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Responsive Regulation and Resiliency: The Renewable Fuel Standard and Advanced Biofuels

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RESPONSIVE REGULATION AND RESILIENCY: THE RENEWABLE FUEL STANDARD AND ADVANCED BIOFUELS

*Nadia B. Ahmad**

Responsive regulation embodies a multiple stakeholder approach to creating flexible choices for regulatory regimes, ranging from the less interventionist form of self-regulation to more stringent, networked regulation. This Article addresses emerging approaches to responsive regulation, drawing examples from the current U.S. regulatory landscape. This landscape includes the Renewable Fuel Standard (“RFS”) and other futures markets. The RFS has not only guaranteed a marketplace for biofuels in the United States, but also catalyzed the rapid scale-up of biofuel use globally. Although the volatility of the market economy and disruption of emerging technologies complicate the implementation and enforcement of the national biofuel mandate, biofuels remain the most viable way to bring about a clean energy future. Evidence suggests that the U.S. government—which has increased its biofuel mandate to 19.28 billion gallons in 2017, more than a six percent increase from 2016 levels—agrees. This fact is evidence of Big Corn’s silent revolution, which it has achieved at the expense of Big Oil, largely through responsive regulation and the rise of advanced biofuels.

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I. INTRODUCTION

Mother Earth—militarized, fenced-in, poisoned, a place where basic rights are systematically violated—demands that we take action.

—Berta Cáceres, Honduran environmental activist, indigenous leader¹

For centuries, America has led the world on a long march toward freedom and democracy. Let’s reclaim our clean energy leadership and lead the world toward clean energy independence.

—John Garamendi, U.S. Congressman²

When the European Union (“EU”) implemented a biofuel mandate to address resource scarcity and energy security,³ the United States followed suit with its own program under the Renewable Fuel Standard (“RFS”).⁴ The RFS serves as the national regulatory program for biomass in the transportation sector, commonly referred to as biofuels.⁵ Increasing

¹ Yara Simón, *Remembering Slain Indigenous Rights Activist Berta Cáceres’ Most Inspirational Speech*, REMEZCLA (Mar. 2016), <http://remezcla.com/lists/culture/berta-caceres-indigenous-rights-activist/>.

² *Middle East Revolutions Demonstrate Need for American Clean Energy Revolution*, Rep. Garamendi Says in Call for National Clean Energy Plan, UNITED STATES REPRESENTATIVE JOHN GARAMENDI, CALIFORNIA’S 3RD DISTRICT (Feb. 28, 2011), <http://garamendi.house.gov/press-release/middle-east-revolutions-demonstrate-need-american-clean-energy-revolution-rep>.

³ In 2009, the EU passed binding legislation to meet its climate and energy targets for 2020, which included three primary goals: (1) twenty percent reduction in greenhouse gas emissions (from 1990 levels); (2) twenty percent target of EU energy from renewables; and (3) twenty percent improvement in energy efficiency. *2020 Climate & Energy Package*, EUROPEAN COMMISSION, http://ec.europa.eu/clima/policies/strategies/2020/index_en.htm.

⁴ James H. Stock, *The Renewable Fuel Standard: A Path Forward*, COLUM. CTR. ON GLOBAL ENERGY POL’Y (Apr. 2015), http://energypolicy.columbia.edu/sites/default/files/energy/Renewable%20Fuel%20Standard_A%20Path%20Forward_April%202015.pdf.

⁵ 42 U.S.C. §7545(o). Karl Simon, *The Renewable Fuel Standard: Implementing Challenges*, PRAC. REAL EST. LAW., Mar. 2016, at 59.

production of biofuels in the national energy mix diversifies the nation's energy portfolio and is a step toward greater energy independence.

Energy experts argue that production of renewable energy must grow dramatically over the next decades in order to address increasing energy demands and the gradual depletion of hydrocarbon resources.⁶ According to United Nations figures, 1.2 billion people do not yet have access to electricity and more than 2.7 billion people lack clean cooking facilities.⁷ Biofuels have the potential to fill that energy void, at least once they are added to the prevailing energy mix and substituted into future renewable energy targets regionally and nationally.⁸ Yet the promise of biofuels may be undercut by a lack of global food security, rising food prices, climate change, political uncertainty, increased land values, and production costs. Additionally, political support for mandatory biofuel production rates is declining throughout the E.U. and in the United Kingdom.⁹ Tertiary challenges could also hinder the RFS program.

The U.S. oil and gas industry, for example, is concerned about competition from biofuels that can threaten the industry.¹⁰ Conversely, environmentalists are discouraged by the RFS's lackluster impact on

⁶ Guyomard Hervé, Forslund Agneta & Dronne Yves, *Biofuels and World Agricultural Markets: Outlook for 2020 and 2050*, in ECONOMIC EFFECTS OF BIOFUEL PRODUCTION 129–61 (Marco Aurilio dos Santos Bernardes ed., 2011), <http://www.intechopen.com/books/economic-effects-of-%20biofuel-production/biofuels-and-world-agricultural-markets-outlook-for-2020-and-2050> (“Food demand will also increase due to population growth as our planet will host more than 9 billion people by 2050, nearly 2 billion more than today, economic growth and increased urbanization.”).

⁷ *Energy Access*, INTERNATIONAL ENERGY AGENCY, <http://www.iea.org/topics/energypoverty/> (Of those without access to electricity, more than ninety-five percent of them are either in sub-Saharan African or developing Asia, whereas nearly eighty percent reside in rural areas.).

⁸ The ideal clean energy sources are wind and solar energy due to their carbon footprint, limited negative environmental externalities and efficient use of natural resources. However, due to the intermittent nature of solar and wind power, these renewable energy sources will require a longer lag time for full and complete launch. Technologies of scale will need to be accounted for to improve the long-term durability and viability of solar and wind power programs. Until such time as solar and wind power are cost competitive with fossil fuels, these specific renewable energy resources will not be enough to provide fiscally sound energy access and energy demands. Energy sources should be able to account to for consumer usage as well as more equal opportunities to access energy. In other words, when low-income individuals and families have to choose between paying electricity bills or for groceries, the issue of human dignity re-emerges. The burden to pay for the transition to renewables may not be able to be borne by individuals and families who are struggling. As such, biofuels are a more cost-effective energy alternative since some biofuels are on price parity with fossil fuels. The economic dynamics of energy costs should be considered with the price of energy access. It is due to this concern that biofuels are a well-suited transition fuel for a clean energy future.

⁹ Mark Chesworth, *How a biofuel phase-out would hit Europe's struggling farmers*, POLITICO (Jan. 23, 2017), <http://www.politico.eu/sponsored-content/how-a-biofuels-phase-out-would-hit-europes-struggling-farmers/>.

¹⁰ Nadia B. Ahmad, *Unearthing Clean Energy*, TEDxOcala, Ocala, Florida, YOUTUBE (Nov. 4, 2016), <https://www.youtube.com/watch?v=QP39lio396s>.

carbon emissions and deforestation. Despite these challenges, the Department of Energy (“DOE”) “estimates that roughly 900 million metric tons of animal waste and inedible plant materials are available each year—a renewable resource that could make about 300 billion liters of ethanol.”¹¹

In response, U.S. President Donald Trump considered a plan by Carl Icahn and the Renewable Fuels Association.¹² This plan would transfer the point of obligation from refiners to fuel blenders.¹³ The Renewable Fuels Association has agreed to support the plan in exchange “for a waiver allowing gasoline blends containing fifteen percent ethanol—called E15—to be sold year-round in U.S. markets.”¹⁴ The year-round access to E15 would increase the marketplace for ethanol. Nevertheless, both fossil fuel lobbyists and environmental advocates have questioned the utility of the RFS program. Opponents argue such a change would impact the regulation of advanced biofuels: those fuels derived from algae, seaweed, food waste, or other plant and animal residues.

While use of advanced biofuels has expanded in recent years, they have yet to gain deep market penetration. One reason for this is the failure of existing regulatory tools to improve their scalability. This Article seeks to address the regulatory lag and innovation gap, and to explore ways to incentivize the production, refinement, and use of advanced biofuels, with specific attention paid to algal, cellulosic, and waste-based biofuels.

Advanced biofuels are unique in that they do not have the same negative consequences as conventional biofuels, which are used to produce sugar- and corn-based ethanol. The negative consequences of conventional biofuels, which are drawn from agricultural and forest resources, are well documented and include food shortages, deforestation, violent conflicts, urban riots, rural protests, and rising food costs.¹⁵

¹¹ David Biello, *Whatever Happened to Advanced Biofuels?*, SCIENTIFIC AMERICAN (May 26, 2016), <https://www.scientificamerican.com/article/whatever-happened-to-advanced-biofuels/> (noting advanced biofuels can use existing engines, pipelines, pumps, and refineries, reducing greenhouse gas emissions by sixty to ninety-five percent compared to fossil fuels).

¹² Chris Prentice & Jennifer Ablan, *U.S. ethanol group clashes with Icahn over details of biofuels negotiation*, REUTERS (Mar. 2017), <http://www.reuters.com/article/us-usa-biofuels-icahn/u-s-ethanol-group-clashes-with-icahn-over-details-of-biofuels-negotiation-idUSKBN16A2IS>.

¹³ Jennifer Dlouhy & Mario Parker, *Trump Said to Consider Biofuel Plan*, BLOOMBERG (Feb. 27, 2017), <https://www.bloomberg.com/news/Articles/2017-02-28/trump-said-to-consider-biofuel-plan-between-icahn-ethanol-group> (“Icahn has pushed to shift the burden for complying with the biofuel quotas from refiners to fuel blenders.”).

¹⁴ *Id.*

¹⁵ *Biofuel*, GLOBAL GREENHOUSE WARMING, <http://www.global-greenhouse-warming.com/biofuel.html>. In a previous paper I refer to these as “blood biofuels” because of their

This Article will explain how the RFS can help to create a viable alternative to conventional biofuels. The basic idea is that the RFS is an illustrative example of responsive regulation, which incorporates the perspectives of multiple stakeholders. By doing so, this Article argues that the RFS may help create more flexible institutional arrangements, ranging from less exacting self-regulation to more stringent networked regulation.¹⁶ If correct, other global mechanisms for achieving biofuel targets also may employ this new regulatory model.

This Article proceeds in three parts. Part II provides an introduction to the RFS program and suggests interagency collaborations and public and private partnerships through responsive regulation theory. Part III analyzes the role of policy changes in creating a low-carbon energy future through the use of advanced biofuels by examining proposals to amend the RFS. Part IV delves into emerging approaches to the RFS for privatization of biofuels standards along with economic factors and international investment and innovation for advanced biofuels.

The aim of advanced biofuels policy research is to put the needed technical and procedural tools in the hands of policy leaders, academics, scientists, and students whose ideas can create new thinking for the bioeconomy that will affect, in large measure, the quality of life, the economy, and the public health of communities of the future.¹⁷ The U.S. government estimates that nearly a billion tons of waste biomass are available each year—a resource that could meet thirty percent of the fuel needs of the country.¹⁸ Because of soaring energy demands, infrastructure and urban planning will have to account for the diversification of the energy portfolio to include advanced biofuels.

negative effect on the “energy poor.” Nadia B. Ahmad, *Blood Biofuels*, 17 DUKE ENVTL L. & POL’Y FORUM (2017). Modern energy policy aims to increase the production and use of biofuels i.e., any fuel produced from biological materials. Agriculture and forest biofuels can be as environmentally and socially devastating as the finite fossil fuel resources they seek to replace. The globalization impacts of agriculture and forest biofuels of “land grabs, food security, greenhouse gas emissions, drought, deforestation, interference with climate change adaptation measures, population displacement, desertification, sea level rise, biodiversity, and scalability” are often overlooked.

¹⁶ JOHN BRAITHWAITE, *REGULATORY CAPITALISM: HOW IT WORKS, IDEAS FOR MAKING IT WORK BETTER* 163–65 (2008).

¹⁷ The term “bioeconomy” refers to the “integral role of abundant, sustainable, domestic biomass in the U.S. economy” and more specifically the “global industrial transition of sustainably utilizing renewable aquatic and terrestrial biomass resources in energy, intermediate, and final products for economic, environmental, social, and national security benefits.” BIOMASS RESEARCH & DEVELOPMENT BOARD, <https://biomassboard.gov/index.html>.

¹⁸ U.S. DEPARTMENT OF ENERGY OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, *2016 BILLION-TON REPORT: ADVANCING DOMESTIC RESOURCES FOR A THRIVING BIOECONOMY* (July 2016), at vii, <https://energy.gov/eere/bioenergy/downloads/2016-billion-ton-report-advancing-domestic-resources-thriving-bioeconomy>.

