayinenergy/detail.cfm?id=16131.

293. Sewalk, *supra* note 15, at 700.

294. Fred Bosselman, *Green Diesel: Finding a Place for Algae Oil,* 86 CHI.-KENT L. REV. 291, 296 (2011).

but algae-based biodiesel could produce the same amount with less than three percent of the land.[295] A significant limitation on the use of this technology will be its requirements for water. Algae produced in an open pond can require up to 3,650 gallons of water for each gallon of gasoline-equivalent fuel as well as needing inputs of large quantities of nitrogen and phosphorus.[296] The water could be recycled wastewater, however, which could also provide needed nitrogen and phosphorus.[297] The conversion process uses carbon dioxide as a nutrient, which could be an input from electric power plants or other industrial sources for commercial levels of algae biofuel production.[298] Development of algae biofuel is being encouraged by the Navy, which is purchasing this fuel from Solazyme in South San Francisco, California.[299] In the short-term, commercialization of algae-based fuel will be limited due to its cost. The biofuel industry, however, believes the cost to produce algae-based fuel will be competitive with petroleum-based fuel by 2020.[300]

VI.
BIOFUEL SUBSIDIES

To create an ethanol market, federal, state, and local governments provide subsidies to the ethanol industry. The first federal tax exemption for mixtures of gasoline and ethanol (gasohol) was provided by the Energy Tax Act of 1978.[301] The first tax credit for biodiesel was enacted in 2004.[302] Since 1978,

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295. BIOFUELS AND THE ENVIRONMENT EPA REPORT, *supra* note 89, at 3-59.

296. *Large-Scale Production of Algal Biofuels Could Be Unsustainable, Report Says*, 43 Env't Rep. (BNA) 2703 (Oct. 12, 2012).

297. Bosselman, *supra* note 194, at 305, 308.

298. *Id.* at 306.

299. *Navy Signs Contract to Buy 450,000 Gallons Of Biofuel, Largest Purchase by Government,* 42 Env't Rep. (BNA) 2746 (Dec. 9, 2011).

300. Jim Lane, *Answers to Your Questions About Parity-Priced, Algae-Based Fuels*, BIOFUELS DIGEST (Mar. 8, 2013), http://www.biofuelsdigest.com/bdigest/2013/03/08/answers-to-your-questions-about-parity-priced-algae-based-fuels.

301. *See* Energy Tax Act of 1978, Pub. L. No. 95-618, tit. II, § 221, 92 Stat. 3174, 3185 (expired Sept. 30, 1984).

302. *See* American Jobs Creation Act of 2004, Pub. L. No. 108-357, § 302,

the tax benefits provided to the biofuel industry have been modified many times.[303] The tax laws do not always mesh with the renewable fuel standards because these tax provision were generated in Congressional committees that are not responsible for the RFS1 and RFS2 programs. Moreover, because the tax provisions are the responsibility of the Internal Revenue Service, they may utilize definitions and applicability criteria that differ from the approach used by EPA.[304] For example, GHG emissions must be lower than lifecycle emissions from petroleum-based fuels for advanced biofuels, but no such requirement applies to the biofuel tax credits.[305] The benefits of the RFS program are related to the energy content of the fuel, but the tax benefits are not.[306]

Although the biofuel subsidies have cost billions of dollars, it is difficult to precisely quantify them because both the recipients and Congress benefit from keeping subsidies hidden from budgetary scrutiny and obscuring who receives the benefits. Production subsidies were given to fuel manufacturers that blended biofuel with gasoline or diesel. The partial exemption from the excise tax for ethanol cost the federal government about eight to eleven billion dollars from 1979 to 2000.[307] According to the Congressional Budget Office, the tax credit for ethanol and biodiesel in 2009 cost the treasury approximately $6.05 billion.[308] In 2010, the Congressional Budget Office estimated that the biofuel tax credit for ethanol resulted in CO_2 reductions at a cost of about $750 per metric ton; for cellulosic ethanol the cost drops

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118 Stat. 1418, 1463 (2004).

303. *See generally* James A. Duffield et al., *Ethanol Policy: Past, Present, and Future*, 53 S.D. L. REV. 425 (2008) (providing a comprehensive overview of the history of ethanol regulation and policy).

