EXAMINING THE RENEWABLE FUEL STANDARD

HEARING

BEFORE THE

SUBCOMMITTEE ON THE INTERIOR

AND THE

SUBCOMMITTEE ON HEALTH CARE, BENEFITS AND ADMINISTRATIVE RULES

OF THE

COMMITTEE ON OVERSIGHT AND GOVERNMENT REFORM HOUSE OF REPRESENTATIVES

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EXAMINING THE RENEWABLE FUEL STANDARD

Wednesday, March 16, 2016

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON INTERIOR, JOINT WITH THE
SUBCOMMITTEE ON HEALTH CARE, BENEFITS, AND
ADMINISTRATIVE RULES,
COMMITTEE ON OVERSIGHT AND GOVERNMENT REFORM,
Washington, D.C.

The subcommittees met, pursuant to call, at 2:00 p.m., in Room 2154, Rayburn House Office Building, Hon. Paul Gosar [chairman of the Subcommittee on Interior] presiding.

Present from Subcommittee on Interior: Representatives Gosar, Buck, Russell, Lawrence, and Cartwright.

Present from Subcommittee on Health Care, Benefits, and Administrative Rules: Representatives Jordan, Walberg, DeSantis, Walker, Carter, Cartwright.

Also Present: Representative Welch.

Mr. GOSAR. The Subcommittees on Interior and on Health Care, Benefits, and Administrative Rules will come to order.

Without objection, the chair is authorized to declare a recess at any time.

I am going to acknowledge myself for my introductory statement.

The Renewable Fuel Standard, or RFS, is a mandatory minimum of biofuels that must be used in the national transportation fuel supply. The program was first established by Congress in 2005 and was later expanded in 2007 under the Energy Independence and Security Act to mandate that 36 billion gallons of biofuels must be blended into the fuel supply by 2022. The original goals of the RFS were to help curb air pollution, reduce greenhouse gas emissions, and reduce U.S. energy dependence through the use of biofuels.

Much has changed since the first 10 years that RFS has been in effect. When the original laws were passed, Americans had serious concerns about the rising price of gas and about our dependence on foreign oil. However, since almost immediately after the law was passed, the U.S. has experienced an extraordinary energy supply boom. Today, gasoline is selling for historically low prices. The assumption under the RFS that demand for oil would continue to rise has not been realized, and we must take a hard look at how this affects the success of the program.

Unfortunately, the way the law was written makes it incapable of adequately adjusting to these changes. The EPA is responsible for developing and implementing regulations for the RFS, but due to the challenging reality the RFS operates in, EPA has continually

been late in issuing its renewable fuel obligation levels and has often had to issue these annual renewable fuel mandates retroactively.

This past November, EPA issued the final renewable fuel volume levels for the year 2014, 2015, and 2016. This would make 2016 one of the few years EPA has issued that mandate on time.

In addition, EPA has often elected to use its waiver authority to issue volume mandates that are below the levels set by law further showing how the original mandates are unsustainable in today's reality.

The current RFS mandates have caused the Nation's fuel supply to reach the blend wall of 10 percent ethanol incorporated into the fuel supply. This blend wall barrier is the highest level of ethanol blended into fuel that can be sustained in the current automobile market. If any percentage higher than this is used in vehicles, serious engine problems can occur in older cars or void warranties in newer models. This creates a serious problem for consumers.

The implementation of the RFS has also created some unintended and adverse consequences. The rapid expansion of biofuel production using corn has caused an increase in food prices, which in turn hurts the poorest and most vulnerable in our society both at home and abroad.

Furthermore, some studies have shown that current ethanol production may actually contribute to higher greenhouse gas emissions. Accordingly, in a 2011 National Academy of Science study, EPA's own emissions analyst found corn ethanol to have a higher lifecycle greenhouse gas emission than that of gasoline. This is in direct contrast with the original RFS goal of improving air quality. These are just some of the problem that must be addressed as we examine the effectiveness and viability of the RFS as a program.

Today, we are joined by Mr. Christopher Grundler from the EPA Office of Transportation and Air Quality. I hope that the EPA can help us help you. Tell us what Congress needs to do to make it able to do its job.

I also hope to hear about the effects of the RFS from other members of the diverse panel that we have here today. I look forward to having a productive discussion with our witnesses on what we can do to best address the problems in the RFS program. I want to thank you for all taking the time to appear today, and I look forward to your testimony.

Mr. GOSAR. And with that, seeing that the ranking member is not here, I am going to recognize the vice ranking member, Matt Cartwright, for his opening statement.

Mr. CARTWRIGHT. Thank you, Dr. Gosar and Chairman Jordan, for holding today's hearing. I also want to thank our witnesses for coming today and sharing your expertise with us.

Renewable energy and energy efficiency technology play an instrumental role in improving America's energy independence and in reducing carbon emissions. Certainly, renewable energy sources are our future. Congress has to help facilitate and expedite our inevitable transition away from fossil fuels and the Renewable Fuel Standard, the RFS, can play an important role in the transition.

Established in 2005 and expanded in '07, the RFS was crafted by Congress to address our nation's dependence on foreign oil, as well

as spark clean energy innovation and job creation. The RFS requires the EPA to issue annual standards on four different categories of renewable fuels: total, advanced, biomass-based diesel, and cellulosic. These standards identify the percentage of each biofuel category that producers and importers of gasoline and diesel must blend into transportation fuel, heating fuel, and jet fuel.

I hope we can all agree that the goals of the RFS are laudable and deserve all of our support. And the industry has certainly achieved some success in meeting them. Biofuels, and especially advanced biofuels, hold the promise of dramatically reducing the carbon and environmental footprint of our transportation sector. According to the biotech industry, over its 10-year lifespan, the RFS has reduced U.S. transportation-related carbon emissions by 589.33 million metric tons.

Moreover, the industry is creating jobs. The cellulosic biofuel industry operates commercial biofuel plants in Kansas, Iowa, Mississippi, and Florida. Twenty States have biofuel facilities at different levels of development.

However, we do have to acknowledge the growing pains this industry has faced over the past decade, and I do have my own concerns. I have concerns about the RFS's impact on agriculture, food prices, and a series of unintended but potentially serious impacts on our environment. I am concerned about the RFS's influence on the conversion of forestlands and wetlands to corn and soy fields. And I am concerned about the different estimates of the carbon footprint of corn ethanol. And I want to understand better what the true current and future climate impact of the RFS will be.

Looking forward, I hope that the progress of the biofuels industry, which, without the RFS, never would have occurred, can lay a foundation for a bright future for renewable fuels. Carbon reductions and environmental benefits have thus far fallen short of the heights we may have hoped for, and cellulosic biofuels have not reached the production levels predicted when the RFS was first established.

But despite this, I still see a bright and essential future for renewable fuels, and the RFS is the most important policy tool we have to allow this industry to continue to innovate and expand. The biotech industry asserts that cellulosic and advanced biorefineries have now reached commercial status and that additional biorefineries can be built at lower capital costs.

I hope that the recent standards announced by EPA can provide certainty and propel us toward the advanced fuels that will truly meet the original goals of the RFS. I hope to work with my colleagues to get over hurdles such as the E10 blend wall and constraints in the supply chains that have limited the industry.

Our reliance on fossil fuels to power our transportation sector is unwise and unsustainable, and Congress was smart to provide a path for renewable fuels. The implementation of the RFS has raised valid concerns from many corners, but I believe the industry is ready to take a major step forward toward the advanced biofuels that will have an important and positive impact on the environment, on jobs, and on the transportation sector.

I look forward to hearing from our witnesses today better to understand the RFS and look forward to working with them and my colleagues in laying out a path toward a renewable energy future.

And I yield back, Mr. Chairman.

Mr. GOSAR. I thank the gentleman. I am glad that we also worked on potato potahto.

I would like to recognize Mr. Jordan, the chairman of the Subcommittee on Health Care, Benefits, and Administrative Rules for his opening statement.

Mr. JORDAN. Thank you, Mr. Chairman. Let me thank you for having this hearing.

You know, this would be laughable if it wasn't so serious. This is a classic example of what happens when you get a bunch of politicians together and think they are smarter than the marketplace. A bunch of politicians got together back in 2007 and said you know what, we think we should blend it at this rate this year and then keep increasing it.

And now all of a sudden we have hit the blend wall where even the EPA says—Mr. Grundler, who is here to testify today, testified even 3 years ago and said it is not feasible for the system to absorb that much ethanol, right? So instead of letting the hundreds of millions of consumers figure this out and the marketplace figure this out, politicians got together and they said we are smarter than everybody else, and we are going to put this schedule together. We think this is the way to go, and we are going to invest taxpayer money and skew the system in a way—this is a classic example of why you shouldn't do that, why you would let the marketplace work.

And I look forward to hearing from our witnesses. I hope our witnesses will just say we never should have gone down this road in the first place, and the best thing we can do is get out of it as quickly as possible. And short of that, maybe there is some other remedy, but this is, again, just a great example of why you don't let a bunch of people in Washington who think they are smarter than everybody else start some program that winds up creating all kinds of problems.

With that, I yield back.

Mr. GOSAR. I thank the gentleman.

I now recognize Mrs. Lawrence, ranking member of the Subcommittee on Interior, for her opening statement.

Mrs. LAWRENCE. Thank you, Chairman Gosar and Chairman Jordan, for holding this hearing today. I also want to thank our witnesses for your time and testimony today.

A Republican Congress passed and a Republican President signed into law the Energy Policy Act, which established the Renewable Fuel Standard. The RFS seeks to decrease our nation's dependency on foreign oil, as well as to promote clean energy innovation and job creation. The need for RFS remains as true today as it was in 2005.

I am proud to say that the innovation by Ford Motor Company headquartered in my home State of Michigan has sparked tremendous progress due to the RFS. For instance, since 2013, vehicles sold by Ford Motor Company in the U.S. are capable of running on gasoline as well as E15 blended ethanol fuel. To date, Ford has

manufactured more than 6.4 million flexible fuel vehicles globally. Ford Motor Company's efforts demonstrate tremendous strides in advancing and promoting the use of renewable fuels, creating jobs and expanding our national economy.

In addition, according to the biotechnology industry, the RFS has displaced nearly 1.9 billion barrels of foreign oil over the past decade by replacing petroleum fuel with homegrown biofuels.

Although the RFS has experienced challenges, it is not the time to abandon the RFS. We owe it to our constituents, the future generations to keep the RFS on track as a means to reduce our carbon emissions and dependence on fossil fuels, and to create jobs building a cleaner energy future.

I look forward to working with my colleagues to keeping this important piece of legislation intact.

Thank you, and I yield back.

Mr. GOSAR. I thank the gentlewoman.

I will also hold the record open for 5 legislative days for any members who would like to submit a written statement.

We will now recognize our panel of witnesses. First, I am pleased to welcome Mr. Christopher Grundler, director of the Office of Transportation and Air Quality at the U.S. Environmental Protection Agency. Our second guest is Mr. John DeCicco, Ph.D., research professor at the University of Michigan Energy Institute. Did I say it right?

[Nonverbal response.]