II. THE REGULATORY LANDSCAPE OF THE RENEWABLE FUEL STANDARD

The negative environmental and social costs of conventional biofuels are greatly underestimated. Conventional biofuels require mitigation under climate change adaptation measures and reconsideration of food security efforts. Accounting for such environmental externalities is closely tied to the concept of sustainable development, defined by the United Nations as, “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”¹⁹ The future impacts of biofuels, including greenhouse gas emissions, deforestation, population displacement, and food security must be included in the calculus of sustainable development. Principle 15 of the Rio Declaration on Environment and Development acknowledged the inadequacy of decision-making processes regarding socio-environmental issues and the necessity to actively deal with the irreversibility of techno-scientific experimentation.²⁰ Melissa Powers warns that in assessing the global consequences of U.S. agricultural and biofuel policies, agriculture-based ethanol does not significantly improve efforts to reduce greenhouse gas emissions.²¹ Because the United States serves as a major agricultural exporter, many developing nations rely on the United States for essential food needs.²² In examining the national RFS program, these global food security and climate change impacts are foundational.

A. Legal Overview of the Biofuel Mandate

The decade-long boom in ethanol production arose from the national biofuel mandate, which, along with tax incentives and rising energy

¹⁹ BRUNDTLAND COMMISSION, OUR COMMON FUTURE: REPORT OF THE WORLD COMMISSION ON ENVIRONMENTAL & DEVELOPMENT, U.N. Doc. A/42/427 (Oct. 1987).

²⁰ Alice Bernessia, *From Certainty to Complexity: Science and Technology*, in A DEMOCRATIC SOCIETY IN SCIENCE, SOCIETY AND SUSTAINABILITY: EDUCATION AND EMPOWERMENT FOR AN UNCERTAIN WORLD 15–16 (Donald Gray, Laura Colucci-Gray & Elena Camino eds., 2009). Principle 15 of the Rio Declaration on Environment and Development states:

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious and irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation. *Id.*

²¹ Melissa Powers, *King Corn: Will the Renewable Fuel Standard Eventually End Corn Ethanol's Reign?*, 11 VT. J. ENVTL. L. 667, 669 (2010) (citing FRIENDS OF THE EARTH EUROPE, AGROFUELS: FUELING OR FOOLING EUROPE? THE PROBLEMS OF USING PLANT-BASED OILS IN POWER STATIONS AND VEHICLES 3–4).

²² *Id.* (citing U.N. ENVIRONMENT PROGRAMME, TOWARDS SUSTAINABLE PRODUCTION & USE OF RESOURCES: ASSESSING BIOFUELS 23 (2009); James Kanter, *Europeans Reconsider Biofuel Goal*, N.Y. TIMES (July 8, 2008), <http://www.nytimes.com/2008/07/08/business/worldbusiness/08fuel.html>).

demands, created a guaranteed market for biofuels.²³ The RFS program was established under the Energy Policy Act of 2005 (“EPAct”),²⁴ amending the Clean Air Act (“CAA”),²⁵ and then expanded under the Energy Independence and Security Act of 2007 (“EISA”).²⁶ The Environmental Protection Agency (“EPA”) implements the program in consultation with U.S. Department of Agriculture and the Department of Energy.²⁷ The current RFS program requires refiners and importers to satisfy annual biodiesel and ethanol quotas.²⁸ Refiners are affected unevenly by these mandates.²⁹ Every year, the EPA updates RFS-mandated volumes into percentage standards that obligated parties use to fix compliance obligations, or renewable volume obligations (“RVOs”).³⁰ EPA utilizes Renewable Identification Numbers (“RINs”) to monitor renewable transportation fuels for compliance with RVOs.³¹ Obligated parties must satisfy the requisite RINs each year to meet RFS compliance obligations by various measures, “including through the blending of

²³ Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program, 74 Fed. Reg. 24,904, 25,042 (May 26, 2009) (codified at 40 C.F.R. pt. 80).

²⁴ 42 U.S.C. § 7401 *et seq.* (2012).

²⁵ 42 U.S.C. § 17001 *et seq.* (2007).

²⁶ *Overview for Renewable Fuel Standard Program*, U.S. ENV'T'L PROT. AGENCY, <https://www.epa.gov/renewable-fuel-standard-program/program-overview-renewable-fuel-standard-program#structure>.

²⁷ News Release, EPA Finalizes Increased in Renewable Fuel Volumes (Nov. 23, 2016), <https://www.epa.gov/newsreleases/epa-finalizes-increase-renewable-fuel-volumes>.

²⁸ Renewable Fuel Standard Program: Standards for 2017 and Biomass-Based Diesel Volume for 2018, 40 C.F.R. § 80 (2016), <https://www.federalregister.gov/documents/2016/12/12/2016-28879/renewable-fuel-standard-program-standards-for-2017-and-biomass-based-diesel-volume-for-2018>.

²⁹ American Fuel and Petroleum Institute, Petition for Rulemaking: Renewable Fuel Standard Definition of Obligated Party – 40 C.F.R. § 80.1406 (Aug. 4, 2016), <https://www.afpm.org/uploadedFiles/Content/documents/20160804%20AFPM%20RFS%20Point%20of%20Obligation%20-%20Petition%20for%20Rulemaking%20FINAL.pdf>.

³⁰ RANDY SCHNEPF & BRENT D. YACOBUCCI, CONG. RESEARCH SERV., R40155, Renewable Fuel Standard (RFS): Overview and Issues (Mar. 14, 2013), <https://fas.org/sgp/crs/misc/R40155.pdf>.

³¹ *Renewable Identification Numbers*, U.S. DEP'T OF ENERGY, ALTERNATIVE FUELS DATA CTR., <http://www.afdc.energy.gov/laws/RIN.html>. RINs can only be generated if it can be established that the feedstock from which the fuel was made meets EISA's definitions of renewable biomass, including land restrictions. The feedstock affirmation and record-keeping requirements apply to RINs generated by both domestic renewable fuel producers and RIN-generating foreign renewable fuel producers or importers. After a RIN is created by a biofuel producer or importer, it must be reported to the EPA (usually on a quarterly basis). When biofuels change ownership (e.g., are sold by a producer to a blender), the RINs are also transferred. When a renewable fuel is blended for retail sale or at the port of embarkation for export, the RIN is separated from the fuel and maybe used for compliance or trade. SCHNEPF & YACOBUCCI, *supra* note 30.

renewable fuel into transportation fuel or the purchase of RINs from other parties.”³²

As a part of a broad package of energy legislation in the 2005 EPAct, Congress created the first RFS (“RFS1”), requiring “gasoline producers, importers, and refiners to mix up to four billion gallons of biofuels into gasoline in 2005 and up to 7.5 billion gallons by 2012.”³³ In 2007, Congress passed EISA, enhancing renewable fuel production and use requirements (“RFS2”) by the EPA.³⁴ The four initial fuel categories included in the RFS program were renewable fuel, biomass-based diesel, cellulosic biofuel, and advanced biofuel.³⁵ In order to qualify as renewable fuel, the fuel has to “be produced from renewable biomass, replace transportation fuel or heating oil, and reduce greenhouse gas emissions by 20% compared to a 2005 baseline.”³⁶ The advanced biofuel category includes cellulosic biofuel and biomass-based diesel.³⁷

Fuel standards under RFS are based on a fixed percentage and are used by each refiner, blender, or importer to determine their renewable fuel volume obligations.³⁸ If each regulated party satisfies the percentage obligations, and if the Energy Information Agency (“EIA”) projections of gasoline and diesel use are correct, then the amount of renewable fuel, cellulosic biofuel, biomass-based diesel, and advanced biofuel used will meet the nationwide volumes mandates.³⁹ Additionally, CAA § 201(o) necessitates each of the mandated volumes of renewable fuels obtain

³² American Fuel and Petroleum Institute, *supra* note 29, at 2. Through the existing RFS program, some blenders that do not themselves refine fuels can create RINs when they mix in biofuels, which can then be sold as compliance credits to refiners to meet obligations. Dlouhy & Parker, *supra* note 13.

³³ Energy Policy Act of 2005 § 1501, 42 U.S.C. § 7545(o)(2)(B)(i) (2006) (amending the Clean Air Act). Powers, *supra* note 21, at 681–82.

³⁴ Regulation of Fossil Fuel Additives, 74 Fed. Reg. at 24,908. EISA modified the RFS by specifying more stringent standards for the production of advanced biofuels and by establishing greenhouse gas emission thresholds. EISA had a loophole for existing corn ethanol facilities to be grandfathered from the new emission requirements. As a result, corn ethanol kept its status as the primary biofuel in the United States until today. Powers, *supra* note 21.

³⁵ Brent J. Hartman, *The Renewable Fuel Standard: Food Versus Fuel?*, 65 ME. L. REV. 525, 530 (2013). The EPA refers to the categories as “nested” in that they are not exclusive. “Fuel qualifying as advanced biofuel must reduce greenhouse gas emissions by 50% and use any renewable biomass feedstock, with the exception of cornstarch. The category is very broad as it is essentially a catch-all category for biofuels other than cornstarch ethanol, the most prevalent biofuel.” *Id.*

³⁶ *Id.*

³⁷ *What is a Fuel Pathway?*, U.S. ENVT’L PROT. AGENCY, <https://www.epa.gov/renewable-fuel-standard-program/what-fuel-pathway>.

³⁸ *Annual Compliance Data for Obligated Parties and Renewable Fuel Exporters under the Renewable Fuel Standard (RFS) Program*, U.S. ENVT’L PROT. AGENCY, FUELS REGISTRATION, REPORTING, AND COMPLIANCE HELP (Dec. 12, 2016), <https://www.epa.gov/fuels-registration-reporting-and-compliance-help/annual-compliance-data-obligated-parties-and/>.

³⁹ *Id.*

minimum thresholds of greenhouse gas emission standards.⁴⁰ The minimum life cycle greenhouse gas emission standard based as a percentage reduction from the baseline, is stated as follows: twenty percent for renewable fuels; fifty percent for advanced biofuels; fifty percent for biomass-based diesel; and sixty percent for cellulosic biofuels.⁴¹

In 2013, EPA updated the RFS to include more possibilities to create production pathways to satisfy one or more of the greenhouse gas emission reduction thresholds specified under CAA § 211(o).⁴² The required assessment of emission performance must encompass the full lifecycle emission impacts of fuel production, including significant emissions from land use changes.⁴³ The 2013 updates add renewable gasoline and renewable gasoline blend stock as new fuel types under the RFS program.⁴⁴ In addition to being made from an approved source material, the update to the program requires the use of specific production processes to render renewable gasoline and renewable gasoline blend

⁴⁰ *New Renewable Fuel Production Pathways Approved Under EPA's Renewable Fuel Standard Program*, 23 AIR POLLUTION CONSULTANT 2.28 (2013) (“The evaluation of renewable fuel greenhouse gas emission performance must include the full lifecycle emission impacts of fuel production, including significant emissions from land use changes.”).

⁴¹ *Id.* (“The 20% criterion for renewable fuels generally applies only to renewable fuel from new facilities that commenced construction after December 19, 2007.”).

⁴² *Id.* Under CAA § 211(o), renewable fuels must meet the required minimum thresholds of greenhouse gas emission criteria. *Id.* Production pathways involve the technology to convert renewable biomass to renewable fuel. *What is a Fuel Pathway?*, ENV'T'L PROT. AGENCY, <https://www.epa.gov/renewable-fuel-standard-program/what-fuel-pathway>.

⁴³ *New Renewable Fuel Production Pathways*, *supra* note 40. See also ALEXANDER E. FARRELL & DANIEL SPERLING, A LOW-CARBON FUEL STANDARD FOR CALIFORNIA, PART 2: POLICY ANALYSIS (Aug. 2, 2007), http://www.energy.ca.gov/low_carbon_fuel_standard/UC_LCFES_study_Part_2-FINAL.pdf (The term life cycle encompasses all activities “in the production, transport, storage and use of the fuel.” A more thorough analysis includes “energy embodied in the materials used in all these activities through their own production, such as batteries in electric vehicles, tractors used for cultivating the biofuel crops, and oil refinery equipment.”). A Food and Agriculture Organization report finds that “the impact of biofuels on greenhouse gas emissions varies widely, depending on where and how the various feedstock crops are produced.” FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, THE STATE OF FOOD AND AGRICULTURE 22 (2008), <ftp://ftp.fao.org/docrep/fao/011/i0100e/i0100e.pdf>.