304. *Fundamental Inconsistencies Between Federal Biofuel Policy and Their Implications*, 44 Envtl. L. Rep. (Envtl. Law Inst.) No. 5, at 10,395 (May 2014).

305. *Id.* at 10,396.

306. *Id.* at 10,398.

307. Letter from Jim Wells, Dir. of Energy, Res., and Sci. Issues, U.S. Gen. Accounting Office to Sen. Tom Harkin (Sept. 25, 2000), *available at* http://www.gao.gov/archive/2000/rc00301r.pdf.

308. CONGRESSIONAL BUDGET OFFICE, USING BIOFUEL TAX CREDITS TO ACHIEVE ENERGY AND ENVIRONMENTAL POLICY GOALS 2 (2010), *available at* https://www.cbo.gov/sites/default/files/07-14-biofuels.pdf.

to $274, and for biodiesel the cost is about $300 per metric ton.[309] Due to government subsidies and mandatory blending requirements, private capital flows to the ethanol industry, and capital investment is further encouraged by government subsidies for the construction of ethanol facilities. The storage and dispensing of renewable fuel blends is also subsidized.[310] The rapid infusion of capital to expand an industry that is completely dependent on government distortion of the free market adds the banking industry to the list of supporters of continuing subsidies. Another economic bubble could burst if subsidies or mandated use are modified or terminated.

These subsidies go primarily to the largest corporations producing ethanol.[311] The five largest ethanol producers were responsible for more than 40 percent of the 13.8 billion gallons of ethanol produced in 2011. Archer Daniel Midland (ADM) produced 1.75 billion gallons; Poet produced 1.6 billion gallons; Valero Energy Corporation produced 1.2 billion gallons; Green Plains Renewable Energy produced 740 million gallons; and Flint Hills Resources LP produced 440 million gallons.[312] A study by Food & Water Watch reported that ethanol refiners received at least $22.8 billion in government financial support between 1999 and 2008, which includes $1.7 billion in the blenders tax credit.[313] The conservative CATO Institute reports that at least 43 percent of ADM's profits come from taxpayer subsidies.[314]

The ethanol producers' political clout comes from an alliance

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309. *Id.* at viii.

310. The Energy Independence and Security Act of 2007 authorizes $200 million per year through 2014, which includes the storage and dispensing grants, but the limit on each applicant is two years and $20 million. *See* Energy Independence and Security Act of 2007, Pub. L. No. 110-140, § 244, 121 Stat. 1492, 1541.

311. FOOD & WATER WATCH, CRYSTAL ETH: AMERICA'S CRIPPLING ADDITION TO TAXPAYER-FINANCED ETHANOL 9 (2011), *available at* http://documents.foodandwaterwatch.org/doc/crystaleth.pdf#_ga=1.151534714.2138149118.1434252496.

312. *The 5 Largest Ethanol Producers*, FARM INDUS. NEWS (Mar. 12, 2012), http://farmindustrynews.com/ethanol/5-largest-ethanol-producers.

313. FOOD & WATER WATCH, *supra* note 311, at 11.

314. Doug Bandow, *Ethanol Keeps ADM Drunk On Tax Dollars*, CATO INST. (Oct. 2, 1997), http://www.cato.org/publications/commentary/ethanol-keeps-adm-drunk-tax-dollars.

with farmers and through trade associations including: the Renewable Fuels Association (RFA), the American Coalition for Ethanol (ACE), the National Corn Growers Association, Growth Energy, the American Farm Bureau Federation, Corn Refiners Association, and other organizations. RFA represents about fifty producer members as well as other businesses associated with ethanol production.[315] ACE is a trade association with about 115 business members.[316] The National Corn Growers Association, a grower-led organization with forty-eight affiliated state organizations, lists among its policies as defending the renewable fuel standard, investing in biofuel infrastructure, and increasing the number of flex-fuel vehicles.[317] Growth Energy represents producers and supporters of ethanol.[318] The American Farm Bureau Federation represents the interests of the farm community through farm bureaus in all fifty states by supporting the use of renewable fuels and biotechnology.[319] The Corn Refiners Association represents ADM, Cargill Incorporated, Ingredion Incorporated, and other members of the industry.[320] After use of second-generation biofuel was required, lobby groups went to work to advance the interests of the new biofuel producers. They include the Advanced Biofuels Association, which represents nearly forty companies that produce advanced biofuels.[321] The biodiesel industry's interests are advanced by the National Biodiesel Board,[322] the United States Canola

315. *See Members*, RENEWABLE FUELS ASS'N, http://www.ethanolrfa.org/pages/members (last visited June 13, 2015).