Mr. GOSAR. Ms. Kelly Stone, policy analyst at ActionAid USA; Mr. Wallace Tyner, Ph.D., the James and Lois Ackerman professor at the Department of Agricultural Economics at Purdue University; and our final witness is Mr. Nicolas Loris, the Herbert and Joyce Morgan fellow at the Heritage Foundation. Thank you all. Welcome to you all.

Pursuant to committee rules, witnesses will be sworn before they testify. Will you please rise and raise your right hand?

[Witnesses sworn.]

Mr. GOSAR. Let the record reflect that the witnesses answered in the affirmative.

Thank you and please be seated.

In order to allow for discussion, please limit your oral testimony to 5 minutes. Your entire written statement will be made part of the record.

With that, I would like to recognize Mr. Grundler for 5 minutes.

WITNESS STATEMENTS

STATEMENT OF CHRISTOPHER GRUNDLER

Mr. GRUNDLER. Chairman Gosar, Ranking Member Lawrence, Chairman Jordan, Ranking Member Cartwright, and other members of the committee, I appreciate the opportunity today to testify on the Renewable Fuel Standard program and the EPA's recent final rule setting the annual volume standard for 2014, 2015, and 2016, as well as the biomass-based diesel volume requirement for 2017.

As has been noted, the program began in 2006 under the Energy Policy Act of 2005 and modified by the Energy Independence and

Security Act of 2007, or EISA, which established new annual volume targets for renewable fuel that increase every year to reach a total of 36 billion gallons by 2022. It included 21 billion gallons of advanced biofuels. Congress also included waiver provisions for EPA to use to adjust these statutory targets in specified circumstances, including where the statutorily prescribed volumes could not be met.

After an extensive notice and comment process, including working closely with our Federal partners at the U.S. Department of Agriculture and the U.S. Department of Energy, EPA finalized regulations to implement the EISA requirements, and those regulations went into effect in July 2010.

The law requires EPA to issue annual standards for four different categories of renewable fuels, and the chairman already described these. We also established the applicable volume of biomass-based diesel, commonly referred to as biodiesel, that will be required in 2017. With this final action, we believe the RFS program is back on schedule and we're determined to keep it on schedule.

Biofuel use over the past decade has increased significantly, especially for ethanol and biodiesel, and recently, we've seen important developments in the production of advanced renewable fuels, including cellulosic biofuel production. Most of this growth in EISA's renewable fuel targets for 2015 and beyond comes from these advanced cellulosic biofuels. We are committed to doing what we can to encourage and support production and blending of such fuels to maximize reductions in greenhouse gases.

The final standards will increase the amount of biofuel in the market beyond historic levels, which is consistent with Congress's intent. The final standards provide for ambitious yet achievable growth and incentivize growth in advanced fuels that achieve substantial reductions in greenhouse gas emissions compared to the transportation fuels they replace. The rule uses the law's waiver authorities to adjust the annual volume targets but does so in a judicious way.

The final rule addresses 3 years' worth of standards and sets the volume requirement for biomass-based diesel for a fourth year. For '14 and '15, we finalized standards at levels intended to reflect the actual amount of biofuel used domestically. For 2016 and for 2017 for biomass-based diesel, the standards we have finalized provide for increases over past levels. The final 2016 volumes for total and advanced renewable fuels reflect our consideration of two essential factors: first, that the market can respond to ambitious volume targets; and second, that today there are limits to the volumes that can be supplied to consumers.

The final rule goes into considerable detail why some of the volume targets established in the statute cannot be reached. There are several reasons why, and some of them have already been mentioned: slower-than-expected development of the cellulosic biofuel industry and the resulting shortfall in cellulosic biofuel supply; a decline in gasoline consumption rather than the growth originally projected in 2007; and constraints in supplying certain biofuels to consumers, ethanol in greater than 10 percent of gasoline in particular.

Our final rulemaking includes a discussion of this last constraint, known as the E10 blend wall. If gasoline demand is flat or trends downward, increasing the amount of ethanol used in the fuel pool will require a significantly greater use of fuels with higher ethanol content such as E15 and E85, which can be used in flexible fuel vehicles.

However, EPA recognizes that there are real limitations in today's market to the increased use of these higher-ethanol-content fuels, including current and near-term limits on fueling infrastructure. USDA is working to expand this ethanol fueling infrastructure.

Overall, the final rule requires that total renewable standards grow by more than 1.8 billion gallons from 2014 to 2016, which is an 11 percent increase over 2014. The final cellulosic standard is nearly 200 million gallons, or seven times more than the market produced in 2014, and for an advanced biofuel, the 2016 standard is nearly 1 billion gallons or 35 percent higher than the actual 2014.

In addition, the biodiesel standard also grows steadily over the next several years, reaching 2 billion gallons by 2017, a 23 percent higher level than the actual 2014 volumes. We believe that these volumes are achievable and consistent with Congress's clear intent to drive renewable fuel up even as we use the authorities that Congress provided EPA to manage the program responsibly.

We've taken other steps to improve the administration of the RFS program. We've improved the petition review process for new pathways under the program, and they're already making a difference. Since launching this new process, we've approved over 50 petitions for more efficient corn ethanol plants with an average review time of less than 2 months. This is an 80 percent improvement over our prior performance. We've also proposed new—six new pathways for second-generation—I'm sorry, finalized six new pathways for second-generation biofuels and proposed five more.

Having finalized these standards as we look towards 2017, it's important to remember that the RFS program is only one part of the overall picture. Both USDA and DOE have programs supporting development of—and infrastructure, and we work closely with them in our work to implement this program.

Thank you for the opportunity to appear before you today.

[Prepared statement of Mr. Grundler follows:]

Christopher Grundler
Director
Office of Transportation and Air Quality
Office of Air and Radiation
U.S. Environmental Protection Agency

Subcommittees on Interior and Health Care, Benefits and Administrative Rules
Committee on Oversight and Government Reform
U.S. House of Representatives
March 16, 2016

Statement

Chairwoman Lummis, Ranking Member Lawrence, Chairman Jordan, Ranking Member Cartwright, and other members of the Committee, I appreciate the opportunity to testify on the Renewable Fuel Standard (RFS) program and the EPA's recent final rule setting the annual volume standards for 2014, 2015, and 2016, and the biomass-based diesel volume requirement for 2017.

The RFS program began in 2006 under the Energy Policy Act of 2005. The program's requirements were then modified by the Energy Independence and Security Act of 2007 (EISA). EISA's stated goals include moving the United States toward "greater energy independence and security," and increasing "production of clean renewable fuels." EISA established new annual volume targets for renewable fuel that increase every year to reach a total of 36 billion gallons by 2022, including 21 billion gallons of advanced biofuels. Congress also included tools, known as waiver provisions, for EPA to use to adjust the statutory targets in specified circumstances, including where the statutorily prescribed volumes could not be met. After an extensive notice and comment process, including working closely with our federal partners at the U.S. Department of Agriculture (USDA) and U.S. Department of Energy (DOE), EPA finalized regulations to implement the EISA requirements. Those regulations went into effect in July 2010.

EISA requires EPA to issue annual standards for four different categories of renewable fuels: total, advanced, biomass-based diesel, and cellulosic. These standards designate the percentage of each biofuel category that producers and importers of gasoline and diesel must blend into transportation fuel, heating oil, or jet fuel. On November 30, 2015, we issued a final rule to establish the annual volume standards for cellulosic biofuel, biomass-based diesel, advanced biofuel, and total renewable fuel that apply for years 2014, 2015, and 2016. We also established the applicable volume of biomass-based diesel, commonly referred to as biodiesel, that will be required in 2017. The Clean Air Act requires EPA to issue renewable fuel standards by November 30 of each year for the following year and 14 months in advance for the biomass-based diesel category.

Biofuel use over the past decade has increased significantly, especially for ethanol and biodiesel, and recently we have seen important developments in the production of advanced renewable fuels, including cellulosic biofuel production. This is encouraging, because cellulosic biofuels are the biofuels that have the lowest lifecycle GHG emissions. Most of the growth in EISA's renewable fuel targets for 2015 and beyond comes from these advanced cellulosic biofuels. We are committed to doing what we can to encourage and support production and blending of such fuels to maximize reductions in greenhouse gases.

With this final rule, EPA established volume requirements that will increase the amount of biofuel in the market beyond historic levels – consistent with Congressional intent. The final standards provide for ambitious yet achievable growth, and incentivize growth in advanced fuels that achieve substantial greenhouse gas (GHG) reductions compared to the transportation fuels they replace. The rule uses the law's waiver authorities to adjust the annual volume targets, but does so in a judicious way. As a result, the final standards, though lower than the statutory levels, still require substantial growth in renewable fuel use.

The final rule addresses three years' worth of standards, and sets the volume requirement for biomass-based diesel for a fourth year. For 2014 and 2015, we finalized standards at levels intended to reflect the actual amount of biofuel used domestically. For 2016 – and for 2017 for biomass-based diesel – the standards we have finalized through use of waiver authorities provide for significant increases over past levels. The final 2016 volumes for total and advanced renewable fuels reflect our consideration of two essential factors: first, that the market can respond to ambitious volume targets, and second, that there are limits today to the volumes that can be supplied to consumers.

Many of our stakeholders rightly want to know why some of the volume targets established in the statute cannot be reached. There are several reasons: slower than expected development of the cellulosic biofuel industry and the resulting shortfall in cellulosic biofuel supply, a decline in gasoline consumption rather than the growth projected in 2007, and constraints in supplying certain biofuels to consumers – ethanol at greater than 10 percent of gasoline, in particular. Our final rulemaking includes a discussion of this last constraint, known as the "E10 blend wall." If gasoline demand is flat or trends downward, increasing the amount of ethanol used in the fuel pool will require significantly greater use of fuels with higher ethanol content. Examples are blends of 15 percent ethanol in gasoline, or E15, and blends of up to 85 percent ethanol, or E85, which can be used in flexible fuel vehicles (FFVs). EPA has taken steps to enable the use of higher-level ethanol blends, including granting partial waivers for the use of E15 in certain light-duty cars and trucks beginning with model year 2001. USDA has also put resources into expanding ethanol fueling infrastructure. At the same time, EPA recognizes that there are real limitations in today's market to the increased use of these higher ethanol content fuels, including current near term limits on fueling infrastructure.

The standards we finalized for 2016 will continue to spur growth in renewable fuel use. Overall, this final rule requires that total renewable standards grow by more than 1.8 billion gallons from 2014 to 2016. That's 11 percent more biofuel than the market produced in 2014.

The final 2016 standard for cellulosic biofuel – the fuel with the lowest carbon emissions– is nearly 200 million gallons, or 7 times more, than the market produced in 2014. For advanced biofuel, the 2016 standard is nearly 1 billion gallons, or 35 percent, higher than the actual 2014 volumes. In addition, the biodiesel standards also grow steadily over the next several years, increasing every year to reach 2 billion gallons by 2017. That's 23 percent higher than the actual 2014 volumes.

We believe that these volumes are achievable, and consistent with Congress' clear intent to drive renewable fuel use up, even as we use the authorities that Congress provided EPA to manage the program responsibly.

EPA has taken other steps to improve the administration of the RFS program. We have improved the quality, transparency, and efficiency of our petition review process for new biofuel pathways that can count under the RFS program. These improvements to our pathways review process are already making a difference. Since launching the new Efficient Producer process on September 30, 2014, EPA has approved over 50 petitions for efficient corn ethanol plants with an average review time of less than 2 months. Compared to our previous performance, we have reduced our processing time for similar petitions by 80%, and we are continuing to work toward shortening that time. Since announcing our streamlining initiative, we have approved six new pathways for second-generation biofuels.