⁴⁴ Regulation of Fuels and Fuel Additives: Identification of Additional Qualifying Renewable Fuel Pathways Under the Renewable Fuel Standard Program, 78 Fed. Reg. 14,190, 14,190–01 (Mar. 5, 2013) (To qualify as a renewable fuel under the renewable fuel standard program, renewable gasoline and renewable gasoline blendstock can be created from crop residue, slash, pre-commercial thinnings, tree residue, annual cover crops, and cellulosic components of separated yard waste, separated food waste, and separated municipal solid waste.).

stock.⁴⁵ To qualify as a renewable fuel, the processes have to “use natural gas, biogas, and/or biomass as the only process energy sources.”⁴⁶

A 2016 report from the EPA’s Office of Inspector General raised concerns that the EPA failed to meet statutory reporting obligations for identifying the environmental impacts of the RFS.⁴⁷ The EPA’s Office of Research and Development must report to Congress every three years regarding the effects of biofuels.⁴⁸ EPA submitted a report to Congress in 2011, but failed to submit subsequent reports.⁴⁹ The RFS reporting requirement provides for an objective analysis on environmental impacts and unintended consequences of U.S. biofuel policy.⁵⁰ EPA’s Office of Air and Radiation has also not fulfilled anti-backsliding requirements, intended “to analyze and address any negative air quality impacts of RFS.”⁵¹ This office suggested that there would be “minimal utility in updating the 2010 analysis,” because approximately 80 percent of the biofuels blended with the gasoline supply today are “grandfathered” into the RFS, such that they do not have to meet any additional greenhouse gas emissions reduction requirements.⁵² Stakeholders, however, have pushed for these analyses to support their positions for expanded biofuel usage, noting that scientific innovation and updated data show that the difference in greenhouse gasses emissions between biofuels and traditional gasoline is even greater than initially thought.⁵³

Another factor to consider in changes to the RFS program is that not all biofuels are the same in terms of size and source. Because of equivalence values, a RIN-gallon can be larger than a standard gallon.⁵⁴ EPA assumed a value system “to level the playing field” so that “the

⁴⁵ *New Renewable Fuel Production Pathways*, *supra* note 40 (Allowable production processes include: “thermochemical pyrolysis, thermochemical gasification, biochemical direct fermentation, or biochemical fermentation with catalytic upgrading.”).

⁴⁶ *Id.*

⁴⁷ U.S. ENV’T L PROT. AGENCY OFFICE OF INSPECTOR GENERAL, REPORT NO. 16-P-0275, EPA HAS NOT MET CERTAIN STATUTORY REQUIREMENTS TO IDENTIFY ENVIRONMENTAL IMPACTS OF RENEWABLE FUEL STANDARD 4 (Aug. 18, 2016), https://www.epa.gov/sites/production/files/2016-08/documents/_epaog_20160818-16-p-0275.pdf.

⁴⁸ *Id.*

⁴⁹ *Id.* at 9.

⁵⁰ *Id.* This level of analysis is paramount because of conflicting scientific opinions about biofuel impacts, potential impacts outside of the EPA’s regulatory control, and divergent RFS interests. The EPA does not have an assessment that satisfies the requirement to identify whether RFS has any impacts on air quality, and if so, necessitates mitigation impacts. *Id.* at 2.

⁵¹ *Id.* at 7 (In 2010, the EPA completed a comprehensive lifecycle analysis to determine greenhouse gas reduction thresholds for RFS.).

⁵² Rebecca Chillrud, *Inspector General: EPA Has Failed to Report on the Impact of Ethanol, RFS*, ENVTL. & ENERGY STUDY INST. (Aug. 26, 2016), <http://www.eesi.org/articles/view/inspector-general-epa-has-failed-to-report-on-the-impact-of-ethanol-rfs>.

⁵³ *Id.*

⁵⁴ *See* How are equivalence values assigned to renewable fuel?, 40 C.F.R. § 80.1415 (2010).

equivalence value is determined by the fuel's energy output in comparison with ethanol, assigned an equivalence value of 1.0."⁵⁵ The EPA's formula for energy content determines the equivalence value for all renewable fuel types that "have not assigned an equivalence value in existing regulations."⁵⁶ Equivalence values will be pivotal in ensuring compliance with RFS goals.⁵⁷ Interagency collaboration and public-private partnerships will also enhance compliance and enforcement mechanisms to achieve these targets.

B. The Learning Curve for Interagency Collaboration

Trust and confidence form the soil from which collaboration grows. The essence of collaboration is joint effort towards a common goal, which means we are reliant on each other. If we don't trust the other to follow through, if we don't have confidence in the other's abilities, it won't work.

—Russell Linden, management educator⁵⁸

Interagency collaboration will be crucial for promoting increased development of sustainable biofuels. Interagency collaboration creates the ability to jointly accomplish a mission that one agency acting alone could not.⁵⁹ Benefits of collaboration include: conservation of scarce capital; avoidance of duplicated efforts; opportunity for the agency to create new programs that would otherwise be unfeasible; higher-quality outcomes; integration of unique ideas for greater assessment of the situation; enhanced communication; improved trust and understanding; greater capacity for learning; and higher likelihood to accomplish vital missions.⁶⁰

⁵⁵ Hartman, *supra* note 35, at 531 (citing Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program, 77 Fed. Reg. 14,670, 14,709–10 (Mar. 26, 2010); 40 C.F.R. § 80.1415(b)(1)). In other words, one standard gallon of biodiesel (mono-alkyl ester) equals 1.5 RIN-gallons, or ethanol-equivalent gallons. See 40 C.F.R. § 80.1415(b)(2).

⁵⁶ See 40 C.F.R. § 80.1415(c)(1).

⁵⁷ Hartman, *supra* note 35, at 531.

⁵⁸ RUSSELL LINDEN, WORKING ACROSS BOUNDARIES: MAKING COLLABORATION WORK IN GOVERNMENT AND NONPROFIT ORGANIZATION 42 (2002), <https://books.google.com/books?id=tqIsJAHcxH0C&printsec=frontcover#v=onepage&q&f=false>.

⁵⁹ *Environmental Health: Pulling Together*, NATIONAL ASSOCIATION OF COUNTY & CITY HEALTH OFFICIALS (2017), <http://archived.naccho.org/topics/environmental/pullingtogether/sectiontwo.cfm>. See generally UNITED NATIONS, ACHIEVING SUSTAINABLE DEVELOPMENT AND PROMOTING DEVELOPMENT COOPERATION: DIALOGUES AT THE ECONOMIC AND SOCIAL COUNCIL (2008).

⁶⁰ *Environmental Health: Pulling Together*, *supra* note 59.

Existing federal agency partnerships for advanced biofuels have already produced positive outcomes.⁶¹ The U.S. Department of Agriculture (“USDA”) has been working with the U.S. Department of the Navy and Department of Energy (“DOE”) to develop advanced, drop-in biofuels for flight and marine use.⁶² With the Farm to Fly Agreement with the Federal Aviation Administration and commercial sector partners, USDA continues to work “across the supply chain to accelerate the development of commercial scale, cost-competitive aviation biofuels that will create competition in the marketplace and reduce costs with a cleaner alternative to jet fuel.”⁶³

Another interagency collaboration’s efforts seek to penetrate the biofuel supply chain in the areas of feedstock production⁶⁴ and related activities: logistics,⁶⁵ conversion,⁶⁶ distribution,⁶⁷ and end use.⁶⁸ The Biomass Research and Development Board seeks “to provide the interagency leadership to steer biofuels development on a sustainable path through the compilation and evaluation of biofuels sustainability criteria, benchmarks and indicators.”⁶⁹ In fact, “[i]nteragency studies suggest[ed] that the United States has enough indigenous biomass to meet

⁶¹ *Acting Under Secretary Discusses USDA’s Role in Building Support for Aviation Biofuels*, U.S. DEPT. OF AGRIC. (July 2, 2013), <http://content.govdelivery.com/accounts/USDAOOC/bulletins/81dbbe/>.

⁶² *Id.*

⁶³ *Id.* (USDA seeks “to enable commercially viable, sustainable bio-Jet Fuel supply chains in the U.S. that are able to support the goal of one billion gallons of bio-Jet Fuel production capacity and use for the Aviation Enterprise by 2018.”).

⁶⁴ “Feedstock production includes comprises the cultivation of biomass resources such as corn, crop residues, and woody residues used as raw material inputs for biofuels production.” BIOMASS RESEARCH AND DEVELOPMENT BOARD, NATIONAL BIOFUELS ACTION PLAN 3 (Oct. 3, 2008), <http://www.afdc.energy.gov/pdfs/nbap.pdf>.

⁶⁵ Feedstock Logistics entails “harvesting or collecting feedstock from the area of production, processing it for use in biorefineries, storing it between harvests, and delivering it to the plant gate.” *Id.*

⁶⁶ Conversion includes “the transformation of the processed feedstock to liquid fuels. Currently, cellulosic ethanol and other technologies essential to achieving the EISA production targets are too costly to compete effectively in the marketplace. Because the pace of technological breakthroughs required to lower costs is inherently uncertain, the availability of advanced technologies to contribute to the EISA goal on an economically and ecologically sustainable basis cannot be assumed.” *Id.*

⁶⁷ Distribution focuses on “the transfer of the fuel from the biorefinery to the point of retail sale. A network of trucks, trains, barges, blending and storage terminals, and, possibly, pipelines, must be able to handle significant volumes safely and economically.” *Id.*

⁶⁸ “End Use is the purchase of biofuels by the consumer for use in either traditional vehicles at low level blends or vehicles that are specially modified to accommodate higher biofuels blends.” *Id.*

⁶⁹ *Id.* at 4. The Board activities “promote close coordination among federal and state agencies and industry to identify best agricultural and land use practices and the most efficient production, conversion, transportation and storage systems that assure economic growth and viability of the biofuel system while protecting ecosystem and human health.” *Id.*

the EISA targets.”⁷⁰ In order to satisfy these targets, the USDA recommends additional interagency work in four key activities: 1) “environmental implications and balance between food, feed, and fiber” for first generation feedstocks; 2) availability and cost of second generation feedstocks to qualify plant siting opportunities; 3) development of third generation feedstocks to resist drought and stress, to enhance fertilizer and water use efficiencies, and offer efficient conversion; and 4) better yields of feedstocks for support future targets.⁷¹

Interagency collaborations would promote improvements to innovation and investment of biofuel resources at various stages of production, distribution, and use. Biofuels may still be competitive with fossil fuels as an energy resource for consumer use without adequate incentives and collaboration mechanisms, but to intensify their availability and long-term scalability would require a sustained level of collaboration which cannot be accomplished by the EPA or USDA acting independently. Such cooperative activity is a cost-effective way to enhance energy security and improve energy access. The next step beyond interagency collaboration would be to ratchet up public-private partnerships.

C. Reassessment of Public-Private Partnerships

While interest for public-private partnerships has been growing steadily through the late 1980s and 1990s, the concept was first used by the U.S. government in the 1970s to spur private investment in inner-city infrastructure.⁷² Economists caution against over-simplifying the concept of public-private partnerships as steps toward privatization. Stephen Linder warns, “To say that partnerships are yet another anti-liberal effort to shrink the state by privatizing its functions is to misconstrue the significance of the partnership idea.”⁷³ Importantly, the success of public-

⁷⁰ *Id.* at 5.

⁷¹ *Id.*

⁷² Stephen H. Linder, *Coming to Terms with the Public-Private Partnership*, 43 AM. BEHAV. SCIENTIST 35, 35–36 (1999), http://cityextension.osu.edu/sites/urban/files/imce/Coming%20to%20terms%20with%20public%20private%20partnership_4_20.pdf. “The idea of government and business partnering for some common purpose evokes images of wartime solidarity and memories of small time life in America, where business and local government shared talent and community responsibilities.” *Id.* at 36. See also William D. Eggers, *The New Public-Private Landscape*, in ANNUAL PRIVATIZATION REPORT 2006 35–36 (Reason Foundation, 2006).

⁷³ Linder, *supra* note 72, at 37 (Linder argues that stretching one sector by limiting another is not a precise, because the definitions of the sectors themselves are changing. Then he points out the partnership advocates address ideas for new positions and structures for the public manager role for leveraging private investments for public policy programs.) See generally HARVEY FEIGENBAUM, JEFFREY HENIG & CHRIS HAMNETT, *SHRINKING THE STATE: THE POLITICAL UNDERPINNINGS OF PRIVATIZATION* (1998).

private partnerships is dependent upon their implementation as much as their conceptualization. Actualizing surplus value in public-private partnerships requires cooperation between actors through active investment by the parties and linkages between the interactions.⁷⁴ Erik-Hans Klijn and Geert Teisman contend, “Only if [public private partnerships] utilise their means, link their interests and problem definitions, and pursue mutually interesting solutions, will these actors invest in cooperation.”⁷⁵

When public-private partnerships were created to improve the shared network for nationwide broadband communications, the partnerships benefited from new funding sources and new economies of scale for constructing the desired network.⁷⁶ The build-out requirements by the Federal Communications Commission (“FCC”) are similar to the RFS obligations and volumes issued by the EPA in that they establish defined benchmarks. The FCC issued plans to oversee the public-private partnerships through “enforcing existing rules or creating new rules as circumstances warrant in the future.”⁷⁷ Telecommunications analyst Linda Moore stated that the congressional role would be to offer guidance to the FCC commissions by different avenues.⁷⁸ A similar level of congressional oversight and guidance would benefit the RFS program in the oversight of public-private partnerships. This oversight would also have to factor “overcoming mistrust between the public and private sectors,” “developing management capacity,” and organizing contracting to weigh in on the heterogeneity of the private sector.⁷⁹

Such partnerships can be constrained by divergent goals and competing interests between public and private actors. To attract

⁷⁴ Erik-Hans Klijn & Geert R. Teisman, *Institutional and Strategic Barriers to Public-Private Partnership: An Analysis of Dutch Cases*, 16 BRIT. ACAD. MGMT. CONF. 1, 3 (2002), <https://repub.eur.nl/pub/10259/BSK-CDMN-2007-004.pdf>. In examining various Dutch cases studies, Klijn and Teisman found that the partnership is promoted as an arrangement “to create a high-quality and synergetic regeneration process,” but in actuality, these partnerships resulted in “loosely linked forms of interaction and bilateral negotiations in which all parties play their traditional roles.” *Id.* at 8. See also CHRISTEL LANE & REINHARD BACHMAN, TRUST WITHIN AND BETWEEN ORGANIZATIONS: CONCEPTUAL ISSUES AND EMPIRICAL APPLICATIONS (1998).