316. *See Member Directory*, AM. COAL. FOR ETHANOL, https://ethanol.org/people/member-directory (last visited June 13, 2015).

317. *See Mission/Vision*, NAT'L CORN GROWERS ASS'N, http://www.ncga.com/about-ncga/mission-vision (last visited June 13, 2015).

318. *See About Growth Energy: Structure & Members*, GROWTH ENERGY, http://www.growthenergy.org/about-growth-energy/structure-members (last visited June 13, 2015).

319. *See Farm Bureau Priority Issues*, AM. FARM BUREAU FED'N, http://www.fb.org/index.php?action=issues.home (last visited June 13, 2015).

320. *See Member Companies*, CORN REFINERS ASS'N, http://corn.org/cra-members/member-companies/ (last visited June 13, 2015).

321. *See About*, ADVANCED BIOFUELS ASS'N, http://advancedbiofuelsassociation.com/section.php?sid=6 (last visited June 13, 2015).

322. *See* NAT'L BIODIESEL BD., http://www.nbb.org (last visited June 13, 2015).

Association,[323] and the American Soybean Association, which represents 21,000 United States soybean producers.[324]

The political clout of the corn production industry is supplemented by generous political contributions from the biofuel industry. It is reported that the ten largest ethanol producers gave $4.7 million in federal campaign contributions in 2000-2007.[325] It is also reported that ADM contributed over $8.2 million to political campaigns and soft money from 1990 to 2008.[326] ADM was the 69th largest corporate contributor to Congress from 1989-2010.[327] For 1990-2014, ADM has made a total of $9,597,687 in contributions.[328] Poet LLC, which is also the largest biofuel company in the United States, is reported to have spent over $1 million in 2012 and over $900,000 in 2013 on lobbying efforts; it contributed to thirty-eight members of Congress and it has its own political action committee (PAC) that spent $477,450 in 2014 and $540,000 thus far in 2015. [329] However, the return on these political investments is high given the value of the subsidies at over $22 billion in ten years.[330]

As previously mentioned, the Energy Tax Act of 1978 began the subsidies for ethanol by exempting gasoline with 10 percent alcohol from the motor fuel excise tax.[331] It was repealed and replaced by other subsidies that are codified at 26 U.S.C. §§ 40(b), 40A(b), 40A(f), and 6426.[332] These tax benefits have

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323. *See* U.S. CANOLA ASS'N, http://www.uscanola.com (last visited June 13, 2015).

324. *See Overview*, AM. SOYBEAN ASS'N, https://soygrowers.com/about-asa/overview/ (last visited June 13, 2015).

325. Marianne Lavelle & Bret Schulte, *Is Ethanol the Answer?*, U.S. NEWS & WORLD REPORT, Feb. 12, 2007, at 30.

326. FOOD & WATER WATCH, *supra* note 311, at 4.

327. *See* Dave Gilson, *Capital Hill's Top 75 Corporate Sponsors*, MOTHER JONES, Sept./Oct. 2010, *available at* http://www.motherjones.com/politics/2010/09/capital-hill-top-corporate-sponsors.

328. *Archer Daniels Midland*, OPENSECRETS, http://www.opensecrets.org/orgs/summary.php?id=D000000132&cycle=A (last visited June 13, 2015).

329. *See Poet LLC*, OPENSECRETS, http://www.opensecrets.org/orgs/summary.php?cycle=2014&id=D000046017 (last visited June 21, 2015).