Even as we finalize these standards and look towards 2017, it's important to remember that the RFS program is only one part of the overall picture for biofuels. Both USDA and DOE have programs supporting biofuels development and fueling infrastructure, and we work closely with them in our work to implement this program.

EPA recognizes that both challenges and opportunities lie ahead for the renewable fuel sector. Introducing new fuels into the marketplace, especially cellulosic biofuels, is not an easy task. But that is the challenge that Congress took on with the RFS program, and we are committed to implementing the program in a way that responsibly pushes forward and grows renewable fuels over time, as Congress intended. And in doing so, we will continue to engage with our stakeholders and work in close consultation with USDA and DOE.

Again, I thank you for the opportunity to serve as a witness at this hearing.

Mr. GOSAR. Thank you very much. And in the spirit of the NCAA tournament, -losic is 4, -losic is 0.

[Laughter.]

I would like to now introduce Mr. DeCicco from the University of Michigan.

STATEMENT OF JOHN M. DECICCO

Mr. DECICCO. Thank you. I wish to thank the chairs, Representatives Gosar, ranking members Representatives Lawrence and Cartwright, as well as the other members of your subcommittees and the overall committee who are here today. My name is John DeCicco, and I'm a research professor at the University of Michigan's Energy Institute. My main focus is transportation fuel use and its environmental impact. I have a doctorate in engineering from Princeton University and I've worked on America's energy challenges for nearly 40 years, including 21 years at environmental organizations before returning to academia in 2009. My research has included scientifically rigorous evaluations of the RFS and other policies that promote biofuels such as ethanol and biodiesel.

RFS proponents claim that the policy reduces CO2 emissions. I have found that it does not. In fact, from its inception, the RFS has increased rather than decreased CO2 emissions compared to petroleum fuels such as gasoline. My findings contradict the conventional wisdom about biofuels. They reveal errors in the computer modeling on which the environmental rationale for the RFS was based. It's no surprise that some biofuel researchers and advocates have criticized these findings and those of other scientists who also have found flaws in the modeling that backs the RFS.

The claims that biofuels reduce CO2 emissions rely on a method known as lifecycle analysis. It's a way to compare fuels according to their carbon footprint. When it expanded the RFS through EISA in 2007, Congress required EPA to evaluate the lifecycle emissions of advanced biofuels. The Agency also adapted the method for its RFS impact assessments.

EPA did not originate fuel lifecycle analysis. Rather, the method was largely developed at the Department of Energy and by academic proponents of renewable energy, and its use was advocated by the green groups who backed the RFS. Unfortunately, lifecycle analysis makes a mistake by assuming that biofuels are automatically carbon neutral. Only under certain conditions does replacing a fossil fuel with a biofuel neutralize the CO2 that leaves tailpipes. For that to occur, harvesting the corn or other feedstock must greatly speed up how quickly cropland pulls CO2 from the air. That doesn't happen for the corn and soybean harvests diverted to produce renewable fuels as mandated by the RFS.

My analysis looks directly at farm data, and those data show that in practice the carbon neutrality assumption is not met. My research team evaluated corn ethanol for which a lifecycle analysis study claims a 40 percent reduction in greenhouse gas emissions compared to gasoline. We found no significant reduction of emissions. Moreover, under typical crop rotations, net emissions could be as much as 70 percent higher than those of gasoline. These results do not even include indirect land-use change, which would increase biofuels emissions' impact even more.

So here we are 10 years after the 2005 energy bill first established the RFS, 8 years after it was expanded by EISA, and the policy has worsened CO2 emissions. It turns out that the studies used to justify it are flawed. Environmentally speaking, it would be best to repeal the Renewable Fuel Standard. Short of that, helpful reforms would include scaling the mandate back to well below the blend wall and striking lifecycle analysis from the policy.

Thank you for letting me share my findings, and I'll look forward to your questions.

[Prepared statement of Mr. DeCicco follows:]

Testimony on

The Renewable Fuel Standard

John M. DeCicco, Ph.D.
Research Professor
University of Michigan Energy Institute

Before the

Subcommittees on Interior and on Health Care,
Benefits and Administrative Rules
Committee on Oversight & Government Reform
U.S. House of Representatives
114th Congress of the United States of America

Hearing on the
Examining the Renewable Fuel Standard
2154 Rayburn House Office Building
Washington, D.C.

Wednesday, March 16, 2016

DISCLAIMER

The findings and perspectives presented in this testimony represent the author's own professional assessment as an independent academic researcher. They should not be taken to reflect the views of the University of Michigan, the University of Michigan Energy Institute and other units of the university, the author's past affiliations, or funders present or past.

SUMMARY STATEMENT

I wish to thank the Chairs, Representatives Lummis and Jordan, and the Ranking Members, Representatives Lawrence and Cartwright, as well as the other members of your Subcommittees for inviting me to today's hearing.

My name is John DeCicco and I am a research professor at the University of Michigan Energy Institute, where my main focus is transportation fuel use and its environmental effects. I hold a doctorate in engineering from Princeton University and have worked on America's energy challenges for nearly 40 years, including 21 years at environmental organizations before returning to academia in 2009.

My recent research has included scientifically rigorous evaluations of the Renewable Fuel Standard (RFS) and other policies that promote biofuels such as ethanol and biodiesel. RFS proponents claim that the policy reduces CO_2 emissions. I have found that it does not. In fact, from its inception, the RFS has increased rather than decreased the amount of CO_2 entering the atmosphere compared to petroleum fuels such as gasoline.

My findings contradict the conventional wisdom about biofuels and reveal errors in the computer modeling on which the environmental rationale for the RFS was based. It's no surprise that some biofuel researchers and advocates have criticized these findings and those of other researchers who have found related flaws in studies backing the RFS.

The claims that biofuels reduce CO_2 emissions rely on lifecycle analysis, a method for comparing the so-called carbon footprint of various fuels. When it expanded the RFS through the Energy Independence and Security Act of 2007 (EISA), Congress required EPA to evaluate the lifecycle emissions impact of non-grandfathered biofuels. The agency also adapted the method for its RFS impact assessments. EPA did not originate lifecycle analysis. Rather, the methods used were largely developed by the Department of Energy and academic proponents of renewable energy, and their use was advocated by green groups that back the RFS.

Unfortunately, these lifecycle analysis methods make a serious mistake by assuming that biofuels are automatically carbon neutral. In reality, only under certain conditions does replacing a fossil fuel with a biofuel neutralize the CO_2 leaving the tailpipe. For that to occur, harvesting

the corn or other feedstock must greatly speed up how quickly cropland pulls CO_2 from the air. That doesn't happen for the corn ethanol and biodiesel mandated by the RFS.

Examining real-world farm data shows that, in practice, the carbon neutrality condition is not met. My research team evaluated corn ethanol for which lifecycle analysis had claimed a 40% reduction in greenhouse gas emissions compared to gasoline. We found no significant reduction of emissions. Moreover, under typical crop rotations, net emissions could be as much as 70% higher than those of gasoline. These results do not even include indirect land-use change, which would increase biofuel emissions even more.

So, here we are, ten years after the 2005 Energy Policy Act established the RFS and eight years after EISA. The policy has worsened CO_2 emissions and it turns out that the studies used to justify it are flawed. From an environmental perspective, the best outcome would be to repeal the policy. Short of that, helpful reforms would include scaling back the mandate, ideally to well below the blend wall, and striking the RFS lifecycle provisions.

Thank you for letting me share these findings and I'll look forward to your questions.

Examining the Renewable Fuel Standard

INTRODUCTION

The Renewable Fuel Standard (RFS) was first established by the Energy Policy Act of 2005, which amended the Clean Air Act to require that 7.5 billion gallons of renewable ethanol be blended into the nation's gasoline supply by 2012. The RFS was expanded by the Energy Independence and Security Act of 2007 (EISA) to target a total of 36 billion gallons of renewable fuel by 2022. EISA also set specific requirements for certain categories of advanced, cellulosic and biomass-based diesel fuels to meet specified levels of greenhouse gas (GHG) reduction, relative to the petroleum-based fuels they replace, as determined by the Administrator of the Environmental Protection Agency (EPA) through lifecycle analysis (LCA). Starch-based ethanol from facilities placed into operation after the enactment of EISA must also meet a lifecycle GHG intensity ("carbon intensity" or "CI") threshold, specified as being 20% lower than that of baseline 2005 petroleum gasoline.

Three public policy rationales underpin the RFS and other policies to promote biofuels. One is to support the domestic agricultural sector by creating an additional market for corn and soybeans, thereby bolstering prices for these commodities and enhancing farmer and processor incomes. The second is energy security, which some argue can improved by developing domestic sources of liquid fuels to reduce reliance on imported oil. The third rationale, which was elevated in the expanded RFS called for by EISA, is environmental. It rests on the potential for biofuels, which utilize carbon absorbed from the atmosphere through crop growth, to reduce net carbon dioxide (CO_2) emissions from transportation fuel use. Such renewable fuels can include biomass-based ethanol and biodiesel as well as potential "drop-in" (fully fungible) fuels derived from biomass that are compatible with existing vehicles and fuel distribution systems.

This discussion focuses on the environmental rationale for the RFS. It examines the methodologies that EPA, the Department of Energy (DOE) and other agencies have used to assess the GHG emissions impacts of renewable fuels and addresses the question of whether the RFS has reduced CO_2 emissions to date.

METHODOLOGICAL ISSUES

The environmental impacts of corn ethanol and other biofuels have been disputed for decades. Much of the disagreement hinges on the methods used to assess the impacts and the numerous assumptions that are made in the absence of complete data. Proponents of the lifecycle analysis (LCA) models used for fuels policy, as in the EISA (2007) RFS requirements for non-grandfathered fuels and in California's low-carbon fuel standard (LCFS), claim that these models implement the best available science for comparing transportation fuel alternatives. Such is the case for the DOE-sponsored GREET[1] model, similar LCA tools and the complex modeling apparatus involving commodity trade simulations that have been combined with GREET. However, outside of a certain community of specialists whose work is oriented to promoting biofuels, there never has been scientific consensus regarding the methods, their results or even whether it is appropriate to use LCA for regulation.

My recent in-depth review paper[2] examined over 100 studies dating from the 1970s and documents how the limitations of fuels-oriented LCA (often termed *fuel cycle analysis,* FCA) were pointed out decades ago. It also points out how the more scientifically rigorous method of terrestrial resource analysis (TRA) was developed two decades ago but that its key principles, particularly regarding complete carbon accounting and consistent use of system boundaries, were neglected by the fuels LCA modeling community. When the incorrect treatment of land use was highlighted in key *Science* papers[3] shortly after EISA was passed, established biofuel analysts attempted to mischaracterize the work and dismiss its applicability, leveling particular criticism at the issue of indirect land-use change (ILUC).[4] Subsequently, the fuels LCA community has addressed ILUC and other economic interactions by combining fuel cycle models with economic models. The resulting lifecycle modeling is more complex but still fails to address fundamental shortcomings with the approach.