⁷⁵ Klijn & Teisman, *supra* note 74, at 3.

⁷⁶ LINDA K. MOORE, PUBLIC-PRIVATE PARTNERSHIP FOR A PUBLIC SAFETY NETWORK: GOVERNANCE AND POLICY 1 (2007).

⁷⁷ *Id.* at 17 (These enforcement techniques by the FCC included “litigation, revocation of license, or other means that might be supported by a reading of the Communications Act.”) “The Balanced Budget Act of 1997 [gave] the FCC authority to conduct auctions, set performance requirements, and evaluate the qualifications of licensees.” *Id.* at 17 n.98 (citing 47 U.S.C. § 309(j), especially (3)–(5) (2012)).

⁷⁸ MOORE, *supra* note 76, at 17.

⁷⁹ Monika Sharma & Anita Bindal, *Public-Private Partnership*, 7 INT’L J. RES. 1270, 1271–1272 (2014).

competitive private sector investment, an enabling framework is necessary.⁸⁰ There are multiple stages of public-private partnership development, the advancement of which may require oversight.

One of the earlier public-private partnerships for advanced biofuels was established by former Colorado Governor Bill Ritter and the Colorado Center for Biorefining and Biofuels. Together they engaged both private business and the Colorado Renewable Energy Collaboratory, which itself was a collaboration between the federal National Renewable Energy Laboratory, the Colorado School of Mines, the University of Colorado at Boulder, and Colorado State University.⁸¹ Rick Zalesky, vice president of Chevron, one of the participating companies, said of the initiative: “We need every molecule we can find that we can bring to market.”⁸² Stating the research would “help oil companies expand their business opportunities and provide a new source of fuel.”⁸³ As another example, the Arizona Center for Algae Technology and Innovation at Arizona State University and the UTEX Culture Collection of Algae at the University of Texas at Austin have provided a comprehensive workshop program through the DOE-sponsored Algae Testbed Public-Private Partnership.⁸⁴ These workshops offer an array of topics pertaining to the management and processing of microalgal cultures, and uses of their products, which include laboratory and field training led by algae experts, biochemists, and engineers.⁸⁵

These initiatives support the same goals articulated in two 2010 Memorandum of Understandings (“MOUs”) that the U.S. Department of Defense (“DOD”) entered into with the DOE, and subsequently with the U.S. Department of Interior (“DOI”).⁸⁶ The DOE MOU highlighted the “expedient development of innovative energy technologies, including renewable energy technology, to better enforce energy security because

⁸⁰ *Id.* at 1273–74 (The enabling framework for public private partnerships can be created through model documents, an appraisal system, and funding scheme for the viability gap.).

⁸¹ The Associated Press, *Colleges Join Public-Private Partnership for Biofuels Research*, DENVER POST (Mar. 19, 2007), <http://www.denverpost.com/2007/03/19/colleges-join-public-private-partnership-for-biofuels-research/>.

⁸² *Id.*

⁸³ *Id.*

⁸⁴ *Algae Testbed Public-Private Partnership (ATP3) Workshop*, ADVANCED BIOFUELS USA (Mar. 10, 2016), <http://advancedbiofuelsusa.info/algae-testbed-public-private-partnership-atp3-workshop-may-16-20-2016-santa-fe-and-los-alamos-nm/>.

⁸⁵ *Id.*

⁸⁶ Memorandum of Understanding Between the Dep’t of Def. & the Dep’t of the Interior on Renewable Energy & a Renewable Energy P’ship Plan, at 1 (July 20, 2012) [hereinafter DOI MOU], <http://perma.cc/S9SP-HLS3>; Memorandum of Understanding Between U.S. Dep’t of Energy & U.S. Dep’t of Def. Concerning Cooperation in a Strategic P’ship to Enhance Energy Sec., at 1 (July 22, 2010) [hereinafter DOE MOU], <http://perma.cc/R6RJ-9G9V>.

energy efficiency has the ability to serve as a ‘force multiplier.’”⁸⁷ Meanwhile, the DOI MOU sought to have agencies work together to establish renewable energy resources on public lands held by the DOD and lands, both onshore and offshore, held by the DOI that have been withdrawn for defense purposes through cooperation with the U.S. Bureau of Land Management (“BLM”).⁸⁸ This MOU developed the Renewable Energy Partnership Plan to identify and harness proven solar, wind, geothermal, and biomass resources on or near DOD installations.⁸⁹

Overall, public-private partnerships in the United States have not been as successful in the energy sector as in other industries. This is due in particular to weak incentives in place for private entities in the energy sector, the lack of a streamlined legal and regulatory framework, and the lack of flexible funding options.⁹⁰ The weak incentives result from the short-time horizon for energy infrastructure projects.⁹¹ A way to bridge this gap would be to incorporate biofuel and energy infrastructure projects into larger projects through the U.S. Department of Transportation and USDA, which have a proven string of successful project outcomes. Doing so would provide an additional means to incentivize advance biofuels through existing programs at the federal, state and local levels.

Florida provides an example of successful transportation partnerships at the state level. Florida gives grants to counties to improve highway facilities or reduce traffic through the County Incentive Grant Program. One of the criteria the Florida Department of Transportation must consider for this program is the “extent to which the financial assistance would foster innovative public-private partnerships and attract private

⁸⁷ DOE MOU, *supra* note 86, at 2–4; Ashleigh Acevedo, Note, *Enlisting Renewable Energy: The Military’s Environmental Exceptionalism and a Renewable Energy Initiative in the Face of a National Security Threat*, 45 TEX. ENVTL. L.J. 343, 358 (2015).

⁸⁸ DOI MOU, *supra* note 86, at 1–2; Acevedo, *supra* note 87, at 358.

⁸⁹ Acevedo, *supra* note 87, at 358 (citing Press Release, U.S. Dep’t of Interior, Interior and Defense Departments Join Forces to Promote Renewable Energy on Federal Lands (Aug. 6, 2012), <http://perma.cc/5J84-6E36>).

⁹⁰ Jacob Yaniero, Note, *What About Energy? Why Public-Private Partnerships Are Not Used in the Energy Sector and Whether They Should Be*, 45 PUB. CONT. L.J. 499, 510 (2016).

⁹¹ *Id.*, at 511. Renewable generation project loses efficiency over time. With a useful life of twenty to thirty years for solar panels and wind turbines, public-private energy project agreements would require shorter length, causing a higher repayment rate and making the project less financially attractive. According to a 2012 study by the National Renewable Energy Laboratory, solar panels lose 0.5 percent efficiency every year. DIRK C. JORDAN & SARAH R. KURTZ, NAT’L RENEWABLE ENERGY LABORATORY, U.S. DEP’T OF ENERGY, NREL/JA-5200-51664, PHOTOVOLTAIC DEGRADATION RATES—AN ANALYTICAL REVIEW 1 (June 2012), <http://www.nrel.gov/docs/fy12osti/51664.pdf>. Most solar companies estimate that solar panels last around thirty years. *See, e.g., Solar Panel Lifespan*, SOLARCITY, <http://www.solarcity.com/residential/solar-energy-faqs/how-long-do-solar-panels-last>.

debt or equity investment.”⁹² The Florida Department of Transportation can consider this program when deciding about “loans [or] credit enhancements to government units and private entities” from the State-funded infrastructure bank “for use in constructing and improving transportation facilities.”⁹³ In addition, the Energy Performance Savings Contracts under Florida State law, entitled the “Guaranteed Energy, Water, and Wastewater Performance Savings Contracting Act,” promotes a statewide policy to facilitate state and local government agencies to invest in “energy, water, and wastewater efficiency and conservation measures.”⁹⁴

At the municipal level, the city of Orlando joined a ten-city consortium to boost energy efficiency in buildings to lower energy bills and reduce carbon emissions.⁹⁵ This initiative was followed by an action plan to reduce municipal waste with the aim of becoming a zero-waste community. As a part of this effort, the city has employed waste and recycling technology, increased commercial recycling, and designed programs and policies to enhance existing recycling and food waste collection.⁹⁶ This aim of zero waste is complemented by programs for household hazardous waste, residential recycling programs, backyard composting, and commercial business recycling.⁹⁷ These and other similar programs could be available to provide the raw materials and waste residues for advanced biofuels. Since many cities already have

⁹² Chasity H. O’Steen & John R. Jenkins, *We Built It, and They Came! Now What? Public-Private Partnerships in the Replacement Era*, 41 STETSON L. REV. 249, 267 (2012) (citing FLA. STAT. § 339.2817(1), (3)(c) (2017)).

⁹³ Fla. Stat. § 339.55(1), (7)(d).

⁹⁴ Fla. Stat. § 489.145(1)–(2). The statute designates qualified contractors as those “experienced in the analysis, design, implementation, or installation of energy, water, and wastewater efficiency and conservation measures through energy performance contracts.” *Id.* at § 489.145(3)(e). A governmental agency may enter into a guaranteed contract with a qualified contractor (energy service company or ESCO) to “reduce energy or water consumption, wastewater production, or energy-related operating costs of an agency facility through one or more energy, water, or wastewater efficiency or conservation measures.” *Id.* at § 489.145(4)(a). The contract includes a written guarantee that may take the form of an insurance policy, letter of credit, or corporate guarantee that “annual cost savings will meet or exceed the amortized cost of energy, water, and wastewater efficiency and conservation measures.” *Id.* at § 489.145(5)(a).

⁹⁵ Press Release, City Energy, Mayor Dyer Announces Orlando Participating in 10-City Effort to Cut Climate Pollution from Buildings (Jan. 24, 2014), <http://www.cityoforlando.net/greenworks/wp-content/uploads/sites/9/2014/05/City-Energy-Project-ORLANDO-PRESS-RELEASE.pdf> (Orlando is participating in the City Energy Project (“CEP”), an initiative from the Natural Resources Defense Council and the Institute for Market Transformation “to create healthier, more prosperous American cities by targeting their largest source of energy use and climate pollution: buildings.” CEP’s original participants include Atlanta, Boston, Chicago, Denver, Houston, Kansas City, Los Angeles, Philadelphia and Salt Lake City.).

⁹⁶ *Solid Waste*, CITY OF ORLANDO, <http://www.cityoforlando.net/greenworks/solid-waste/>.

⁹⁷ *Id.*

such recycling and composting programs in place, a program for advance biofuel production at the municipal level would be able to synergize with these initiatives for zero waste to create waste-to-energy programs.

Partnerships between local governments, recycling and compost companies, and biofuel manufacturers can work to expand the public-private linkages to increase the development of advanced biofuels. The successful results achieved in the transportation sector could be replicated by deploying public-private partnerships for biofuels. The next section analyzes how responsive regulation gives insight into these various methods to improve the deployment of advanced biofuels.

III. RESPONSIVE REGULATION THEORY

For purposes of this article, responsive regulation theory analyzes how agencies and government actors interact with public and private entities subject to varying enforcement styles of regulation. In the face of increasing pressure from constituents and private industries, regulators have altered their responses to satisfy enforcement targets. This section analyzes the differences in how state interventions and free markets can incentivize energy production. Creating optimal compliance mechanisms works to improve renewable energy targets for biofuels.

A. Cleavage Between State Intervention and Free Markets

Responsive regulation theory sought to break the divide between strong state intervention and free market idealism with a regulatory scheme that would allow industries “to self-regulate and engage in cooperation in the face of initial noncompliance before escalating to punitive sanctions when repeated offending occurs.”⁹⁸ Responsive regulation involves a mix of collaboration, cooperation, and self-regulation.⁹⁹ Ian Ayres and John Braithwaite argue that regulation should “be responsive to industry structure in that different structures will be conducive to different degrees and forms of regulation.”¹⁰⁰ The flexibility of responsive regulation has led to its implementation in various locales

⁹⁸ Melissa Rorie, *Responsive Regulation*, OXFORD HANDBOOKS ONLINE, July 2015, <http://dx.doi.org/10.1093/oxfordhb/9780199935383.013.109> (“In this formulation of escalated “enforced self-regulation,” scarce state resources are focused on monitoring firms who comply only because the costs of offending are too severe. Firms who demonstrate a strong motivation to comply (and even go beyond compliance) on their own are trusted to self-police and are rewarded with a more lenient regulatory schedule.”).