330. FOOD & WATER WATCH, *supra* note 311, at 5.

331. Energy Tax Act of 1978, Pub. L. No. 95-618, tit. II, § 221, 92 Stat. 3174, 3185.

332. *See* Omnibus Budget Reconciliation Act of 1990, Pub. L. No. 101-508, tit.

expired, but the language remains in the United States Code, and Congress can reinstate the tax benefits at any time. The Internal Revenue Code provided an alcohol fuels credit that was the sum of the alcohol mixture credit, the alcohol credit, the small ethanol producer credit, and the second-generation biofuel producer credit. The ethanol mixture credit and the alcohol credit was $0.60 a gallon, but a taxpayer only received one of the credits.[333] The alcohol mixture credit is available to a taxpayer who produces the mixture and uses it for fuel or sells it to another person to be used as fuel. The alcohol credit is available for alcohol used in a taxpayer's trade or business or is sold by the taxpayer at retail and placed in the fuel tank of a purchaser. Small producers could receive an additional $0.10 a gallon. Second generation biofuel using cellulosic, algae, or similar feedstock received $1.01 per gallon credit for fuel produced after 2008, but that is reduced by the alcohol credit and the ethanol credit and must meet additional requirements.[334] While these tax credits were set to expire on December 31, 2011, the American Taxpayer Relief Act of 2012 extended the second-generation biofuel producer credit until December 31, 2013.[335]

There are three biodiesel tax credits: the biodiesel mixture credit, the biodiesel credit, and the small agri-biodiesel producer credit.[336] The biodiesel mixture's credit provides most of the tax

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XI, 104 Stat. 1388, 1388-482; American Jobs Creation Act of 2004, Pub. L. No. 108-357, § 302, 118 Stat. 1418, 1463-66; Energy Policy Act of 2005, Pub. L. No. 109-58, tit. XIII, 119 Stat. 594, 986; Food, Conservation, and Energy Act of 2008, Pub. L. No. 110-246, tit. XV, § 15321, 122 Stat. 1651, 2274-76; Energy Improvement and Extension Act of 2008, Pub. L. No. 110-343, tit. II, § 202, 122 Stat. 3807, 3832-33.

333. The ethanol tax credit was extended by the Transportation Equity Act for the 21st Century, Pub. L. No. 105-178, 112 Stat. 107 (1998), but the tax credit was reduced to $0.53 starting January 2001, to $0.52 in January 2003, and to $0.51 in January 2005. 112 Stat. at 501.

334. 26 U.S.C. § 40(b)(6) (2012); *see also* James E. Maule, *Tax Credits: Concepts and Calculations*, 506-3rd Tax Management Portfolios (Bloomberg BNA) A-73 (2013) (discussing the details of these tax credits).

335. *See* American Taxpayer Relief Act of 2012, Pub. L. No. 112-240, tit. IV, § 405, 126 Stat. 2313, 2340.

336. *See* Internal Revenue Code § 40A , 26 U.S.C. § 40A (2012) (added by the American Jobs Creation Act of 2004, Pub. L. No. 108-357, 118 Stat. 1418, later amended by the Energy Policy Act of 2005, Pub. L. No. 109-58, § 1345, 119 Stat.

benefit. Internal Revenue Code section 40A(b)(1) provides a federal excise tax or income tax credit of $1.00 per gallon of biodiesel used to produce a qualified biodiesel mixture.[337] The cost to the treasury for the biodiesel mixture credit was about $1 billion in 2012. Biodiesel used by the taxpayer or sold at retail and placed in the buyer's gas tank also receives a $1.00 a gallon credit.[338] The small agri-biodiesel producer credit provides an additional $0.10 per gallon for up to 15 million gallons of biodiesel.[339] Renewable diesel is treated in the tax code almost in the same way as biodiesel.[340] This credit also expired December 31, 2013, after having been extended one year by Congress at a cost to the treasury of about $1 billion.[341]

On April 3, 2014, the Senate Finance Committee approved a tax credit extension package that includes a two-year extension of the $1.01 per gallon production tax credit for cellulosic biofuels, a $1.00 per gallon credit for biodiesel and renewable diesel, and a $0.50 per gallon alternative fuel tax credit. It also continues a $0.10 per gallon bonus for small agri-biodiesel producers and extends the accelerated depreciation provision for cellulose biofuel facilities.[342] An accelerated depreciation allowance is also provided for cellulosic biofuel plants placed in service before January 1, 2014.[343] If the subsidies continue, the cellulosic biofuel tax subsidy could cost the treasury over 16 billion dollars a year by 2022, and the biodiesel subsidy would exceed a billion dollars a year.[344]

594, 1052-55). Agri-biodiesel is limited to fuel derived from virgin oils and from animal fat. 26 U.S.C. § 40A(d)(2).