This dubious method of analysis was widely promoted, particularly by DOE, certain national laboratories and some environmental groups as well as biofuel companies and trade associations. Unfortunately, this community did not adequately validate the methods using real-world data. Instead, the LCA-based claims of GHG reduction benefits for biofuels have been circulated uncritically, often without sufficient attention to the limitations and uncertainties, and broadly disseminated in policy circles.[5] These results about the lifecycle carbon intensity (CI, or "carbon footprint") found wide acceptance due in part to the politically appealing story they told

about the environmental benefits of biofuels. Such was the situation when Congress expanded the RFS through EISA and inserted the requirement for EPA to use lifecycle methods to make compliance determinations for certain categories of renewable fuel.

LCA is a marked departure from proven, empirically verifiable methods for defining environmental regulations. EPA itself pointed out that

> **"the GHG reduction thresholds presented in EISA are the first lifecycle GHG performance requirements included in federal law."**[6]

Since the RFS was passed, recognition of the problems with LCA has only grown. Concerns about food-versus-fuel trade-offs, the realization that highly productive land is a finite resource and the related risks of deforestation have only amplified the large uncertainties regarding the environmental impacts of biofuels. To the extent that a scientific consensus exists, it is that estimates based on LCA models and their augmentations are highly uncertain, particularly when it comes to the complex market interactions involved when using agricultural products for fuel.[7] As one paper concludes, "Obtaining precise estimates of these impacts is likely beyond the reach of current models and data."[8] Although perhaps unwittingly, Congress has put EPA in an untenable position by requiring the agency to use a method that is inherently, and indeed irreparably, inaccurate when writing regulations that have large impacts on costs to consumers and businesses as well as the environment.

In fact, using LCA to determine a specific value for comparing fuels is an abuse of the method. Lifecycle assessment methods were designed to evaluate the diverse sources of environmental impact associated with a product or system. When appropriately used, LCA can help identify problem areas and opportunities for reducing impacts within a given supply chain. Some LCA scholars have now highlighted the increasingly irreconcilable difficulties incurred when the method is used for bioenergy policy.[9] Moreover, in its guidelines for the method, the International Standards Organization (ISO) states that

> **"there is no scientific basis for reducing LCA results to a single overall score or number, since weighting requires value choices."**[10]

Yet that is exactly what Congress has required EPA to do through the EISA stipulation that certain renewable fuels meet specified thresholds for lifecycle GHG emissions reduction compared to baseline petroleum fuels.

The LCA method is misused when GREET and similar models are used to claim GHG reduction benefits for corn ethanol, biodiesel and other biofuels.[11] It is also abused in the more elaborate modeling done by California to compute lifecycle carbon intensity values for the LCFS. Similarly, when such LCA modeling calculations are used to assert GHG savings due to the RFS either in the past[12] or prospectively,[13] the results cannot be claimed as scientifically valid. Even though legitimate scientific results may be used as inputs for such modeling, the LCA results depend on numerous value judgements about how to combine the available data for the purposes of obtaining the numbers that purport to represent fuel GHG emissions impacts. EPA's RFS analyses, even though they reflect a careful effort to use the best data available, are still burdened with this profound limitation of the LCA method itself.

Although there are many problems with the method, one key problem is that, by construction, the LCA models used for analyzing fuels assume that renewable fuels are inherently "carbon neutral," meaning that the CO_2 emitted when they are burned is fully offset by CO_2 uptake during feedstock growth. That assumption leads many scientists to presume that environmental impact assessments need only consider production-related GHG emissions throughout a biofuel's lifecycle. Although it is merely an accounting convention that is valid only under certain conditions, the carbon neutrality assumption is automatically invoked by GREET, regardless of whether the conditions are met, and it is also assumed by LCA models used for the RFS, as noted in EPA's statement that "CO_2 emissions from biomass-based fuel combustion are not included in their lifecycle emissions results."[14]

The notion that using a renewable fuels automatically reduces CO_2 emissions (short of processing impacts) is based on an incomplete and incorrect understanding of how carbon is recycled through plant growth. Only under limited conditions does substituting a biofuel for a fossil fuel neutralize tailpipe CO_2 emissions. Moreover, it is possible to evaluate the extent to which this condition is met using field data. Therefore, although it is not possible to estimate a scientifically valid single number that reflects the total lifecycle impact of a fuel, it is possible to carry out a scientifically valid test of whether a biofuel's feedstock has removed enough CO_2 from the air enough to offset, and thereby potentially neutralize, the CO_2 emissions from fuel use. My research has involved performing such evaluations using data for actual biofuel production as seen in the United States since the passage of the RFS. We find that the carbon neutrality condition is not met in practice.

To provide background for understanding this finding, the next section of this testimony describes the principles that underpin scientifically verifiable carbon accounting for interactions among the terrestrial biosphere (which is the source of biofuel feedstocks), the geosphere (the source of fossil fuel feedstocks) and the atmosphere (where excess CO_2 concentrations disrupt the Earth's climate).

PRINCIPLES FOR VERIFIABLE CARBON ACCOUNTING

A crucial foundation for any analysis of biofuels is the fact that CO_2 is always cycling between the biosphere and the atmosphere,[15] whether or not biomass-based products are being used for fuel. Figure 1 highlights the basic carbon flows needed to analyze the substitution of biofuels for fossil fuels, based on the "Biofuels Carbon Balance" paper published in *Climatic Change.*[16]

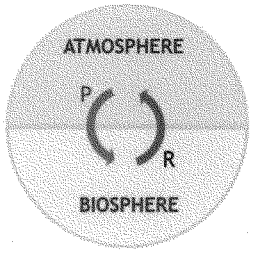

Figure 1. The main flows of the terrestrial carbon cycle: P = net primary production; R = heterotrophic respiration.

In this diagram, P stands for Net Primary Production (NPP), which is the amount of carbon absorbed into plants as they grow after subtracting plants' own metabolic release of CO_2. R stands for heterotrophic respiration (often designated R_h), which is the CO_2 respired by organisms that consume plants. That includes humans and livestock, but the vast majority of such respiration is from soil bacteria, fungi and other organisms collectively known as decomposers. These creatures form a critical part of the food chain that sustains all living things. Carbon is the fuel of life. In nature, no carbon is wasted; it is all put to use whether or not it is used commercially. On average, P exceeds R, which enables carbon to accumulate in the biosphere.

Another key tenet is the fact that the total amount of carbon in the world is fixed. Otherwise put, whether as food for biological processes, CO_2 in the atmosphere, fuel for motor vehicles or in living biomass such as forests, wetlands and other carbon-rich ecosystems, carbon utilization occurs in a closed system. This reflects the law of conservation of mass as applied to carbon. Unfortunately, this basic principle it is neglected in the LCA models used to analyze biofuels. The error is related to the fact that these models were designed without properly accounting for CO_2 uptake (that is, P in the diagram above) even though they track CO_2

emissions throughout a fuel's lifecycle. The failure to respect the law of conservation of mass is one of the reasons why most prior evaluations of the RFS (and biofuel use generally) give results that inconsistent with the realities of the terrestrial carbon cycle.

Using these principles for carbon accounting, rigorous analysis of what happens when a biofuel substitutes for a fossil fuel is straightforward. The situation is depicted in Figure 2, which shows the carbon flows associated with fuel use in addition to the basic carbon flows shown in Figure 1. Also shown is the P-minus-R difference, which is termed Net Ecosystem Production (NEP).[17] It is given as a downward arrow and reflects the net flow of carbon from the atmosphere to the biosphere.

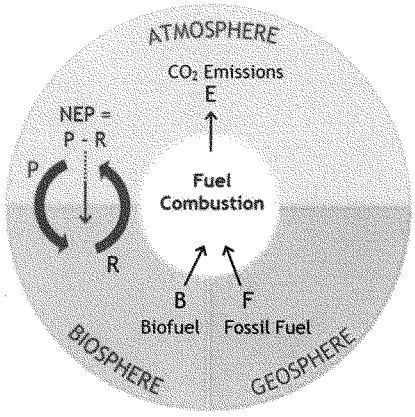

Figure 2. An increase in Net Ecosystem Production (NEP) is needed for biofuels to have a potential climate benefit.

At the center of the figure is fuel combustion. Whether the source of carbon in the fuel is biomass (B) or fossil (F), the amount of CO_2 emitted (E) when burning the fuel is essentially the same per unit of useful energy. In other words, using a biofuel (such as ethanol or biodiesel) instead of a fossil fuel (such as gasoline or diesel from petroleum) does not appreciably change the rate at which CO_2 flows into the atmosphere, e.g., from vehicle tailpipes or jet engines. As a matter of basic chemistry, if biofuels have a benefit, it is not when they are burned.

To reduce CO_2 buildup in the atmosphere, the emissions from fuel combustion must be balanced by *increasing* NEP, that is, speeding up how quickly CO_2 is removed from the atmosphere by cropland. In other words, there must be an acceleration of the net rate at which CO_2 flows from the atmosphere into biosphere. Mathematically, this condition is written as

$$d(NEP)/dt > 0$$

which means that NEP must be higher from one year to the next in order for fuel combustion emissions to be offset. If this condition is not met, biofuels cannot provide a climate mitigation benefit and biofuel use is not carbon neutral. Moreover, this failure to reduce net GHG emissions comes even before considering the emissions involved in growing the feedstock and processing it into fuel. It is also before considering the land-use change impacts that have become so prominent in the biofuels debate.

NEP can be evaluated over any area of land from a farm field up to the entire globe. To determine the potential climate protection benefits of a biofuel, it is necessary to evaluate how NEP changes on the cropland from which the feedstock is harvested. Figure 3 illustrates NEP for a crop such as corn. In annual crops, very little carbon accumulates in the soil from year to year; as NRC (2011) points out, the uncertainties in soil carbon changes are large relative to the magnitudes involved, and so it is fair to assume no change in soil carbon on average. Therefore, NEP is essentially proportional to the harvest (H as shown in the figure).

For example, on a 40 acre farm field that grows corn with an annual yield of 160 bushels per acre, the amount of carbon removed in the harvest is roughly 59 metric tons.[18] That means that the downward rate of carbon flow from the atmosphere into the biosphere over the field (that is, its NEP) is 59 tons of carbon per year. Corn is among the most productive of crops in terms of

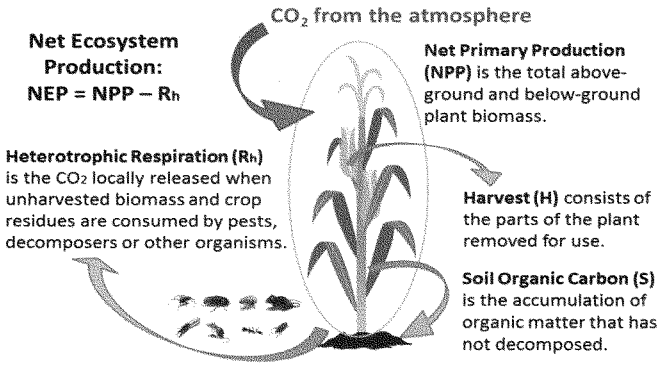

Figure 3. Carbon exchanges associated with an annual crop
Image Credit: Jane Thomas, Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/imagelibrary/)

yield, and so the NEP on a cornfield is significantly higher than that of other crops. An average soybean yield is 44 bushels per acre, and so a similar calculation for a 40 acre soybean field implies a NEP of roughly 18 tons of carbon per year.[19] As noted in the analysis discussed below, a gain in NEP occurs when rotating from soy to corn; conversely, a loss in NEP occurs when rotating back to soy.