⁹⁹ Bruce P. Archibald, *Let My People Go: Human Capital Investment and Community Capacity Building Via Meta/Regulation in a Deliberative Democracy – A Modest Contribution for Criminal Law and Restorative Justice*, 16 CARDOZO J. INT’L & COMP. L. 1, 11 (2008).

¹⁰⁰ IAN AYRES & JOHN BRAITHWAITE, *RESPONSIVE REGULATION: TRANSCENDING THE DEREGULATION DEBATE* 4 (1992).

on different issues. The adoption of responsive regulation could also have served to prevent major regulatory failures, such as the Global Financial Collapse of 2008.¹⁰¹

A major tenant of responsive regulation is the role of regulators in using persuasion as a principal and primary means for ensuring compliance.¹⁰² The state in implementing responsive regulation strategies should seek to protect parties' rights as a part of restorative justice processes within the community.¹⁰³ The designers of responsive regulation saw the pitfalls of having the parties cooperate and negotiate with regulators, because of the broad discretion available to federal agencies.¹⁰⁴

Regulatory changes during the Reagan administration loosened environmental protections.¹⁰⁵ This deregulation faced a backlash to where the 1984 EPA enforcement was exceeded by the 1977 level by thirty percent.¹⁰⁶ This is particularly pertinent, given that the Trump administration has mimicked the Reagan administration's hallmark rhetoric of government deregulation. The rise of consumer and environmental movements paralleled the push for deregulation.¹⁰⁷ Responsive regulation proponents argue that when one enterprise is weak another political structure must strengthen to fill that void, otherwise there will be a failing of institutional order that will not be able compensate for these changes.¹⁰⁸

The practice of responsive regulation in the United States has occurred through voluntary compliance programs.¹⁰⁹ While the EPA has moved

¹⁰¹ Roric, *supra* note 98.

¹⁰² Leigh Osofsky, *Some Realism About Responsive Tax Administration*, 66 TAX L. REV. 121, 127 (2012).

¹⁰³ Peter Cleary Yeager, *Law Versus Justice: From Adversarialism to Communitarianism*, 29 LAW & SOC. INQUIRY 891, 902 (2004) (reviewing JOHN BRAITHWAITE, *RESTORATIVE JUSTICE AND RESPONSIVE REGULATION* (2002)).

¹⁰⁴ Osofsky, *supra* note 102, at 128.

¹⁰⁵ AYRES & BRAITHWAITE, *supra* note 100, at 8 ("In 1982, the General Accounting Office found the Environmental Protection Agency (EPA) enforcement actions under the Clean Water Act to have dropped to 27 percent of its 1977 peak.") (citing U.S. GOV'T ACCOUNTABILITY OFF., GAO-84-53, *WASTEWATER DISCHARGERS ARE NOT COMPLYING WITH EPA POLLUTION CONTROL PERMITS 58* (1983)).

¹⁰⁶ Mark Seidenfeld & Janna Satz Nugent, "*The Friendship of People*": *Citizen Participation in Environmental Enforcement*, 73 GEO. WASH. L. REV. 269, 283 (2005).

¹⁰⁷ AYRES & BRAITHWAITE, *supra* note 100, at 12.

¹⁰⁸ *Id.* at 13.

¹⁰⁹ Marc Allen Eisner, *Corporate Environmentalism, Regulatory Reform, and Industry Self-Regulation: Toward Genuine Regulatory Reinvention in the United States*, 17 GOVERNANCE 145, 145-167 (2004); Cynthia Estlund, *Rebuilding the Law of the Workplace in an Era of Self-Regulation*, 105 COLUM. L. REV. 319, 319-404 (2005); Michael W. Toffel & Jodi L. Short, *Coming Clean and Cleaning Up: Does Voluntary Self-Reporting Indicate Effective Self-Policing?*, 54 J. L. & ECON. 609, 609-649 (2011).

away from a deterrence-based strategy to one that was more flexible with greater reliance on voluntary programs and industry self-regulation, the new administration may return to a deterrence based strategy.

Advanced biofuel production facilities face layers of permitting requirements from the EPA and USDA. The concern relates to impacts of engineering genetically modified plants, including algae, to replicate outside of their natural environment at rates to sustain commercial viability for large scale production of advanced biofuels.¹¹⁰ Extreme reactions to algal biofuel abound. Environmental groups are at odds with commercial use of synthetic organisms, and some favor a moratorium on their use in open-air facilities, including in the use of biofuels.¹¹¹ Others have sought a new regulatory agency to supervise the specifics involved with production and distribution of advanced biofuels.¹¹² As a result of these and other hurdles for advanced biofuels, this section analyzes the role of responsive regulation theory in creating new rules and laws for advanced biofuels under the RFS scheme.

B. Compliance Mechanisms in Environmental Matters

The EPA has sought to increase the “public availability of the enforcement and compliance information currently available.”¹¹³ Using such an approach for monitoring advanced biofuels programs would be especially beneficial. EPA officials informed the Government Accountability Office that “they are observing the public’s increasing use of EPA’s Enforcement and Compliance History Online (“ECHO”) website and are continually looking for ways to improve and expand the information publicly available on the website.”¹¹⁴ In 2012, for example, “EPA released a Clean Water Act Discharge Monitoring Report Pollutant Loading Tool on its ECHO website to provide the public with information about pollutants that are released into local waterways.”¹¹⁵

A more cohesive approach to voluntary sustainability initiatives was available through the EPA’s now defunct National Environmental Performance Track (“Performance Track”), which provided a means for corporate transparency and accountability. A revitalization of this program would be beneficial under the Trump administration. The

¹¹⁰ Heather Hunziker, Note, *Finding Promise in Pond Scum: Algal Biofuels, Regulation, and the Potential for Environmental Problems*, 42 TEX. ENVTL. L.J. 59, 84 (2011).

¹¹¹ *Id.* at 79.

¹¹² *Id.* at 79–80.

¹¹³ U.S. GOV’T ACCOUNTABILITY OFF., GAO-13-115, EPA SHOULD DEVELOP A STRATEGIC PLAN FOR ITS NEW COMPLIANCE INITIATIVE 8, (2012), <http://www.gao.gov/assets/1660/650711.pdf>.

¹¹⁴ *See id.*

¹¹⁵ *See id.*

Performance Track Program, “was a public private partnership that encouraged continuous environmental improvement through environmental management systems, community outreach, and measurable results.”¹¹⁶ The premise of the program was that government should enhance existing programs with new tools and strategies for public health and environmental safety and create opportunities for cost reduction and technological innovation.¹¹⁷ For example, former Regional Administrator James Palmer emphasized recruiting new members to the tracking system and prioritized the inclusion of industry and local governments.¹¹⁸ As a result, Region IV became a national leader in the Performance Track Program under Palmer’s leadership, and Palmer was able to reach his goal of recruiting one hundred Performance Track members for the Region—an effort that exceeded the next closest Region by over thirty-five percent.¹¹⁹

The Performance Track Program was initially launched near the end of the Clinton Administration in 2000.¹²⁰ The Bush Administration adopted and strongly expanded the program until it was terminated by the Obama Administration in 2009.¹²¹ Despite the termination of the Performance Track Program, many states now administer their own programs patterned after the Performance Track Program. At the time of its conclusion, 547 facilities in forty-nine states and Puerto Rico participated in the program.¹²² In addition, more than half the states have

¹¹⁶ *National Environmental Performance Track*, U.S. ENVTL PROT. AGENCY, <https://archive.epa.gov/performance-track/web/html/index.html>.

¹¹⁷ *See id.*

¹¹⁸ E-mail from former EPA Region IV Director James Palmer to author (Mar. 25, 2013) (on file with author). Through the Performance Track Program, Palmer said he generated overwhelming, documented evidence of remarkable environmental improvements the Performance Track members accomplished through reductions in water use and wastewater generation, reductions in solid waste generation and increases in recycling, restoration of degraded wetlands, and protection of terrestrial habitats.

¹¹⁹ *See id.*

¹²⁰ Cary Coglianese & Jennifer Nash, *Performance Track’s Postmortem: Lessons From The Rise and Fall of EPA’s “Flagship” Voluntary Program*, 38 HARV. ENVTL. L. REV. 1, 22 (2014), http://harvardelr.com/wp-content/uploads/2014/04/Coglianese__Nash_Print1.pdf.

¹²¹ *Id.* at 6, 8.

¹²² U.S. ENVTL PROT. AGENCY, *supra* note 116. The EPA described membership for the program as follows:

Performance Track members represented virtually every manufacturing sector, as well as public-sector facilities at the federal, state, and local levels. Among the criteria for membership in Performance Track were a commitment to challenging environmental goals and a dedication to continuous improvement. Performance Track worked with members to improve performance among a variety of environmental indicators and priority environmental issues such as climate change, clean water, and land preservation. Members would report annually on progress toward their goals. In 2004, the program added a Corporate Leader designation to recognize companies that demonstrated an

developed programs similar to Performance Track since the termination of the federal program.¹²³

As of 2011, the Stewardship Action Council (“SAC”), a non-profit group, has assumed the form of the Performance Track Program. As a voluntary non-governmental organization, however, SAC’s program is less prominent than its predecessor.¹²⁴ In the events which resulted in the Performance Track’s demise, the EPA Inspector General issued a report stating that “only a couple of the members sampled had met all of their commitments and the program lacked standards for measuring progress.”¹²⁵ The SAC has attempted to differentiate itself from the Performance Track Program through eliminating both the award and recognition components of Performance Track, and time limits for accomplishing company goals.¹²⁶ Some of the founding members of the SAC are Johnson & Johnson, BMW, Lockheed Martin Manassas, Michelin, Pfizer, Audubon International, and the Wildlife Habitat Council.¹²⁷ SAC’s goal mimicked international best practices to create a platform for a broad range of organizations to collaborate and share ideas for best practices and existing stewardship structures to accelerate the further development and implementation of stewardship initiatives.¹²⁸

In 2005, EPA issued a final policy statement entitled “Incentives for Self-Policing: Discovery, Disclosure, Correction, and Prevention of Violations,” commonly referred to as the Audit Policy, to “encourage greater compliance with environmental regulations by providing incentives for facilities to voluntarily disclose and correct violations of environmental regulations.”¹²⁹ Proponents of the Audit Policy argued that it was an “efficient and economical means of ensuring and improving compliance with environmental laws and regulations.”¹³⁰ Opponents were concerned the policy protected polluters from negative consequences and

exceptional corporate-wide commitment to environmental stewardship and continuous improvement. *Id.*

¹²³ *See id.*

¹²⁴ Jonathan Bardelline, *EPA’s Cancelled Performance Track Program Finds New Life as Nonprofit*, GREENBIZ (March 18, 2011), <http://www.greenbiz.com/news/2011/03/18/epa-cancelled-p-track-program-finds-new-life-nonprofit>.

¹²⁵ *See id.*

¹²⁶ *See id.*

¹²⁷ *See id.*

¹²⁸ *Building Organizational Capacity for Public Sector Innovation*, background paper prepared for the OECD Conference Innovating the Public Sector: From Ideas to Impact (2015), <http://www.oecd.org/innovating-the-public-sector/Background-report.pdf>.

¹²⁹ Incentives for Self-Policing: Discovery, Disclosure, Correction, and Prevention of Violations, 60 Fed. Reg. 66,706 (Dec. 22, 1995); Sarah Stafford, *Does Self-Policing Help the Environment? EPA’s Audit Policy and Hazardous Waste Compliance*, 6 VT. J. ENVTL. L. 14, 22 (2005).

¹³⁰ Stafford, *supra* note 129, at 14.

would have a detrimental impact on the environment due to the lack of incentives for facilities to comply.¹³¹ Melissa Rorie, a proponent of the policy, argues these types of compliance programs seek “to address offending that stems from lack of knowledge about regulatory rules or an incapacity to implement programs at the corporate level” and are examples of strategies that “should be used at the bottom of the enforcement pyramid, to prevent alienating companies that want to comply.”¹³² Research on frontline U.S. regulators demonstrates that those responsible for compliance seek out cooperative relationships and trust-building to generate beneficial outcomes despite the absence of regulatory agency formally adopting a responsive approach.¹³³

Additionally, employees and managers can be important for monitoring for compliance in the corporate setting both for government regulation and in the self-regulatory process. Internal personnel can assist in developing and implementing new rules and protocols, monitoring compliance, taking complaints, and training new employees.¹³⁴

Responsive regulation is able to impact compliance in ways that existing regulatory models do not. Corporate social responsibility expert Christine Parker states: “Simple deterrence will often fail to produce compliance commitment because it does not directly address business perceptions of the morality of regulated behavior—it merely puts a price on noncompliance, and the ability of that price to deter misconduct will depend on the operation of the deterrence trap.”¹³⁵ Instead, responsive regulation, she argues, aims:

[T]o build moral commitment to compliance with the law . . . [so] a regulator can overcome the deterrence trap with the skillful use of responsive regulatory techniques that “leverage” the deterrence impact of its enforcement (and settlement) strategies with moral judgments and public interest considerations (such as

¹³¹ See Richard Dahl, *Audit-Privilege Laws: The Right to Know Nothing*, 107 ENVTL. HEALTH PERSPECTIVES (1999).