337. 26 U.S.C. § 40A(b)(1).

338. *Id.* § 40A(b)(2).

339. *See id.* § 40A(b)(4) (added by the Energy Policy Act of 2005, Pub. L. No. 109-58, § 1345, 119 Stat. 594, 1052-55).

340. 26 U.S.C. § 40A(f).

341. Matthew L. Wald, *Congress Renews Credit for Biodiesel Industry*, N.Y. TIMES (Jan. 3, 2013), http://www.nytimes.com/2013/01/04/business/energy-environment/congress-extends-incentives-for-biodiesel-industry.html?_r=0.

342. Erin Volgete, *Senate Committee Approves Tax Credit Extension Package*, ETHANOL PRODUCER MAG. (Apr. 3, 2014), http://www.ethanolproducer.com/articles/10908/senate-committee-approves-tax-credit-extension-package.

343. 26 U.S.C. § 168(l) (2012).

344. 26 U.S.C. § 40(b)(6) (added by Food, Conservation, and Energy Act of

In addition to tax benefits, Congress provides grants, loans, and loan guarantees to the biofuel industry. The Energy Security Act of 1980 provided loan guarantees up to 90 percent of the construction costs of biomass energy projects.[345] The Farm Security and Rural Investment Act of 2002 contained one of the first energy titles in a farm bill and made the Department of Agriculture a player in the biofuel subsidy programs.[346] The Food, Conservation, and Energy Act of 2008 continues the federal efforts to subsidize renewable fuel development, but with new emphasis on advanced biofuels that do not use corn as a feedstock.[347] Title IX of the bill has many sections that provide or authorize money for renewable fuels, with most subsidy provisions funded through fiscal year 2018 and subject to congressional appropriations thereafter.[348] Section 9002, the bio-based markets program, provides for federal procurement of bio-based products.[349] Section 9003 provides for biorefinery loan guarantees.[350] Section 9004 for repowering assistance provides $12 million to subsidize replacement of fossil fuel used in biorefineries for the fiscal 2014 year, with biomass-based fuel and authorizes an additional discretionary $10 million per year from 2014 to 2018.[351] Section 9005, the bioenergy program for advanced biofuels, provides $375 million and authorizes an additional discretionary $100 million from 2014 to 2018 to support expanded production of feedstock for advanced

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2008, Pub. L. No. 110-246, § 15321(b)(1), 122 Stat. 1651, 2274-75).

345. *See* Biomass Energy and Alcohol Fuels Act of 1980, Pub. L. No. 96-294, § 214, 94 Stat. 683, 691.

346. *See* Farm Security and Rural Investment Act of 2002, Pub. L. No. 107-171, tit. IX, 116 Stat. 134, 475-86.

347. *See* Food, Conservation, and Energy Act of 2008, Pub. L. No. 110-246, 122 Stat. 1651.

348. See tit. IX, 122 Stat. at 2064-96; U.S. Dep't of Energy, *Federal Laws and Incentives for Biodiesel*, ALT. FUELS DATA CTR., http://www.afdc.energy.gov/fuels/laws/BIOD/US (last updated Mar. 6, 2015). *See also* BRENT D. YACOBUCCI, CONG. RESEARCH SERV., RL33572, BIOFUELS INCENTIVES: A SUMMARY OF FEDERAL PROGRAMS 3 (2006) [hereinafter YACOBUCCI, BIOFUELS INCENTIVES].

349. 7 U.S.C. § 8102 (2012).

350. *Id.* § 8105.