DIRECT CARBON BALANCE EFFECTS FOR ETHANOL PRODUCTION

Measuring the extent to which biofuel feedstock production raises NEP enable an empirical test that of whether the GHG reductions predicted by LCA models actually occur in practice. To answer this question, we examined a case study for a state-of-the-art natural gas dry mill corn ethanol biorefinery and the farmland that serves it. The method we used relies on the directly measurable carbon flows associated with crop growth, refining and other production processes associated with both ethanol and gasoline, and the tailpipe ("end-use") CO_2 emitted when vehicles are driven.

Figure 4 is a schematic illustration of the system examined for a carbon balance analysis. Notably, the system boundary always includes CO_2 uptake on cropland because this uptake occurs whether or not the crops are used for fuel. It also tallies process emissions, including any process-related CO_2 that comes from biomass itself (known as biogenic emissions), which for

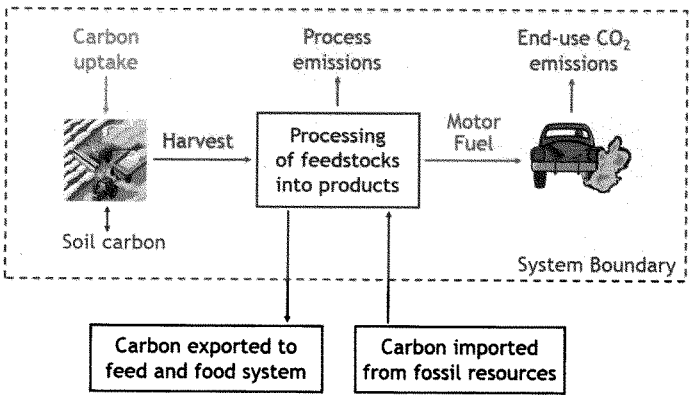

Figure 4. Schematic diagram for direct carbon balance analysis of motor fuel GHG impacts

Table 1. Summary of direct annual basis carbon (ABC) flows for a unified vehicle-fuel system using gasoline in a baseline year and corn ethanol the following year

Carbon-equivalent mass flows, thousand metric tons per year (kt_c/yr)			
	$Year_0$ using gasoline	$Year_1$ using ethanol	$Year_1$ - $Year_0$ Difference
Carbon exchange on cropland	(119)	(189)	(70)
Process emissions	39	115	76
Vehicle emissions	89	87	(2)
Net emissions impact of the system	**10**	**14**	**4**
Biomass carbon exported from system	119	65	(53)
Source: combined pathway results from DeCicco & Krishnan (2015); note that 1 $kt_c/yr = (12/44)kt_{CO2}/yr$			

ethanol production includes the CO_2 released during fermentation. As shown in the diagram, flows of fixed carbon (as opposed to CO_2) are exported across the fuel system boundary in the form of biomass products (corn, soybeans, other agricultural products and coproducts) and are imported across the system boundary from fossil resources such as crude oil. Changes in these external flows result in displacement effects, such as reduced corn and soybean consumption in the food and feed system, which is partly offset by coproducts such as distillers' grains, and petroleum that remains unused by motor vehicles but which can induce a rebound effect in fuel markets. However, these flows of fixed carbon do not result in CO_2 emissions to the atmosphere from the vehicle-fuel system itself, which is what matters when evaluating the extent to which tailpipe CO_2 emissions are offset by CO_2 uptake on cropland.

Table 1 summarizes what we found in our recent report.[20] The first line gives the carbon uptake on land, shown as a negative emission and reflecting the downward flow of CO_2 from the atmosphere into growing biomass, including carbon removed in the harvest plus any gain in soil carbon; the units are thousand metric tons (10^6 kg) of carbon mass per year, kt_c/yr. The difference column shows the change in carbon uptake; it is negative because the rate of carbon removal from the atmosphere by the cropland went up from the baseline year to the ethanol production year. The main reason for this large gain in uptake is a shift from growing soybeans on nearly half the cropland serving the facility to growing all corn when ethanol was produced. Because corn yields are higher than soybean yields, a corn field removes CO_2 from the atmosphere more rapidly than does a soybean field.

The second line of Table 1 gives process emissions, which are higher for ethanol production than for petroleum refining. These values are consistent with typical LCA estimates of the GHG emissions from feedstock and fuel processing, but for ethanol the ABC method also includes biogenic process emissions, notably the CO_2 released during fermentation. Vehicle tailpipe CO_2 emissions differ only slightly, with ethanol being 2% lower than gasoline.

Summing these values indicates that the net GHG emissions impact of the unified system (cropland, upstream and downstream processing and motor vehicles) is higher when ethanol is used than when gasoline is used. The difference is about 4 thousand metric tons of carbon per year (kt_c/yr), which in relative terms is 4.3% of the baseline 89 kt_c/yr end-use CO_2 emissions from gasoline use. This estimate is not a lifecycle ("well-to-wheels") CI metric, but simply the difference in direct GHG emissions from the circumscribed system of Figure 4 when using corn ethanol instead of gasoline. This increase in direct GHG emissions contradicts the previously published GREET analysis of the facility's first year of operation, which found a lifecycle CI for the corn ethanol that was 40% lower than that of gasoline.

The bottom row of Table 1 shows the changes in the rate at which carbon leaves the system in exported biomass. In the baseline year when gasoline is used, corn and soybeans are supplied to the external food system. When fuel ethanol is produced, only the coproducts are supplied to the food system. This large change in the supply of food-related biomass drives the displacement effects analyzed using the consequential modeling that has become part of LCA for fuels policy. For the case study examined here, the 53 kt_c/yr loss of biomass exports represents 45% of the baseline 119 kt_c/yr of exported biomass. Although not shown in the table, there is a reduction of 111 kt_c/yr of fossil carbon imported into the system as petroleum. Nevertheless, this reduction of fossil fuel use does not result in a direct reduction of CO_2 emissions because vehicle emissions do not significantly change.

This analysis highlights the critical importance of pre-existing CO_2 uptake on the land from which a biofuel feedstock is sourced. In the LCA methods used for the RFS, such baseline carbon uptake is automatically and fully credited against tailpipe CO_2 emissions, a modeling convention equivalent to assuming that uptake was zero before the feedstock was harvested for producing biofuel rather than for feed and food. But CO_2 uptake is never zero on productive land and is in fact substantial for existing cropland, the main source of biofuels produced at

commercial scale. For the facility analyzed here, a gain in CO_2 uptake occurred because of the shift from soybeans to corn on nearly half the cropland serving the facility.

Corn-soy is the dominant crop rotation on U.S. farmland, but farms cannot permanently shift from soy to all corn, and so the case illustrated in Table 1 represents a best-case scenario for carbon uptake. We conducted a sensitivity analysis of different baseline conditions for crop rotation and yield; those results are detailed in the aforementioned report.[20] We found that a situation that just involves diverting corn from food and feed markets to the fuel market, and which does not credit a yield gain that would mostly likely have occurred anyway, resulted in an emissions increase of 61 kt_c/yr, implying that using corn ethanol would increase GHG emissions by nearly 70% compared to baseline tailpipe CO_2 emissions using gasoline. This can be considered an upper bound scenario, in contrast to the relatively insignificant 4 kt_c/yr emissions increase shown in Table 1, which can be considered a best-case scenario. The conclusion is that the change in direct CO_2 emissions when using corn ethanol instead of gasoline is insignificant at best, or it could make matters far worse.

In other words, the carbon neutrality assumption built into LCA models does not hold up for real-world biofuel production. Direct accounting of actual carbon flows shows that, at best, corn ethanol production fails to reduce CO_2 emissions relative to petroleum gasoline, and even that result depends on the gain in cropland carbon uptake that occurs with a large shift from growing soybeans to growing corn. If the baseline land use was corn production, then the increase in GHG emissions due to ethanol production would be significantly higher. Finally, if consequential effects including ILUC were included, the result would be a yet even higher estimate of the adverse net GHG emissions impact of biofuel use.

Our next and still ongoing phase of research is performing a data-driven carbon balance analysis of the effect of the RFS nationwide since 2005. To carry out this assessment, we are examining how carbon uptake changed on all U.S. cropland from 2005 through 2013, which was the year of most recently available complete data when we started the project.

The key input to this ongoing analysis is shown in Figure 5, which charts the rate of CO_2 uptake on U.S. cropland in teragrams (10^{15}g) of carbon per year (TgC/yr, which is the same as millions of metric tons of carbon per year).[21] The gain from 2005 to 2013 amounted to roughly 20 TgC/yr, indicating an increase of 10% in the net rate at which CO_2 flows downward from the

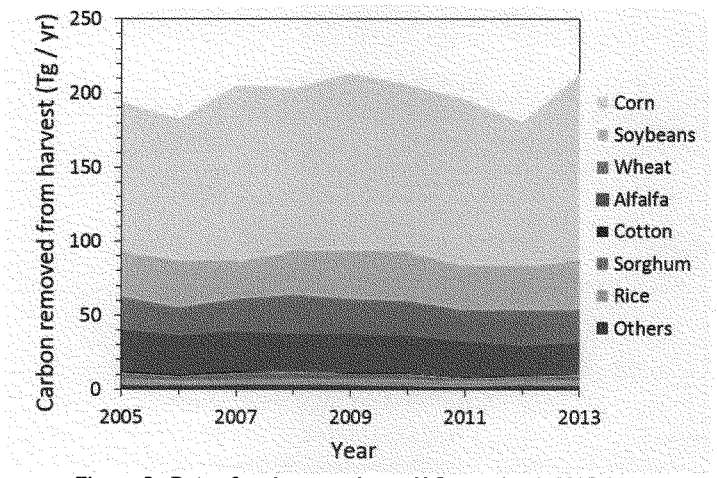

Figure 5. Rate of carbon uptake on U.S. cropland, 2005-2013.
Source: Derived from USDA Crop Production Summary data.

atmosphere into vegetation growing on cropland. It reflects changes in harvested area, crop mix and yield. The estimated 20 TgC/yr gain in CO_2 uptake is essentially an upper bound on the potential offset of end-use CO_2 emissions that might be achieved when substituting biofuels derived from the cropland for fossil fuel products. The amount of this gain in uptake that can be reasonably attributed to the demand for grains created by the RFS is less than the total amount of carbon contained in the harvest supplied to biorefineries. That means that once processing and direct land-use change emissions are factored in, there is no significant reduction in net GHG emissions due to the use of the corn ethanol and soy biodiesel. Using EPA's estimates for indirect land-use change then pushes the total CO_2 impact to a much higher level, implying substantially higher cumulative CO_2 emissions overall.

In theory, the net rate of CO_2 uptake on cropland (i.e., NEP) can be increased by using crop residues to make fuel, as now being pursued at a small scale through cellulosic ethanol production. NEP then increases because R decreases, e.g., by collecting corn stover that would otherwise decompose and thereby reducing the CO_2 emissions from cornfields after grain is harvested. In any case, it is necessary to do a careful, location-specific assessment of how NEP

actually changes when biofuel feedstocks are produced; one cannot just assume (as lifecycle models now do) that the carbon in a harvest fully offsets CO_2 emissions during fuel combustion. Ecologically speaking, the extent to which one can safely "starve the decomposers" by harvesting residues is likely to be limited.