¹³² Rorie, *supra* note 98.

¹³³ *Id.* Although frontline regulators do not have discretion to escalate enforcement matters at will, they appear to adopt a responsive style in terms of dialogue and trust. JOHN BRAITHWAITE, TONI MAKKAI & VALERIE A. BRAITHWAITE, *REGULATING AGED CARE: RITUALISM AND THE NEW PYRAMID* (2007).

¹³⁴ Estlund, *supra* note 109, at 358 (“Unlike many regulatory regimes, workplace regulations operate for the benefit of fully competent adults who work inside the regulated entity, and are potentially capable of speaking for themselves and playing a part in the internal regulatory regime. Workers are on the scene, well informed about workplace conditions, and motivated to represent their own interests within the firm. Within the internal self-regulatory regime, a union—or any other representative of employees—functions not only as an independent third party but as an integral constituent of the ‘self’ that is charged with self-regulation.”).

¹³⁵ Christine Parker, *The “Compliance” Trap: The Moral Message in Responsive Regulatory Enforcement*, 40 LAW & SOC’Y REV. 591, 592 (2006).

failing to settle early if public interest conditions are not met, or using publicity to underline the social unacceptability of the conduct).¹³⁶

The voices and interests of those outside of the corporate decision-making context are overlooked and marginalized, which, in turn, impacts “not only the occasion of lawbreaking, but also legal process itself in ways fateful for the ultimate distribution of the costs and benefits of production.”¹³⁷

C. Compliance Mechanisms for Biofuels

Responsive regulation as analyzed in the biofuel context could result in the culling of inefficient and unsustainable forms of biofuels, namely agriculture and forest based biofuels, to produce more advanced biofuels that would improve the overall carbon footprint of biofuels. Doing so would slice off the “lower tail” of the unsustainable forms of biofuels and elevate the sustainability of the energy resource.¹³⁸ David B. Brushwood considers the changes necessary to respond to market pressures from the rise of internet pharmacies with existing regulation. The development of new advanced biofuels also relates to this phenomenon of technology-forcing regulations for sustainability and accountability. Another way to achieve sustainability targets would be an “array of activities which emphasize removing systematic threats to quality and introducing systematic incentives to quality.”¹³⁹ This type of regulation aimed at or near the mean of sustainability targets, and those at the “higher tail” of the curve can also shift the overall sustainability of biofuels in a positive direction.¹⁴⁰

¹³⁶ *Id.*

¹³⁷ Peter Cleary Yeager, *Law Versus Justice: From Adversarialism to Communitarianism*, 29 LAW & SOC. INQUIRY 891, 910 (2004). (“In . . . the ‘penetration’ of law . . . industry’s views and interests are regularly privileged over those of citizens and even of public interest environmental groups. The latter’s voices are muted, and often silenced, by the requirements of highly specialized technical expertise in countless discretionary decisions as to the substance of regulations and conditions of their enforcement. The consequences run to legally permitted pollution levels higher than the law had originally contemplated, and enforcement measures more lenient than foreseen by the law’s drafters, both results disproportionately favoring larger producers over smaller ones.”).

¹³⁸ David B. Brushwood, *Responsive Regulation of Internet Pharmacy Practice*, 10 ANNALS HEALTH L. 75, 88–89 (2001).

¹³⁹ *Id.*

¹⁴⁰ *Id.* (These regulatory actions have greater abilities to enhance the overall efficiency of the group due to their “statistical subset near or above the mean than there are well below the mean.” Brushwood in referring to responsive regulation in the public health context cautions that “despite its potential for success, apple ‘polishing’ has not been used by regulators nearly as frequently as has apple ‘picking.’ New theories of regulation suggest that cautious culling is necessary but far from sufficient to meet the regulatory challenge.”).

From the perspective of price controls under responsive regulation, the regulator may be unable “to award adequate rate increases during periods of high or rising costs” due to “consumers’ relative indifference to rate decreases, [the regulator] can compensate the firm for those losses by granting above-cost rates when costs remain steady or decline.”¹⁴¹

With respect to reporting requirements, the Office of Inspector General (“OIG”) found that EPA’s lack of an electronic monitoring system resulted in the agency’s failure to satisfy the control standard for monitoring some of the renewable fuel standard program control activities.¹⁴² “The OIG noted that internal control assures effective and efficient operations, while also acting as the first line of defense in safeguarding assets and preventing and detecting fraud.”¹⁴³ In its report, the OIG identified three main program control activities: independent third-party engineering reviews,¹⁴⁴ EPA moderated transaction system,¹⁴⁵ and attest engagements.¹⁴⁶ Requiring electronic submittal of all renewable fuel standard reporting requirements would allow the agency to more easily monitor control activities.¹⁴⁷ In its report, the OIG recommended that the agency first modify existing electronic systems to track reporting requirement submissions in order to ensure compliance with the renewable fuel standard program; second, that it require the electronic submission of all reporting requirements;¹⁴⁸ and third, that the agencies identify potential conflicts of interest when the same third party

¹⁴¹ Glenn Blackmon Richard, *Fragile Commitments and the Regulatory Process*, 9 YALE J. ON REG. 73, 97–98 (1992) (“Commentators often note the tendency of regulators to repress price increases, but one can also find examples of regulators allowing utilities to keep the higher profits resulting from cost decreases.”) Richard considers the example of the natural gas industry:

[F]rom 1984 to 1987, the wholesale or “city gate” price paid by local gas distribution utilities fell from \$3.95 per thousand cubic foot to \$2.87, a decrease of \$1.08. Yet the prices charged residential consumers and approved by state regulators decreased by \$0.58. Utilities were allowed to keep about half the decrease in wholesale costs, or about \$4.9 billion over three years. Using regression analysis of gas prices in forty-eight states, we found that about 63% of the change in city gate price was passed through to residential consumers. Regulation of electricity profits also appears to be less onerous during times of relatively stable costs. From 1976 to 1980, when residential electricity rates increased at an average annual rate of 11.5%, the real rate of return on new utility plant was -3.4%. From 1982 to 1987, the average annual increase in residential costs was 3.9%, and the real return on new utility investment was 6.0%. *Id.*

¹⁴² *EPA Should Improve Monitoring of Controls in the Renewable Fuel Standard Program*, 24 AIR POLLUTION CONSULTANT 1.1, 1.2–1.4 (2014).

¹⁴³ *Id.*

¹⁴⁴ *Id.*

¹⁴⁵ *Id.*

¹⁴⁶ *Id.*

¹⁴⁷ *Id.*

¹⁴⁸ *Id.*

completes multiple reporting requirements.¹⁴⁹ The failure of the EPA to properly monitor the control activities for the renewable fuel standard programs shows the inherent difficulty of obtaining transparency and accountability for sustainability efforts. Without oversight and control mechanisms, the success of sustainability programs is more difficult to measure and analyze.

IV. ADVANCED BIOFUEL POLICY FOR A LOW-CARBON FUTURE

The most interesting biofuel efforts avoid using land that's expensive and has high opportunity costs. They do this by getting onto other types of land, or taking advantage of byproducts that aren't used in the food chain today, or by intercropping.

—Bill Gates, investor and Microsoft co-founder¹⁵⁰

The RFS program began as a bipartisan effort to reduce reliance on foreign oil and to enhance research and investment into renewable fuels. Today however, it “has devolved into a polarizing crusade involving dozens of industries” from farms to biofuel refiners and community activists.¹⁵¹ Opponents of the RFS program seek to repeal the law altogether based on concerns of increasing food costs, environmental degradation, and vehicle damage.¹⁵² RFS proponents argue that the program is a success because of reduced oil imports, lower gas prices, higher farm income, and decreases in greenhouse gas emissions.¹⁵³

Recent bills in the U.S. House of Representatives have sought to chisel away at the efficacy of the RFS program. Congressman Jim Sensenbrenner, a Republican from Illinois, introduced two bills aimed at reforming the RFS, requesting additional study and review of the ethanol mandate to ensure EPA volume obligations for biofuels are realistic.¹⁵⁴ The first bill, the comprehensive mid-level ethanol assessment legislation, seeks to have the EPA enter into an agreement with the National Academy of Sciences for “a comprehensive assessment of research on the implications of the use of mid-level ethanol blends, which

¹⁴⁹ *Id.*

¹⁵⁰ Chris Anderson, *Q&A: Bill Gates on the World's Energy Crisis*, WIRED (June 20, 2011), https://www.wired.com/2011/06/mf_qagates/.

¹⁵¹ Jaqueline Campos, *Scrap or Overhaul? Trump and Clinton Promise Changes to the Renewable Fuel Standard*, FORBES (Oct. 12, 2016), <http://www.forbes.com/sites/energysource/2016/10/12/scrap-or-overhaul-trump-and-clinton-promise-changes-to-the-renewable-fuel-standard/#360136f619e8>.

¹⁵² *Id.*

¹⁵³ *Id.*

¹⁵⁴ Press Release, Jim Sensenbrenner, Congressman, Rep. Sensenbrenner Introduces Renewable Fuel Standard Reform Legislation (Jan. 31, 2017), <https://sensenbrenner.house.gov/2017/1/rep-sensenbrenner-introduces-renewable-fuel-standard-reform-legislation>.

compares mid-level ethanol blends to gasoline blends containing ten percent or zero percent ethanol.”¹⁵⁵ The second bill focuses on cellulosic biofuel assessment.¹⁵⁶ If passed this legislation would reduce EPA’s volume requirements for cellulosic biofuel to what is commercially available until a comprehensive study by the National Academy of Sciences is completed on the environmental and economic impacts of cellulosic biofuel and the feasibility of large scale commercial production.¹⁵⁷ Congressman Sensenbrenner’s bills to lower RFS blending volumes fail to account for funding cuts proposed to the EPA and the National Academy of Sciences. To date, neither bill has obtained any co-sponsors, but the introduction of the bills shows an appetite for reducing the RFS biofuel volume mandates. The question that lawmakers struggle with is how those reductions should be accomplished. A complete repeal of the RFS program is unlikely however, given the threat of potential for political backlash from farmers in the Midwest and Great Plains states.

Nonetheless, the broader refining industry has continued to call for administrative and congressional action to repeal biofuel blending requirements.¹⁵⁸ Even without congressional action however, EPA administrator Scott Pruitt could direct the agency to use its authority to lower annual blending requirements through the existing waivers.¹⁵⁹ As such, regulatory uncertainty exists as to future support for the ethanol industry. President Trump will likely compromise on the RFS program

¹⁵⁵ To provide for a comprehensive assessment of the scientific and technical research on the implications of the use of mid-level ethanol blends, and for other purposes, H.R. 777, Sec. 2 (a)(1) 115th Cong. (2017), <https://www.congress.gov/bill/115th-congress/house-bill/777> (“The term “mid-level ethanol blend” means an ethanol-gasoline blend containing greater than 10 and up to and including 20 percent ethanol by volume that is intended to be used in any conventional gasoline-powered motor vehicle or nonroad vehicle or engine.” Section 2(b)(1) would require the assessment include: “An evaluation of the short-term and long-term environmental, safety, durability, and performance effects of the introduction of mid-level ethanol blends on onroad, nonroad, and marine engines, onroad and nonroad vehicles, and related equipment. Such evaluation shall consider the impacts of qualifying mid-level ethanol blends or blends with higher ethanol concentrations as a certification fuel. Such evaluation shall include a review of all available scientific evidence.”).

¹⁵⁶ To require that until a comprehensive study is completed, the volume of cellulosic biofuel mandated under the renewable fuel program be limited to what is commercially available, and for other purposes, H.R. 776, 115th Cong. (2017), <https://www.congress.gov/bill/115th-congress/house-bill/776>.

¹⁵⁷ *Id.* See also Erin Voegelé, *Sensenbrenner introduces bills that aim to reform the RFS*, BIOMASS MAGAZINE (Feb. 2, 2017), <http://biomassmagazine.com/articles/14169/sensenbrenner-introduces-bills-that-aim-to-reform-the-rfs>.

¹⁵⁸ See e.g., Campos, *supra* note 151.