351. *Id.* § 8104.

biofuels.[352] Section 9011, the biomass crop assistance program, provides qualified feedstock producers up to 50 percent of the cost of establishing an advanced biofuel feedstock crop with annual payments for up to five years for herbaceous feedstocks and up to fifteen years for woody feedstocks.[353] Section 6202, the Value-Added Producer Grants Program, provides grants for value-added agricultural activities including biofuel production.[354] The Farm Security and Rural Investment Act of 2002 also authorizes development grants for biorefineries.[355]

Numerous other federal agencies provide biofuel subsidies. For example, the Department of Energy provides loan guarantees for projects that support early commercial use of biofuels.[356] The Department of Defense is an important supporter of biofuel development in order to secure sources of fuel that are immune from disruption. It is interested in "drop in" fuels that are chemically indistinguishable from the petroleum-derived fuels they replace and can be easily substituted for existing fossil fuel uses without modification of either the engines or the supporting infrastructure.[357] The Navy, for example, is spending $170 million over three years to develop advanced biofuels made from grass, straw, and other cellulosic feedstock.[358]

Federal procurement policy requires contractors to make maximum use of USDA-designated bioproducts unless they cannot be acquired competitively within the contract time frame, cannot meet contract requirements, or cannot be acquired at a reasonable price.[359] The Farm Security and Rural Investment

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352. *Id.* § 8105.

353. *Id.* § 8111.

354. *Id.* § 1632a; *see also* YACOBUCCI, BIOFUELS INCENTIVES, *supra* note 348, at 4.

355. *See* Farm Security and Rural Investment Act of 2002, Pub. L. No. 107-171, § 9003, 16 Stat. 134, 478 (codified at 7 U.S.C. § 8103).

356. 42 U.S.C. § 16513 (2012).

357. *See* U.S. Dep't of Energy, *Renewable Hydrocarbon Biofuels*, ALT. FUELS DATA CTR., http://www.afdc.energy.gov/fuels/emerging_hydrocarbon.html (last updated May 13, 2015).

358. *Armed Services Committees Say Restrictions on Biofuels Use Removed from Defense Bill,* 43 Env't Rep. (BNA) 3267 (Dec. 21, 2012).

359. *White House Calls for Increased Federal Purchasing of Biobased*

Act of 2002 requires federal contractors to give preference to items with the highest percentage of biobased products.[360] Executive order 13,514 requires federal agencies to ensure that 95 percent of new contracts use biobased products when available.

A renewable energy law that benefits the automobile industry is the Energy Policy and Conservation Act (EPCA) that imposes Corporate Average Fuel Economy (CAFE) standards on motor vehicle manufacturers.[361] In 1993, Congress created a flexible-fuel credit that allows automobile manufacturers to receive credit toward the federal fuel economy requirements for producing vehicles that run on ethanol. [362] Flexible-fuel vehicles can run on petroleum-based fuels or an alternative fuel, with a 51 to 85 percent ethanol blend; it is usually 85 percent ethanol (E85). To receive credit, the flexible-fuel vehicles must be driven half the time using an 85 percent ethanol fuel. Vehicles only need to have the capability to run on ethanol; they do not actually have to use the fuel. There are nearly 10 million vehicles in the United States that can use E85.[363] Relatively few vehicles use E85, however, in part because there are only 2,393 public stations selling E85 in the United States.[364] This is less than two percent of the 121,446 gas stations in the United States[365] The Department of Agriculture is helping to fund the installation of E15 blender pumps by providing $100 million to states with the aim of doubling the number of pumps in use.[366] A

Products, 43 Env't Rep. (BNA) 451 (Feb. 24, 2012).

360. Farm Security and Rural Investment Act § 9002 (codified at 7 U.S.C. § 8102).

361. Energy Policy and Conservation Act, Pub. L. No. 94-163, §§ 502, 503, 89 Stat. 871, 902-07 (Dec. 22, 1975).

362. *See* 49 U.S.C. § 32905 (2012).

363. *Frequently Asked Questions: How Many Alternative Fuel and Hybrid Vehicles Are There in the U.S.?*, U.S. ENERGY INFO. ADMIN., http://www.eia.gov/tools/faqs/faq.cfm?id=93&t=4 (last updated May 16, 2013).

364. U.S. Dep't of Energy, *Ethanol Fueling Station Locations*, ALT. FUELS DATA CTR., http://www.afdc.energy.gov/fuels/ethanol_locations.html (last visited June 18, 2015).

365. *Gas Station Statistics*, STATISTIC BRAIN RESEARCH INST., http://www.statisticbrain.com/gas-station-statistics (last visited June 18, 2015).