The implication is that, while it may be possible for biofuels to contribute to climate mitigation, the conditions under which they actually do so are much more restricted than is commonly assumed. Moreover, because any climate benefit hinges not on biofuel use per se, but rather on raising the net rate of CO_2 removal from the atmosphere, there are other ways to accomplish this task that are less costly and more ecologically sound.

OTHER ENVIRONMENTAL IMPACTS

Although my own studies have focused on the GHG emissions impacts of renewable fuel use, excess CO_2 emissions are not the only environmental harm caused by the RFS.

Other researchers at University of Michigan conducted a detailed, geographically explicit assessment of how the cropland expansion related to the rising mandated demand for corn ethanol has destroyed habit for waterfowl and other wildlife.[22] Expanded corn production to meet the ethanol mandate is worsening water pollution, contributing to algae blooms and oxygen-starved zones in the Gulf of Mexico and Lake Erie.[23] Biofuel processing also releases other forms of air pollution; for example, recent research has found that the country's third largest corn ethanol refinery emits 30 times more air pollution than was assumed for the RFS regulatory analysis.[24] Ethanol's corrosive properties are also incompatible with many cars already on the road and degrade the operation of lawn mowers, motor boats and other gasoline-powered equipment used by homeowners and businesses alike.

CONCLUSION

My studies have identified serious problems in the lifecycle modeling done for the RFS, raising concerns that have been shared with EPA and other agencies. The EPA Inspector General's investigation of the RFS analysis will hopefully shed further light on these issues. Our empirical research finds that the RFS is harming the environment. The program has caused higher CO_2 emissions than otherwise would have occurred and has also damaged the environment in other ways. Careful scrutiny reveals that the LCA studies used to justify the mandate were deeply

flawed and that when passing EISA Congress was misled by claims that the RFS would be environmentally beneficial.

The policy implications of this examination of the Renewable Fuel Standard from an environmental perspective can be summarized as follows:

- The Congressionally imposed requirement to evaluate fuels using lifecycle analysis (LCA) lacks scientific merit. It is legally unprecedented; LCA-based RFS obligations cannot be verified empirically and therefore the method is inappropriate for specifying regulations.
- The use of LCA has resulted in erroneous conclusions regarding the GHG impacts of corn ethanol and other biofuels. Although it is not possible to unambiguously quantify the induced impacts of biofuel production and use, data-driven carbon balance accounting for the directly measurable aspects of a vehicle-fuel system shows that corn ethanol increases GHG emissions compared to gasoline.
- For CO_2 emissions, there is no merit in downstream regulation of motor fuels *per se* (in contrast to CO_2 permits as part of an economy-wide carbon cap, for example).
- Policies such as the RFS or an LCFS are ill-targeted for purposes of climate mitigation. Beyond tailpipe GHG emission standards and other measures that reduce transportation fuel demand, policy should focus on increasing the rate at which CO_2 is removed from the atmosphere in locations outside the transportation sector.
- Environmental harm will be minimized if the RFS is repealed or if the volume mandates are greatly scaled back.
- Environmental integrity will be improved if lifecycle analysis requirements are permanently struck from the law.

ENDNOTES

[1] Wang (1999).

[2] DeCicco (2015).

[3] Fargione et al (2008); Searchinger et al (2008).

[4] Wang & Haq (2008).

[5] An widely-cited meta-analysis from that period was the *Science* paper by Farrell et al (2006); a recent paper by Plevin et al (2014) describes how such attributional LCA studies can be very misleading.

[6] EPA (2009), RFS2 NPRM, *Federal Register* 74(99): 25021.

[7] Plevin et al (2010).

[8] Hertel & Tyner (2013).

[9] McManus & Taylor (2015).

[10] ISO (2006), p. 9.

[11] For example, as done by Wang et al (2007, 2011, 2012), among others.

[12] For example, as by BIO (2015).

[13] For example, as by Markey & Boxer (2014), citing Erickson et al (2014).

[14] EPA (2009), RFS2 NPRM, *Federal Register* 74(99): 25040.

[15] Churkina (2013).

[16] DeCicco (2013).

[17] Lovett et al (2006).

[18] The assumptions for this calculation are that a bushel of corn weighs 56 pounds; that its moisture content is 14% and that its carbon content is 42.1% of the dry mass.

[19] For soybeans, the parameters are a weight of 60 lbs/bu, 12.5% moisture and 42.6% carbon.

[20] DeCicco & Krishnan (2015).

[21] Unless otherwise noted, values are reported on a carbon rather than CO_2 mass basis, where $C:CO_2 = 12:44$; this includes CO_2 equivalences of other GHGs as weighted by 100-year global warming potential.

[22] Brooke et al (2010).

[23] Cho (2011).

[24] de Gouw et al (2015).

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Mr. GOSAR. I thank the gentleman.

I now recognize the gentlewoman, Ms. Stone, for her 5 minutes.

STATEMENT OF KELLY STONE

Ms. STONE. Thank you, Chairman Gosar, Chairman Jordan, Ranking Members Lawrence and Cartwright, and members of the committee. Thank you for inviting me to testify on the Renewable Fuel Standard. I greatly appreciate the opportunity to share ActionAid USA's perspective on the RFS and the need for reform.

ActionAid is an international organization committed to countering extreme poverty and social injustice. We make long-term commitments to empower the communities that we work with helping them to identify and address the challenges they face in realizing their human rights and overcoming extreme poverty.

ActionAid USA advocates for reform of the RFS because of its impact on food security, land tenure, and water. Mandates for food-based biofuels such as the RFS increase hunger around the world, drive land grabs in developing countries, and divert resources such as water to fuel.

First, on food, I want to emphasize to the subcommittee how fundamentally important food security is. Hunger impacts every aspect of development, from health to education and the workforce. Without food security, real development is not possible.

One of the primary ways biofuel mandates impact hunger is by increasing food prices. Of course, many factors go into determining the price of food. However, it is widely recognized that food-based biofuels create an upward pressure on food prices. And while prices have dropped from 2012, they are still high compared to historical levels and present real challenges to poor families.

Mandates for food-based biofuels impact prices by driving up demand for a particular feedstock. This increase in demand impacts the price not only of that feedstock but any food that requires that feedstock for production or feedstocks that can be a substitute. For example, significantly increased demand for corn creates upward pressure on food prices for corn, dairy because cows eat corn as feed, and for other grain like wheat. If people find corn prices have gone up, they may try to substitute for corn with wheat, but that means demand and prices for wheat have gone up as well.

Access to safe and nutritious food often comes down to the ability to pay, so food price is a critical part of food security. Poor families in developing countries often spend a significant amount of their income on food, sometimes as much as 80 percent. What looks like a small increase to us can be devastating to poor people trying to feed their families.

On land, demand for biofuels also drives up demand for land on which to produce those biofuels. This results in small family farmers being forced off their land in developing countries to make way for large biofuel plantations. Instead of producing food for the local community, that land is used to produce fuel for a developed country. ActionAid has worked with communities in Central America, Africa, and Asia who've had their land threatened or taken in this way.

I want to emphasize what a loss of land means to these farmers. This is not simply a loss of property for which they can be easily

compensated. For small-holder farmers, secure land tenure is crucial to their ability to feed themselves, their families, and their communities. Land is their livelihood, their investment in the future, and in some cases, a part of their cultural identity. That security is not easily replaced.

Last May, I met with some family farmers in Mato Grosso, Brazil. They were struggling to grow food because of the biofuel production next door, including the aerially sprayed chemicals involved in a production were hurting their crops. One man's voice in particular stays with me because he did not just talk about the loss of food but a loss of identity. He had been a farmer his whole life but now he cannot grow food for his family. It was as if he felt that his identity had been taken from him, as well as his crops.

Finally, water, like land, is a finite resource. There is only so much available to a community at any given time for growing and preparing food, drinking, and hygiene needs. Water, as you know, is profoundly important for human survival, as well as development. ActionAid USA's research has found that in most cases expanding biofuel production in countries that the U.S. imports these fuels from results in an increase in water consumption. Even when biofuel crops are rain-fed, that resource is being used to produce fuel for export instead of being used to meet the community's fundamental needs.

The RFS is a broken policy that is badly in need of reform. Many in Congress supported the RFS in 2005 and again in 2007 with the best of intentions. However, the evidence is now clear that this is a policy that is not helping the environment and it is doing real harm to people. We need a fundamental shift in our approach to biofuels, and we must end mandates for food-based biofuels such as corn ethanol.

Thank you.

[Prepared statement of Ms. Stone follows:]

Written Testimony for Kelly Stone, Policy Analyst with ActionAid USA

Chairman Lummis, Chairman Jordan, Ranking Members Lawrence and Cartwright, and Members of the Committee, thank you for inviting me to testify on the Renewable Fuel Standard (RFS). I greatly appreciate the opportunity to share ActionAid USA's perspective on the RFS and the need for reform.

ActionAid is an international organization committed to countering extreme poverty and social injustice. We make long-term commitments to empower the communities that we work with, helping them to identify and address the challenges they face in realizing their human rights and overcoming extreme poverty.

ActionAid USA advocates for reform of the RFS, because of its impact on food security, land tenure, and water. The RFS has global implications, beyond just a domestic energy policy. Mandates for food-based biofuels, such as the RFS, increase hunger around the world. Specifically, biofuels impact food security by increasing food prices and undermining land tenure. At a time when we are committing globally to combat and end chronic hunger, while also facing the challenge of feeding a growing population, promoting food-based biofuels is the wrong policy. I strongly urge Congress to reform the RFS to end mandates for food-based biofuels. They are not helping the planet, and at the same time they are hurting people. It is past time for a change.

Food Price

I want to begin my remarks by emphasizing to the Committee how fundamentally important food security is. It is hard to overstate how central food security is to human well-being and development. Hunger impacts every aspect of development, from health to education and the workforce. Children who do not receive enough nutrition before their 2nd birthday can be physically and mentally stunted for the rest of their lives.

That biofuels impact food prices may be the most familiar point to Members of the Committee, as it has been part of the biofuels debate since at least the 2008 spike in food prices. Food-based biofuels make food prices more unstable and, over the long term, increase the price of food. By creating an inflexible and growing demand for feedstocks such as corn, mandates create an upward pressure on prices. This impacts the price of corn and every food that uses corn in its production. For example, increases in feed prices will eventually be passed on to consumers in higher meat and dairy prices.

Due to the increased price of corn, if it is possible to substitute corn with another grain then some consumers will do so. However, this creates a substitution effect where the increase in the price of corn drives up demand for other grains, increasing their price as well. Additionally, the demand for corn also means increased demand and price for the inputs needed to produce corn, including seeds, fertilizer and water. This increase in cost is also eventually passed on to the consumer, but is especially apparent in developing countries where people are buying less processed foods.

Access to safe and nutritious food often comes down to the ability to pay, so food price is a critical part of food security. Poor families in developing countries spend more of their income on food; in Sub-Saharan Africa and Asia it can be between 60 and 80 percent of their income.