¹⁵⁹ *Id.* (Several independent refiners, namely CVR Energy, HollyFrontier and Valero—all of which operate in Oklahoma—have requested that “the EPA use its rulemaking authority to shift more of the burden of complying with the law to blenders and other companies not currently obligated under the RFS.”).

because of his “Buy American” economic philosophy, despite being surrounded by a wide-ranging group of advisors with ties to the oil and gas industry.¹⁶⁰

Public health risks and environmental hazards will continue to loom large for communities on the frontlines of oil and gas production. If EPA lowers mandated volumes there would be “a chilling effect on the ethanol industry,”¹⁶¹ which in turn would benefit those refiners penalized under the current regime. Such changes would also impact certain communities in a disparate manner. At stake are the livelihoods of weak farm-based economies that heavily rely on agricultural income from biofuel production.

A. Variations in Blending Models

While deep pathways to decarbonization rely on the electrification of vehicles, some forms of transport will be harder to electrify, such as air travel and shipping.¹⁶² The right selection of biofuel raw materials would include “forest waste such as sawdust, fast-growing trees, agricultural residue, algae and ‘high-energy’ crops, such as grasses grown on degraded parcels of land around the world” according to a report by the International Renewable Energy Agency (“IRENA”).¹⁶³ This move to decarbonization is part of a larger scheme under the United Nations Sustainable Energy for All initiative. The source of biofuels along with the variations in blending models will be significant in achieving greater energy access and energy security through biofuel production and use. This subsection considers how the variation in blending models for biofuels can be improved through responsive regulation practices.

In looking at variations in blending models for biofuels, environmental and social concerns are important to consider. The most common blend is E10, which is motor fuel with up to ten percent ethanol. While EPA approved E15 for sale in 2010, increasing the amount of ethanol sold annually by fifty percent, a number of issues inhibit market penetration

¹⁶⁰ Robert Rapier, *Why the Ethanol Industry Should Fear Trump*, FORBES (Jan. 22, 2017), <http://www.forbes.com/sites/rpapier/2017/01/22/why-the-ethanol-industry-should-fear-president-trump/2/#8f786f214832>.

¹⁶¹ *Id.*

¹⁶² Maina Waruru, *Biofuels could cut transport emissions – but food may be at risk*, REUTERS (Mar. 2, 2017), <http://www.reuters.com/Article/us-energy-biofuel-transportation-idUSKBN1691DV>. (“Shipping, aviation, mass transport systems and long haul transport—all significant contributors to global emissions – will need to rely on biofuels to achieve carbon-cutting targets.”).

¹⁶³ *Id.*

for E15 blends.¹⁶⁴ Those problems include the lack of compatible fueling infrastructure, warranty and liability concerns, and consumers' hesitations to pay more for "a lower-value product."¹⁶⁵ In 2013, the EPA delayed the finalization of the 2014 RFS renewable volume obligation, prompting President of the Renewable Fuels Association, Bob Dinneen, to point blame at the oil industry for its refusal "to make the investments in infrastructure or allow their marketers to offer higher ethanol blends like E85 or E15."¹⁶⁶ Oil industry commentators question why the oil industry would be required to pay for these improvements.

Critics of the E15 program are concerned about its impacts on the economy, including the need for separate E15 fueling dispensers and storage tanks and the potential damage to engines by E15 fuels.¹⁶⁷ One of the most drastic effects of E15 is that it will require separate fueling dispensers at American gas stations and underground storage tanks that are made of stainless steel.¹⁶⁸ Automakers have allocated the risks of E15 onto consumer by offering warranties that do not cover damages associated with using E15.¹⁶⁹ Of all vehicles on the road in 2013, only five percent have been approved by the manufacturer to use E15.¹⁷⁰ Yet in 2015, more vehicles explicitly approved E15. In fact, an analysis of 2016 model year warranty statements and owner's manuals conducted by the Renewable Fuels Association ("RFA") shows that auto manufacturers explicitly approve E15 (fifteen percent ethanol, eighty-five percent

¹⁶⁴ Marlo Lewis, *Root Causes of Ethanol 'Blend Wall'? Consumers Don't Like Rip Offs*, GLOBAL WARMING (Mar. 13, 2015), <http://www.globalwarming.org/2015/03/13/root-cause-of-ethanol-blend-wall-consumers-dont-like-rip-offs/>.

¹⁶⁵ *Id.*

¹⁶⁶ *RFS Announcement: A Cloud of Uncertainty with a Silver Lining*, RENEWABLE FUELS ASSOCIATION (Nov. 21, 2014), <http://ethanolrfa.org/2014/11/rfs-announcement-a-cloud-of-uncertainty-with-a-silver-lining/>.

¹⁶⁷ Tyler Brewer, *E15 Partial Waivers: How the EPA Exceeded Its Authority and Placed Its Liability on Others*, 5 KY. J. EQUINE, AGRIC. & NAT. RESOURCES L. 289, 303–07 (2013).

¹⁶⁸ See generally *Grocery Mfrs. Ass'n v. EPA*, 693 F.3d 169 (D.C. Cir. 2012); LARRY GREGORY CONSULTING, LLC, A COMPREHENSIVE ANALYSIS OF CURRENT RESEARCH ON E15 DISPENSING COMPONENT COMPATIBILITY 11 (2012), <http://www.api.org/~media/files/policy/fuels-and-renewables/e15-infrastructure-comprehensive-analysis.pdf>. See also U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-11-513, BIOFUELS: CHALLENGES TO THE TRANSPORTATION, SALE, AND USE OF INTERMEDIATE ETHANOL BLENDS (2011), <http://www.gao.gov/assets/320/319297.pdf>; Pete Bigelow, *How the Fiscal Cliff Bill Might Void Your Car's Warranty*, AOL AUTOS (Jan. 10, 2013), <http://autos.aol.com/Article/fiscal-cliff-ethanol-E15-tax-credit/>; Brian Swint & Mark Drajem, *Ethanol Confusing Could Result In Engine Damage*, BLOOMBERG BUS. (Dec. 2, 2012), <http://www.startribune.com/ethanol-confusion-could-result-in-engine-damage/181622651/>.

¹⁶⁹ Bigelow, *supra* note 168.

¹⁷⁰ Brewer, *supra* note 167, at 304–05.

gasoline) use in more than seventy percent of new vehicles.¹⁷¹ This is up from 2015, when just over sixty percent of model year (“MY”) 2015 automobiles were clearly approved for E15.¹⁷²

In 2016, EPA finalized a historic increase in volume requirements and associated standards. The new standards begin to “apply under the RFS program in calendar year 2017 for cellulosic biofuel, biomass-based diesel, advanced biofuel, and total renewable fuel along with the volume requirement for biomass-based diesel for 2018.”¹⁷³ The total renewable fuel volumes called for increased by six percent (1.2 billion gallons) from 2016 to 2017,¹⁷⁴ and advanced biofuel targets increased by approximately 700 million gallons for the same period.¹⁷⁵ Conventional biofuel targets grew in 2017 to satisfy the 15 billion gallon congressional target.¹⁷⁶ Table 1 below shows current and future requirements for renewable fuel volumes: The final volumes offer continued growth over previous levels.¹⁷⁷ The final standards meet or exceed the volume targets set out by Congress for total renewable fuel, biomass-based diesel, and advanced biofuel.¹⁷⁸

*Table 1: Renewable Fuel Volume Requirements for 2014-2018*¹⁷⁹

	2014	2015	2016	2017	2018
Cellulosic biofuel (million gallons)	33	123	230	311	n/a
Biomass-based diesel (billion gallons)	1.63	1.73	1.9	2.0	2.1
Advanced biofuel (billion gallons)	2.67	2.88	3.61	4.28	n/a
Renewable fuel (billion gallons)	16.28	16.93	18.11	19.28	n/a

¹⁷¹ *RFA Analysis Shows Uptick in Number of Automakers Who Have Approved E15 for Use in New Vehicles*, RENEWABLE FUELS ASSOCIATION (Dec. 1, 2015), <http://ethanolrfa.org/2015/12/rfa-analysis-shows-uptick-in-number-of-automakers-who-have-approved-e15-for-use-in-new-vehicles/>.

¹⁷² *Id.*

¹⁷³ *Final Renewable Fuel Standards for 2017, and the Biomass-Based Diesel Volume for 2018*, U.S. ENV'T'L PROT. AGENCY, <https://www.epa.gov/renewable-fuel-standard-program/final-renewable-fuel-standards-2017-and-biomass-based-diesel-volume>.

¹⁷⁴ *Id.*

¹⁷⁵ *Id.* Advanced biofuels requires fifty percent lifecycle carbon emissions reductions.

¹⁷⁶ *Id.*

¹⁷⁷ *Id.*

¹⁷⁸ *Id.*

¹⁷⁹ *Id.*

Biodiesel is a biodegradable alternative fuel, but its “higher viscosity and density pose some acute problems when used it in unmodified engine.”¹⁸⁰ The specific gravity and viscosity of these types of biodiesel fuels are critical for deciding upon their sustainability and suitability for use in diesel engines.¹⁸¹

In responding to comments to the 2017 proposal, EPA emphasized that Congress did not include renewable fuel targets in the statute, allowing for greater flexibility for the EPA to update and amend targets based on changed circumstances through waiver provisions.¹⁸² In light of changed production projections for cellulosic biofuels, EPA reduced the volume requirements for cellulosic biofuels through its cellulosic waiver authority to lower the statutory target volumes for these advanced biofuels.¹⁸³ EPA also considered congressional intent in setting high volumes in the statute.¹⁸⁴

In July of 2017, EPA issued proposed volume requirements for calendar year 2018 and biomass-based diesel volume standards for calendar year 2019. The proposed volume requirements are listed in Table 2 below.

¹⁸⁰ Belachew Tesfa et al., *Prediction models for density and viscosity of biodiesel and their effects on the fuel supply stems in CI engines*, 35 RENEWABLE ENERGY 2752, 2752–53 (2010), https://www.researchgate.net/publication/222666499_Prediction_models_for_density_and_viscosity_of_biodiesel_and_their_effects_on_fuel_supply_system_in_CI_engines.

¹⁸¹ AMIT SARIN, BIODIESEL: PRODUCTION AND PROPERTIES 119 (2012), <https://books.google.com/books?id=72kIFb2goSUC&printsec=frontcover#v=onepage&q&f=false>.

¹⁸² U.S. ENV'T'L PROT. AGENCY, EPA-420-R-16-019, RENEWABLE FUEL STANDARD PROGRAM – STANDARDS FOR 2017 AND BIOMASS-BASED DIESEL VOLUME FOR 2018: RESPONSE TO COMMENTS 25 (Nov. 2016), <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100PV0A.pdf>.

¹⁸³ *Id.*

¹⁸⁴ In responding to public comments about the changes in high volume requirements for the 2017 and 2018 targets, EPA stated:

It is highly unlikely that Congress expected the very high volumes that it specified in the statute to be reached while maintaining a gasoline pool-wide ethanol content of less than 10%. At the time EISA was passed in 2007, EIA's Annual Energy Outlook for 2007 projected that 17.3 billion gallons of ethanol is the maximum that could be consumed in 2022 if all gasoline contained E10 and there was no E0, E15, or E85. However, 17.3 billion gallons is far less than the 36 billion gallons of renewable fuel that Congress targeted for use in 2022. Thus, if the statutory targets for 2022 were to be achieved, 18.7 billion gallons of renewable fuel would need to be consumed in 2022 either as higher level ethanol blends (E15 and/or E85), or as non-ethanol fuels. Such levels were far beyond the industry's abilities at the time of EISA's enactment, strongly suggesting that Congress expected the RFS program to drive dramatic industry changes in a relatively short period of time. *Id.* at 83.

*Table 2: Proposed Volume Requirements for 2018, and Bio-Mass Diesel Volume for 2019*¹⁸⁵

	2018	2019
Cellulosic biofuel (million gallons)	238	n/a
Biomass-based diesel (billion gallons)	2.1 ^b	2.1
Advanced biofuel (billion gallons)	4.24	n/a
Renewable fuel (billion gallons)	19.24	n/a

Regarding the new mandate, EPA administrator Scott Pruitt remarked:

Increased fuel security is an important component of the path toward American energy dominance. We are proposing new volumes consistent with market realities focused on actual production and consumer demand while being cognizant of the challenges that exist in bringing advanced biofuels into the marketplace. Timely implementation provides certainty to American refiners, the agriculture community and broader fuels industry, all of which play an important role in the RFS program.¹⁸⁶

A push from the fossil fuel industry would make way for the EPA to abandon the possibility of lowering biodiesel requirements and counting ethanol exports toward the Renewable Fuel Standard. Any major changes would have to account for the impact on the local economies, jobs, and existing agriculture industries.¹⁸⁷

B. Renewable Identification Numbers and Tracking Metrics

In order to ensure compliance with their renewable volume obligations, each obligated party must accumulate a sufficient number of Renewable Identification Numbers (“RINs”).¹⁸⁸ A batch-RIN is a thirty-eight digit code demonstrating the type of renewable fuel category, the calendar year of production or import, the company and facility where the renewable fuel was produced, and the number of gallon-RINs of

¹⁸⁵ *Proposed Volume Standards 2018 and Biomass Based Diesel Volume 2019*, U.S. ENVTL. PROT. AGENCY (Nov. 23, 2017), <https://www.epa.gov/renewable-fuel-standard-program/proposed-volume-standards-2018-and-biomass-based-diesel-volume-2019>.