366. *See* Stephen Edelstein, *Agriculture Department To Spend $100 Million*

problem in obtaining consumer acceptance of E85 vehicles is the substantial increase in the cost of fuel due to E85's lower energy content.[367]

CAFE standards provide for flexible-fuel vehicles to have their fuel economy calculated as 1.74 mpg higher than their actual fuel economy with a total maximum increase per manufacturer of 1.2 mpg.[368] The flexible-fuel credit allows the auto industry to produce vehicles with lower fuel economy than CAFÉ requirements would otherwise mandate. Since manufacturers can continue to use this loophole to avoid some of the CAFE imposed fuel economy requirements, this renewable fuel requirement results in an increase in petroleum consumption. The 2005 Energy Policy Act's section 772 extended the flex-fuel credits through MY2010, and extended the Department of Transportation's authority to continue the credits through MY2014.[369] Congress extended the flex-fuel loophole until MY2019, but with a declining credit in section 109 of the Energy Independence and Security Act of 2007.[370]

In addition to federal support for ethanol production, many states provide subsidies that usually are not part of the budget process. Subsidies may be direct payments to producers, reduced fuel taxes, grants, subsidized low interest loans, requirements for the purchase of ethanol-fueled government vehicles, and mandatory ethanol content requirements for gasoline.[371]

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for E15 Ethanol 'Blender Pumps', GREEN CAR REP. (June 12, 2015), http://www.greencarreports.com/news/1098691_agriculture-department-to-spend-100-million-for-e15-ethanol-blender-pumps.

367. For example, the federal government estimates the average annual cost of fuel for a 2015 GMC Sierra 4WD to be $2,350 for the gasoline model but $3,700 for the E85 model. *See* U.S. Dep't of Energy et al., *Model Year 2015 Fuel Economy Guide*, FUEL ECON., at 20 (June 17, 2015), https://www.fueleconomy.gov/feg/pdfs/guides/FEG2015.pdf.

368. COMM. ON THE EFFECTIVENESS AND IMPACT OF CORPORATE AVERAGE FUEL ECON. (CAFE) STANDARDS, EFFECTIVENESS AND IMPACT OF CORPORATE AVERAGE FUEL ECONOMY (CAFE) STANDARDS 89 (2002), *available at* http://www.nap.edu/openbook.php?record_id=10172&page=89.

369. Energy Policy Act of 2005, Pub. L. No. 109-58, § 772, 119 Stat. 594, 834.

370. Energy Independence and Security Act of 2007, Pub. L. No. 110-140, § 109(a), 121 Stat. 1492, 1505-06 (codified at 49 U.S.C. § 32906).

371. For more information on the subsidies provided by the various states, see U.S. Dep't of Energy, *Ethanol Laws and Incentives*, ALT. FUELS DATA CTR.,

Biodiesel producers also receive state subsidies. Minnesota, for example, requires all diesel fuel sold in the state to include ten percent biodiesel (B10) from April through September and five percent (B5) during the rest of the year.[372] Pennsylvania mandates that diesel fuel contain two percent biodiesel and the biodiesel content is to increase as the productive capacity of the industry increases.[373] Illinois requires government diesel vehicles to use at least B5 when refueling in bulk. It also provides biodiesel tax exemptions. [374]

The most important subsidy for the biofuel industry is the existence of a legal mandate that requires their products to be purchased. CAA section 211(o), discussed above, requires renewable fuel, primarily ethanol, to be blended into gasoline in large quantities.[375] This is the most important part of the industry's three-part biofuel business plan: (1) use a proven technology that has been used for more than two thousand years; (2) use government subsidies to build capacity and improve efficiency while lowering the cost of production; (3) use the power of government to force consumers to buy their product. While most businesses presumably would like to have a government-backed mandate that requires consumers to buy their product, other industries have not yet persuaded Congress to provide a guaranteed market.

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http://www.afdc.energy.gov/fuels/laws/ETH (last visited June 20, 2015).

372. *See* U.S. Dept. of Energy, *Minnesota Laws and Incentives for Biodiesel*, ALT. FUELS DATA CTR., http://www.afdc.energy.gov/fuels/laws/BIOD/MN (last visited June 20, 2015).