These families are especially vulnerable to sudden increases in price - even if it looks like small increases to the rest of us.

Of course, many factors go into determining the price of food. However, it is widely recognized, including by the World Bank, the United Nations Committee on Food Security and even the Congressional Budget Office, that food-based biofuels contribute to increasing food prices over the long-term. While food prices have dropped from the historic high point of 2012, they are still high compared to historical levels. The United States is one of the major corn producers in the world. Since 2000, ethanol's share of the domestic corn market has grown from almost nothing to about 37 percent of the market. That kind of profound shift in demand is inevitably going to impact prices. Too many people around the world cannot afford enough to eat, and the RFS plays a role in that.

Land

Food-based biofuels impact food security beyond just food prices, however. As was already discussed, demand for increased biofuel production means increased demand for inputs. For certain inputs, like agricultural land, this has a greater impact than just food prices. Increased demand for land-intensive biofuel production undermines food security by driving land grabs in developing countries, which results in smallholder farmers being forced off their land.

Food-based biofuels, or any biofuels that must be produced on agricultural land, create a demand for large-scale mono-crop plantations and drive land grabs. Smallholder farmers, who typically grow multiple food crops, end up being forced off their land to make way for these major plantations. ActionAid has worked with communities around the world who have been displaced by land grabs or had their land threatened in this way, including in Central America, Africa and Asia. This not only undermines food security for the displaced farmers and their families, but the whole local community.

I want to emphasize what a loss of land means to these farmers. In the U.S., we think of land as something that has an easily assignable monetary value. However, loss of land for smallholder farmers is not simply a loss of property for which they can be easily compensated. Land is fundamental to food security, of course, as a requirement of food production. For smallholder farmers, secure land tenure is crucial to their ability to feed themselves, their families and their communities. But land is also their security. It is their livelihood, their investment in the future, and in some cases, a part of their cultural identity. That security is not easily replaced.

I traveled to Mato Grosso, Brazil last May to meet with a community of smallholder farmers who were slowly being surrounded by biofuel production. They were fortunate that their land rights were secure, but the biofuel production next door was still having a negative impact on the community. Farmers in the center of the community were quite successful; it was in many ways a model of what you want to see in smallholder communities. They grew multiple types of food crops and worked together as an association to sell what they did not need to local schools and markets for low-income women and children. Those who were closest to the biofuel plantations, however, were not so fortunate and struggled to grow food crops. I met with one man who had been a farmer his whole life; he had secured his own land for his own farm about 10 years ago. For the first few years, his farm was successful. However, when sugarcane production for biofuels started next door, pesticides and chemicals were aerially sprayed on the sugarcane, and ended up on his crops too. His crops started failing, and after a few years, it did not make any financial sense for him to even try growing food anymore. What struck me the most is that he did not just talk about the loss of food for his family, but a loss of identity. He had been a

farmer his whole life, but now he cannot grow food for his family. It was as if he felt his identity had been taken from him as well as his crops.

Water

Like land, water is crucial to food security. You cannot grow crops without water, and agriculture often has a significant impact on water availability and quality. For development more broadly, water is even more important than land. Water is recognized as a human right because it is so fundamental to human survival and health.

Water is part of the biofuel production process in two ways: first, as a needed input for feedstock production and second, as an important part of the processing to turn that feedstock into fuel. Those processing plants can have an impact on nearby water quantity and quality, but the impact of growing biofuel feedstocks is more widespread.

As with land, water is a finite resource. That means committing water to biofuel production, through for example irrigation, means that that water is not available for other uses. Even if the biofuel feedstock is rain-fed, there is still an opportunity cost to using that rainfall for energy production instead of food. Different biofuel feedstocks have different requirements to grow and result in different types of water pollution. However, in most cases, expanding biofuel feedstock production increases effective water consumption (through pollution or actual water usage) in developing countries that export biofuels to the U.S.

What was most compelling in this research from my perspective is the literally billions of gallons of water that goes into producing these feedstock. Since biofuel feedstocks are generally exported, this water is essentially exported as well. So, Guatemala virtually exports about 3 billion gallons of water per year to the U.S., through the exported sugarcane ethanol. Considering the food security, water and development challenges facing that country, this is not insignificant.

As we have learned, water availability is something that we too often take for granted in developed countries. We assume it will be safe and available for drinking, cooking, hygiene needs and growing food. In developing countries, this is not always the case and committing water to energy production has real impacts on the other needs.

Structure of the RFS

Finally, I want to raise a concern that the lack of development in cellulosic biofuels and how the RFS is structured could result in continued reliance on food-based biofuels, beyond Congress's original intent. Cellulosic biofuels by definition do not include edible parts of feedstocks or plants. However, the EPA has repeatedly included food-based biofuels within the advanced biofuel mandate, including Brazilian sugarcane ethanol.

As the Committee knows, the RFS is a nested mandate. The mandates for total renewable and advanced renewable fuel also include the mandated amount of cellulosic biofuel. Cellulosic fuels have largely failed to develop at the needed scale thus far. Experts have made it clear that there will not be nearly enough cellulosic biofuel available to meet the 16 billion gallon mandated by 2022. This means that there will also be a significant shortfall within the total renewable fuel mandate and advanced fuel mandates as well. We are concerned that if the missing cellulosic gallons are backfilled by advanced or conventional biofuels, the RFS would be driving demand for even more food-based biofuels than Congress originally intended.

Conclusion

The RFS is a broken policy that is badly in need of reform. As you have and will hear from environmental experts, first generation and food-based biofuels are not delivering the promised emission cuts and environmental benefits. In addition, the RFS is increasing food prices, driving land grabs, and creating hunger around the world. We need a fundamental shift in our approach to biofuels and we must end mandates for food-based biofuels such as corn ethanol. Many in Congress supported the RFS in 2005 and again in the 2007 expansion with the best of intentions. However, now the evidence is clear that this policy is not helping the environment and it is doing real harm to people. I strongly urge the Committee to support reforming the RFS.

Thank you.

Mr. GOSAR. I thank the gentlelady.
I now recognize Dr. Tyner for his 5 minutes.

STATEMENT OF WALLACE E. TYNER

Mr. TYNER. Thank you for the opportunity to be here today and to share my observations on the Renewable Fuel Standard and its possible impacts.

In general, biofuel policies have—in the RFS have had three major objectives. One is to enhance rural incomes, two is to reduce oil imports, three is to reduce greenhouse gas emissions. My assessment is that the RFS has been successful in achieving all three of these objectives. And as was indicated earlier, the final numbers for the 2014–2016 RFS were released by EPA in November of 2015. Let me review briefly what they said in each of the three major categories.

For cellulosic biofuels, basically the decision that EPA made is that they cannot mandate something be blended which doesn't exist. So they've taken a "build it and we will come" attitude. That is, they estimate the amount of cellulosic biofuel that will be available in the following year, and that becomes the RFS level.

For biodiesel, EPA believes the system can absorb much more than the original RFS level, so they set the 2016 level at 1.9 billion gallons, almost twice the original RFS level.

For corn ethanol, EPA took into account the blend wall but also the fact that the original congressional intent of the RFS was to pull into the market more biofuels than would have come into the market by market forces alone. My sense is that they made a reasonable compromise between conflicting issues and objectives.

Next, I want to comment on greenhouse gas emission estimations. When biofuels are produced and consumed, greenhouse gases are released, and these must be measured and compared with fossil fuel emissions to determine the extent of emission reductions for each biofuel pathway. Agencies use some combination of attributional and consequential lifecycle analysis to estimate these emissions.

Economic models are used to estimate the market-mediated responses to the higher demand for the agricultural commodities. Possible responses include—to the higher commodity prices include reduced consumption, crop-switching from one crop to another, converting forest or pasture to cropland, more intensive use of cropland, and changes in international trade and production.

Consequential lifecycle analysis is driven by market forces. Some have argued for an approach called additional carbon. The basic argument is crops grown for biofuels would have been grown anyway so there is no additional carbon sequestered in producing the biofuel crops. Any crop used for biofuels just reduces use elsewhere in the economy.

The empirical evidence in my view does not support this argument. For example, harvested corn area of the United States has increased to roughly 10 million acres over the last two decades. Global harvested area of grains, cotton, and oilseeds has increased over 200 million acres between 2003 and 2012. In other words, there has been additional carbon taken from the atmosphere in producing these additional crops.

The U.S. Environmental Protection Agency, the California Air Resources Board, and the European Union all use some combination of attributional and consequential lifecycle analysis to measure the greenhouse gas reductions of biofuels. None accept the additional carbon argument.

Next, I want to comment on biofuel impacts on developing countries. The reasons for commodity price increases in 2008 and again in 2011 have been extensively researched. Most studies have concluded that biofuels did play a role but not a predominant role in the price increases. To the extent that biofuels played a role in commodity price increases, it's clear that urban consumers in developing countries are adversely affected.

But there's another side to the story, and that is that rural areas and farmers in developing countries can be made better off by those higher prices. The World Bank says 70 percent of the world's poor live in rural areas in developing countries and derive their primary livelihood from agriculture. To the extent that these higher prices are transmitted to rural areas, farmers and other rural residents can be made better off as their incomes increase.

Last, some comments on the road to the future. The scientific community has concluded that climate change is real and is caused by human intervention. Most economists believe that the most efficient way to deal with the adverse impacts of climate change is through pricing emissions, through a market mechanism with a carbon tax. But Washington so far prefers a regulatory approach, so we have CAFE standards for fuel economy, the Clean Power Plan for electricity, and the Renewable Fuel Standard for reducing automotive emissions. Absent a market-based approach, I think the Renewable Fuel Standard and the other regulations are an appropriate and effective means to move our economy towards lower greenhouse gas emissions.

[Prepared statement of Mr. Tyner follows:]

Testimony on the U.S. Renewable Fuel Standard before the U.S. House of Representatives Committee on Oversight and Government reform, Subcommittee on the Interior and the Subcommittee on Healthcare, Benefits, and Administrative Rules

March 16, 2016

Wallace E. Tyner
James and Lois Ackerman Professor
Department of Agricultural Economics
Purdue University

The U.S. has had various policies in effect to promote greater use of biofuels since 1978 [1]. The most important current policy is the Renewable Fuel Standard (RFS), the current version of which was created in 2007 [2]. In general biofuels policies and the RFS have had three major objectives [3]:

- Enhance rural incomes and well being
- Reduce oil imports and dependence on foreign oil
- Reduce greenhouse gas (GHG) emissions

My assessment is that the RFS has been successful in achieving all three objectives. It has helped increase rural incomes; it has helped reduce oil imports; and it has helped reduce GHG emissions.

In the rest of this note, I will discuss implementation of the Renewable Fuel Standard, compare the consequential life cycle analysis and additional carbon approaches to estimating GHG emission impacts for biofuels, and describe the possible impacts of biofuels policies on developing countries. I conclude with some thoughts on possible future directions for U.S. energy policy.