¹⁸⁶ News Release, EPA Proposes RFS Volumes Reflective of Market Realities for 2018: Starting Technical Analysis to Inform Future Reset Rule (July, 5 2017), <https://www.epa.gov/newsreleases/epa-proposes-rfs-volumes-reflective-market-realities-2018>.

¹⁸⁷ Erin Murphy & Ed Tibbetts, *Trump orders EPA to back off RFS changes, report says*, THE COURIER (Oct. 18, 2017), http://wfcourier.com/news/local/govt-and-politics/trump-orders-epa-to-back-off-rfs-changes-report-says/article_de0a65df-de35-5535-ae91-51a0c7ad40e6.html.

¹⁸⁸ Jay P. Kesan & Christopher J. Miller, *The Renewable Fuel Standard Mandating Renewable Fuel Production in the United States*, 42 TRENDS 4, 5 (September/October 2010).

renewable fuel represented by each batch of renewable fuel.¹⁸⁹ In terms of RVO compliance, each RIN signifies one gallon of renewable fuel.¹⁹⁰ If an obligated party amasses more RINs than necessary to fulfill with its RVOs, then it may transfer over excess RINs, pursuant to a twenty percent cap, for compliance in the next year or transfer excess RINs over to an alternative party.¹⁹¹ If an obligated party does not acquire sufficient RINs to meet its RVOs, it may transfer the deficit to the following year.¹⁹² Regardless of the circumstances, each obligated party must report and apply its accumulated RINs towards meeting its RVOs at the end of each calendar year.¹⁹³

Some commentators have indicated that RINs were meant only as a compliance mechanism, and that Congress would not have intended for them to incentivize biofuels.¹⁹⁴ Environmentalists were concerned about the negative impacts of biofuels and suggested that the EPA should reduce volumes below the general waiver authority through a finding of severe environmental harm, including those from fertilizer and pesticide runoff affecting water bodies from increased agricultural production.¹⁹⁵ The EPA in responding to comments about the 2017-2018 RFS targets acknowledged that it considered “the impact of the production and use of renewable fuels on the environment, including on air quality, climate change, conversion of wetlands, ecosystems, wildlife habitat, water quality and water supply.”¹⁹⁶

¹⁸⁹ *Id.*

¹⁹⁰ *Id.*

¹⁹¹ *Id.*

¹⁹² *Id.*

¹⁹³ *Id.*

¹⁹⁴ U.S. ENV'T'L PROT. AGENCY, *supra* note 182, at 26–27 (Congress directed EPA to establish a regulatory program that would include credit provisions. EPA established the RIN system as a means to implement this statutory requirement.).

¹⁹⁵ *Id.* at 54–55.

¹⁹⁶ *Id.* In responding to comments, the EPA indicated that to lower volumes under CAA § 211(o)(7)(A)(i), the Administrator must first determine that implementation of the volumes “would severely harm the economy or environment of a State, a region, or the United States,” stating:

EPA has previously interpreted the general waiver provision in CAA Section 211(o)(7)(A) in considering a waiver application from the State of Texas on grounds of severe economic harm. Certain aspects of EPA’s interpretation in that context would also be relevant to consideration of a waiver on the basis of severe environmental harm. In particular, EPA interpreted the provision as requiring that “implementation of the RFS program itself must be the cause of the severe harm.” It is not enough that the RFS program may “contribute significantly to severe harm, as part of a mix of forces.” In addition, EPA interpreted the use of “severe” as “indicating a point that is quite far along the continuum of harm”— “a much higher threshold than ‘significant adverse impacts’” and more than “serious,” but less than “extreme.” Finally, EPA concluded that there must be “a generally high degree of confidence that severe harm would occur from implementation from the RFS.” In other words, if we do not have a high degree of

The risk is that the targets are too ambitious or unrealistic. Others have expressed concerns that determining “what is reasonably attainable” under the cellulosic waiver authority is the incorrect standard, but EPA emphasized in their response to comments that the Agency “has great discretion in determining reductions of advanced and total renewable fuel under the cellulosic waiver authority.”¹⁹⁷ The Agency has wide latitude in offering recommendations for future renewable energy targets due to its expertise. Moreover, “[s]ome commenters criticized EPA’s use of the waiver authorities as sending a negative message to markets, but EPA disagrees with this comment.”¹⁹⁸ As the EPA explains, renewable fuel standards are increasing and will send positive assurances to markets for growth, because “setting standards that are not reasonably attainable would lead to noncompliance, a deleterious drawdown in the bank of carryover RINs and/or the need for subsequent waivers, all of which would undermine confidence in the RFS program and create uncertainty in renewable fuel markets.”¹⁹⁹

These changes in energy policy may fail to appreciate the extent to which suppliers, producers, and distributors have control of their supply chains. Approximately ten percent of the motor fuel sold as gasoline in the United States is ethanol.²⁰⁰ An issue that Congress anticipated is that not every obligated party would blend biofuels to its Renewable Volume Obligation and directed the EPA to “provide for the generation of an appropriate amount of credits by any person that refines, blends, or imports gasoline that contains a quantity of renewable fuel that is greater than the quantity required.”²⁰¹ Therefore the EPA allows participating entities to use transferable credits, which can be bought and sold in order to achieve compliance. Obligated parties who are not able to meet blending requirements can purchase compliance from those who blend

confidence that we can identify severe harm and causally link it to the RFS program, then exercise of the waiver authority is not appropriate. (internal citations omitted).

¹⁹⁷ *Id.* at 61–62.

¹⁹⁸ *Id.*

¹⁹⁹ *Id.*

²⁰⁰ *Ethanol Fuel Basics*, U.S. DEP’T OF ENERGY, ALTERNATIVE FUELS DATA CTR., http://www.afdc.energy.gov/fuels/ethanol_fuel_basics.html (“Ethanol is a renewable fuel made from various plant materials collectively known as ‘biomass.’ Nearly 97% of U.S. gasoline contains ethanol, typically E10 (10% ethanol, 90% gasoline), to oxygenate the fuel and reduce air pollution . . . Ethanol is also available as E85 (or flex fuel), which can be used in flexible fuel vehicles, designed to operate on any blend of gasoline and ethanol up to 83%. Another blend, E15, has been approved for use in newer vehicles, and is slowly becoming available.”).

²⁰¹ Bob Neufeld & Rebecca Lynne Fey, *Winners and Losers: The EPA’s Unfair Implementation of Renewable Fuel Standards*, 60 S.D. L. REV. 258, 264–66 (2015).

beyond their obligation.²⁰² A RIN is “created by the biofuel producer at no cost and is assigned to each batch of biofuel the producer sells.”²⁰³ Anyone registered pursuant to EPA regulations can own a separated RIN, each of which can be transferred multiple times.²⁰⁴

C. Other Approaches

Aside from the federal RFS program, state and local governments have also adopted clean energy programs, many of which include specific targets for biofuels. The following subsection examines various programs for biofuel targets that incorporate elements of responsive regulation theory.

California’s Low Carbon Fuel Standard (“LCFS”) includes gasoline and diesel.²⁰⁵ The LCFS requires petroleum-based fuel producers “reduce the carbon intensity of their products, beginning with a quarter of a percent in 2011 culminating in a 10 percent total reduction in 2020.”²⁰⁶ The LCFS program forces fuel providers “to track the life cycle global warming intensity (“GWI”) of their products, measured on a per-unit-energy basis, and reduce this value over time.”²⁰⁷ As I explain in an earlier article:

The California system allows for the fuel providers to decide how they will select to reduce the carbon intensity of petroleum-based products from various choices, including blending low-carbon biofuels, utilizing low-carbon fuels such as hydrogen, or purchasing credits from other low-carbon fuel providers. In other

²⁰² *Id.* at 264 n.15 (“The refiner then multiplies the percentage RFS for each biofuel times its combined petroleum gasoline and diesel fuel production and arrives at the RVO of each biofuel. The refiner is legally obligated for blending the RVO for each biofuel”).

²⁰³ *Id.* at 265 (“A RIN can be separated from the biofuel to which it is assigned only by an obligated party or unobligated blender owning the biofuel.”) (citing 40 C.F.R. § 80.1428(b)(2) (2014)).

²⁰⁴ *Id.* at 266 n.23 (“[E]ach party that is an obligated party . . . and is obligated to meet the Renewable Volume Obligations . . . must demonstrate . . . that it has retired for compliance purposes a sufficient number of RINs.”) (quoting 40 C.F.R. § 80.1427(a)(1) (2014)).

²⁰⁵ CALIFORNIA ENERGY COMMISSION, *Low Carbon Fuel Standard*, http://www.energy.ca.gov/low_carbon_fuel_standard/.

²⁰⁶ *Id.* Petroleum importers, refiners and wholesalers have the options to “develop their own low carbon fuel products, or buy LCFS Credits from other companies that develop and sell low carbon alternative fuels, such as biofuels, electricity, natural gas or hydrogen.” *Id.*

²⁰⁷ Alexander E. Farrell & Daniel Sperling, *A Low-Carbon Fuel Standard for California, Part 2: Policy Analysis*, Aug. 2, 2007, http://www.energy.ca.gov/low_carbon_fuel_standard/UC_LCFS_study_Part_2-FINAL.pdf. The term life cycle encompasses all activities “in the production, transport, storage and use of the fuel.” *Id.* A more thorough analysis includes “energy embodied in the materials used in all these activities through their own production, such as batteries in electric vehicles, tractors used for cultivating the biofuel crops, and oil refinery equipment.” *Id.*

words, businesses pick the technologies and strategies that work best for them and their customers.²⁰⁸

Similarly, in Massachusetts, Boston University has begun recycling cooking oil from on-campus dining halls for the purpose of heating thirteen of the university's buildings in an effort to use what would otherwise be waste from one process and convert it into a technical nutrient-fuel.²⁰⁹

A concern about biodiesel is that the transesterification process, while efficient, does require a level of technical expertise, and involves the use of chemicals, such as methanol. Although a number individuals and businesses are already conducting this conversion process on their own, many more still need or prefer professional assistance to convert waste oils to fuel.

Additional local-level solutions exist in municipal solid waste and yard waste that are rich in cellulosic biomass. These materials can be readily converted to advanced biofuels, and are available at very low or no cost, and simultaneously provide solutions to waste management concerns.²¹⁰ Moreover, recent reports on algae-based biofuels are offering promising conclusions.

Increasingly, national and local governments have scaled back on biofuels.²¹¹ The city of Berkeley, California, reconsidered its policy of using biodiesel in city trucks and machinery in the wake of a new study claiming that biodiesel production and use actually may increase greenhouse gases worldwide, as well as exacerbate world hunger.²¹²

V. CONCLUSION

Advancements in biofuel use and production can create the potential for increased energy access. The study of best practices and regulatory systems for biofuel production will assist in how the RFS is implemented, enforced, and updated. Currently, biofuels as a technology face challenges in being introduced into a market-based system. The entire

²⁰⁸ Ahmad, *supra* note 15, at 308 (internal citations omitted).

²⁰⁹ Edward Brown, *Recycling Cooking Oil: Pilot Program hopes to connect Fryolators to boiler rooms*, <http://www.bu.edu/sustainability/what-were-doing/waste-reduction/cooking-oil/>.

²¹⁰ GARY C. YOUNG, MUNICIPAL SOLID WASTE TO ENERGY CONVERSION PROCESSES: ECONOMIC, TECHNICAL, AND RENEWABLE COMPARISONS 39 (2010), <http://energy.cleartheir.org.hk/wp-content/uploads/2012/01/Municipal-Solid-Waste-to-Energy-Conversion-Processes-Economic-Technical-And-Renewable-Comparisons-0470539674-Wiley-1.pdf> ("In addition, this Plasma Arc Gasification technology can minimize, if not eliminate, the need for landfills and can be used to eliminate existing old landfills.").

²¹¹ Guy R. Knudsen, *Biofuels: The Environmental Downside*, ABA AGRIC. MGMT. COMMITTEE NEWSL., Jan. 2010, at 13, 15.

²¹² *Id.*

RFS system is at risk without progress on advanced biofuels, currently hindered by consumer opposition and commercial non-viability of these technologies. A successful biofuel program will require the recognition of market forces and consumer attitudes, functioning within a responsive regulatory framework. Integrating synergies between technological advancements, market forces, and consumption trends is essential along with an improved policy framework.