373. *See* U.S. Dept. of Energy, *Pennsylvania Laws and Incentives for Biodiesel*, ALT. FUELS DATA CTR., http://www.afdc.energy.gov/fuels/laws/BIOD/PA (last visited June 20, 2015)

374. *See* U.S. Dept. of Energy, *Illinois Laws and Incentives for Biodiesel*, ALT. FUELS DATA CTR., http://www.afdc.energy.gov/fuels/laws/BIOD/IL (last visited June 20, 2015)

375. *See* Energy Policy Act of 2005, Pub. L. No. 109-58, § 1504(a), 119 Stat. 594, 1076-77.

VII.
CONCLUSION

The biofuel program is justified by its proponents based on five arguments: (1) it will replace imports of petroleum used for motor fuel; (2) it will spur economic development in rural areas and increase farm income; (3) it will help control fuel prices by reducing the demand for petroleum; (4) it will reduce United States dependence on foreign oil from unstable or hostile nations; and (5) it will reduce emissions of GHGs in a cost effective manner. These benefits, however, are marginal and come at a high cost. The biofuel industry uses a business model that is based on profitability resulting from government subsidies and mandated use requirements. Although biofuel subsidies are a welfare program for farmers and biofuel producers, full-time farmers have a net worth of more than ten times that of the average American household.[376]

In November 2013, the Organization for Economic Cooperation and Development (OECD) reported the cost for reducing CO_2 using biofuels was $673 per ton in the United States, compared to the use of motor fuel taxes in the European Union that cost from zero to $270 a ton.[377] The overall potential contribution of biofuel to reducing petroleum demand is minimal, and its use adds to the problems created by using food as fuel. If the United States is serious about reducing its demand for petroleum, it should aggressively pursue improved motor vehicle fuel efficiency and a shift to electric vehicles.[378]

Alternative renewable fuel programs are grossly ineffective and costly in comparison to programs to increase motor vehicle fuel efficiency. In 2005, there were 2,757 million gallons of ethanol used in gasohol; in 2011, the figure was 8,564 million gallons, which is over 98 percent of the total alternative fuel

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376. James Bovard, *Nearly All Aboard the Grainy Train*, WALL ST. J., Aug. 26, 1987, at 16.

377. Rick Mitchell, *OECD Says U.S. Biofuel Policy Less Effective Than Fuel Taxes for Cutting Auto Emissions*, 44 Env't Rep. (BNA) 3388 (Nov. 15, 2013).

378. Brian Dumaine, *China Charges into Electric Cars*, FORTUNE, Nov. 1, 2010, at 138.

oxygenates.[379] Thus fuel oxygenates contribute to about 6.55 percent of highway energy use.[380] Model year 2013 light-duty vehicles get twenty-four miles per gallon,[381] which means that an additional fuel efficiency of less than two miles per gallon would provide more GHG benefits than the biofuel program, requiring no costly subsidies. Fuel efficiency improvements should be reinforced with programs to reduce vehicle miles traveled, including land use planning to reduce the need to drive. Avoiding suburban sprawl is important because our agricultural land must feed a growing population.[382] Energy and land conservation should therefore be an essential component of an energy policy.

The corn-based ethanol fuel program is an expensive way to obtain its supposed benefits and involves the distortion of market forces to benefit a relatively small number of actors. Renewable fuel proponents have successfully substituted a government-run planned economy for the free market. This benefits neither the taxpayer nor the environment.

Second-generation biofuels have fewer environmental problems associated with their use, but their production at this time is viable only if heavily subsidized. This presents a dilemma for policymakers because the petroleum industry is mature and has benefited from massive subsidies over many years. If an emerging biofuel industry is to flourish, external support will be needed. Support should focus on research and development efforts to improve biofuel technologies and lower their cost. The relatively insignificant contribution to the nation's fuel supply made by biofuels should lead to caution when considering the desirability of costly federal subsidies, mandated purchase, and other incentives that distort the free market.

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379. DAVIS ET AL., *supra* note 47, at 2-6, tbls.2-1 & 2-4.

380. Nearly 10 percent of the gasoline is ethanol, which has two thirds of the energy of gasoline so ethanol is providing about 6.55 percent of the highway fuel energy.

381. DAVIS ET AL., *supra* note 47, at 4-10, tbl.4.10.

382. *See* David Connor & Ines Minguez, *Letters: Looking at Biofuels and Bioenergy*, 312 Science 1743, 1743 (June 23, 2006).