Renewable Fuel Standard

Despite the success of the RFS in achieving its objectives, it has been controversial with strong interest groups aligned for and against the RFS. The U.S. Environmental Protection Agency (EPA) administers the RFS. The RFS as created by Congress [2] contains four categories of biofuels – biodiesel, cellulosic biofuels, other advanced biofuels, and conventional biofuels. There is an overall biofuel mandate and also levels for each category of biofuel, or buckets as I call them. It is also a nested structure as illustrated in Figure 1, which shows the 2022 target levels. Biodiesel only can be used to meet the requirement of the biodiesel bucket, but biodiesel can also be used to satisfy the other advanced bucket or the conventional bucket. The same structure holds for cellulosic biofuels. Only cellulosic biofuels can be used to meet that requirement, but cellulosic biofuels can also be used to meet the requirements for other advanced or conventional biofuels. Corn ethanol can only be used to meet the requirement for conventional biofuels, which is really the difference between the overall mandate and the separate mandates for the other categories. There is no direct mandate for corn ethanol.

Each fall, EPA is expected to announce the mandate levels for the following year. It also specifies the share of the total mandate that is allocated to each obligated party based on their market share in the product markets. EPA has found it difficult to maintain the schedule, and has at times fallen behind. In November 2015, EPA did announce its final numbers for 2014, 2015, and 2016, and those are contained in Table 1.

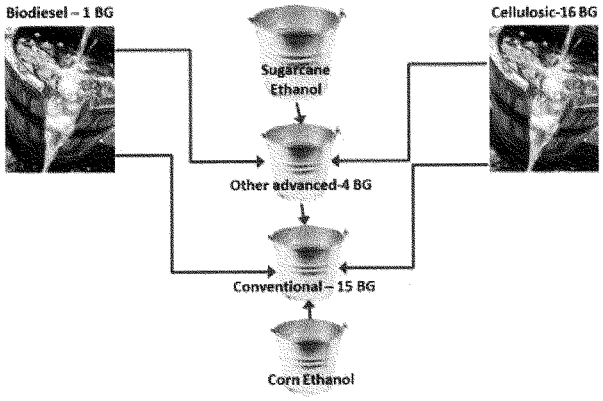

Figure 1. Nested Structure of the U.S. Renewable Fuel Standard

The figures for 2014 essentially ratify what happened that year. The more important figures are the levels announced for 2016. My interpretation of the EPA approach in reaching these levels is explained below:

- **Cellulosic** – EPA essentially used data on existing and projected future plants and set the RFS mandate to match the projected production levels. In other words, it is a "build it and we will come" approach. The projected production levels are very small relative to the levels in the original RFS. For example, in 2016, the cellulosic RFS level was 4.25 bil. gal., and the actual 2016 RFS level is 0.23 bil. gal., or 5.4% of the original mandate.
- **Biodiesel** – the RFS level for biodiesel grows steadily over the period. The original Congressional mandate was at least 1 bil. gal., and the 2016 level reaches 1.9 bil gal. EPA believes that the market can provide and absorb significant increases for biodiesel. Additional biodiesel can be used in the other advanced category as well.
- **Corn (conventional) ethanol** – EPA allows growth in the implied corn ethanol mandate. Essentially the EPA believes the blend wall is a strong barrier, which must be taken into consideration in fixing the final level. However, my interpretation is that they also respect the intent of the original RFS mandate to pull in more ethanol. For 2016, EPA set the level at 14.5 bil. gal., which assumes some consumption beyond the E10 blend wall. In other words, EPA sought to achieve

balance between the reality of the blend wall and the intent of the RFS to pull in more biofuels.

- **Other advanced biofuels** – EPA set the 2016 level at 0.53 billion gallons. Ethanol from sugarcane can be used in this category. Also, biodiesel and cellulosic biofuel can be used here. So, in fact, even more biodiesel could be used to meet the other advanced mandate.
- **Total renewable biofuels** – the total required biofuels grows about 1.2 billion gallons between 2015 and 2016.

How should we interpret the EPA announcement? Essentially, EPA attempted to find a balance between arguments pro and con on the RFS. Biodiesel grows far beyond the original number in the RFS. For corn ethanol, EPA accepted the arguments that the blend wall is a legitimate barrier. Their 2016 level requires some growth of E85/E15, but it does not reach the original 15 bil. gal. mandate. If the higher mandate does not pull in additional corn ethanol, there are enough carry-forward RINs in 2016 to make up for the shortfall. The EPA final numbers represent a reasonable compromise position.

Table 1. EPA Final Numbers for 2014, 2015, and 2016 (bil. gal.)

Fuel category	2014	2015	2016
Cellulosic	0.033	0.123	0.23
Biodiesel	1.63	1.73	1.90
Other advanced	0.192	0.162	0.53
Total advanced	2.67	2.88	3.61
Conventional	13.61	14.05	14.50
Total renewable	16.28	16.93	18.11

Notes: All volumes are ethanol equivalent except biodiesel, which is actual.

The other advanced category is total advanced - 1.5*biodiesel - cellulosic. This presentation of the RFS levels differs from the way EPA communicates the levels, but the bottom line is the same.

EPA indicated that they are committed to releasing the final RFS numbers in the future in November of each year. Thus, they intend to be on schedule in the future.

Consequential life cycle analysis versus additional carbon

Greenhouse gas (GHG) impacts of biofuels are usually estimated with either attributional or consequential life cycle analysis or a combination of the two. The most common approach is consequential life cycle analysis. The consequential life cycle analysis approach calls for estimating the GHG consequences of biofuels technologies or policies [4, 5] with a system boundary that includes all important impacts. Several authors have proposed the use of an additional carbon approach to (GHG) emission calculations instead of the attributional or consequential life cycle analysis approaches. The additional carbon approach essentially argues that the carbon sequestration done by

biofuel feedstock plants cannot be counted as savings because the plants would have been grown anyway [6-9]. Both approaches imply a "with-without" analysis, but implementation of the approaches would be quite different.

The additional carbon assumption is well expressed by Searchinger and Heimlich [9]:

> The world's lands are already growing plants every year and these plants are already being used. (p. 16)

In other words, the assumption is that every hectare of land that goes to biofuels deducts from other uses. If we use corn for ethanol, we have less corn to eat. The consequential life cycle analysis approach normally uses as its system boundary the entire domain or impact area of any given policy [10]. Examples are the California Low Carbon Fuel Standard [11] and the US Renewable Fuel Standard [12]. There is no regulatory body in any country that employs the additional carbon approach.

Another related argument often embedded in the additional carbon approach is that it would be better to use any available land to sequester carbon than to produce biofuels to displace fossil carbon. In addition, the food-fuel argument also often gets included in additional carbon reports [9]. However, these are different arguments. There have been several studies that compare forest sequestration with biofuels and biopower [13]. Some use a carbon tax with endogenous decisions on the amount of sequestration and biofuels that will be produced over a range of carbon prices [14]. In fact, most economists would argue that pricing carbon is the efficient way to determine the extent to which biofuels, sequestration, solar energy, etc. would come into the market. The additional carbon approach makes the assumption that all land is being used, that any plant material use for biofuels necessarily means less availability elsewhere, and that sequestration is more efficient than biofuels. None of these assumptions are adequately justified by the proponents.

The consequential LCA approach often makes use of computable general equilibrium models to estimate the impacts of what are called market mediated responses to the higher demand from biofuels [15]. Possible responses included the following:

- With a higher price, consumption (quantity demanded) normally would fall.
- With a higher price for this commodity, there can be switching among crops so that more of this crop is produced and less of other crops.
- With a higher demand for this commodity, more cropland can be needed to meet that increased demand, and this cropland can come from pasture or forest converted to cropland. This is referred to as a change on the extensive margin.
- With the higher commodity demand, the existing cropland might be farmed more intensively such as via double cropping or irrigation or other investments in increased productivity and yield. This is referred to as a change on the intensive margin. An increase in intensive margin on existing cropland reduces demand for land conversion (from either forest or pasture to cropland).

- With higher demand for this commodity for biofuels, there can be impacts on international trade of the commodity and of other substitute commodities. In other words, a biofuel demand increase in country A can have repercussions anywhere in the world because the agricultural commodity markets are global.

An important difference between the two approaches is that the consequential LCA approach is driven by market forces, whereas the additional carbon approach assumes that any incremental demand reduces availability elsewhere. We can take two examples from the US to illustrate the difference. Prior to the biofuels era (before 1980 in the US), both the US and the EU had programs to set aside agricultural lands because market forces produced "too much" of the commodities. To participate in farm programs in both the US and EU, farmers had to take part of their land out of production. Since then the US and EU set aside programs (with different rules) have been modified or eliminated. In the period between 2006 and 2012 (the biofuels boom) corn production in the US increased substantially, but total cropland area hardly changed. Corn substituted for other crops. Production also changed in other world regions, and there was more double cropping than before. In fact, 213 million acres was added to the global cropland base between 2003 and 2012 for production of cereal grains, cotton, and oilseeds [15]. Not all or even most of this increase was driven by biofuels. The point is that these changes were driven by market forces, and there was no one-for-one drop in other uses as biofuels production increased.

Another important difference between the two approaches concerns implementation feasibility. The consequential LCA approach is being used by US EPA and by CARB. While there is large uncertainty in the land use impacts and associated emissions, the approach can be implemented. It is hard to see how the additional carbon approach could be implemented. It relies on totally unjustified assumptions on what is additional carbon. Once one departs from the simple assumptions that none of the carbon is additional, then implementation becomes very problematic. Since it does not rely on market mechanisms, there is no obvious way to consistently determine what carbon is additional.

Biofuels impacts on the developing world

Another important issue that has arisen with respect to biofuels concerns the extent to which biofuels policies and production have led to food price increases, and, to the degree they have, what have been the consequences on developing countries. There have been many studies on these issues, and the results vary significantly [16-19]. See [16] for an annotated bibliography of many of the papers in this area through 2008.

There is no doubt that biofuels programs have had some impact on commodity prices. There are many other drivers of changes in commodity prices such as changes in global supply and demand for the commodities, weather, and changes in exchange rates, among others [16, 20-22]. To the extent that biofuels have led to higher commodity prices, the extent to which that translates to higher food prices varies by state of development of the economy. In the U.S., citizens spend less than 10% of their disposable income on

food, and about half of that is spent on food away from home. The U.S. diet contains more processed foods, so raw commodity price changes do not translate to significant food price changes. On the other hand, in countries like Sri Lanka and Bangladesh, more than 60% of disposable income is spent on food, and much of that on raw commodities rather than processed foods. So it is clear that higher commodity prices induced by biofuels or by any of the other drivers adversely impact urban consumers in developing countries.

What is often overlooked in the commodity price story with respect to developing countries is the impacts on developing country farmers. Urban consumers get the attention when they march in the streets to protest higher food prices, and they have more political power than rural inhabitants. However, it is very important to consider the impacts of higher commodity prices on rural areas in developing countries [22]. The World Bank says that 70% of the world's poor live in rural areas in developing countries and derive their primary livelihood from agriculture. Higher commodity prices have the potential to increase rural incomes and reduce rural poverty as farmers receive more for what they produce. Even rural laborers can see higher incomes as higher rural productivity and incomes help increase rural wages.

One of the impediments in achieving this rural supply increase in response to higher commodity prices is that some developing countries have tried to keep the higher prices from being transmitted to their domestic economy, again to protect urban consumers. To the extent they succeed in preventing price transmission, the supply response and increased rural well-being will be muted. However, to the extent that the higher commodity prices are transmitted to rural areas, it is clear that rural incomes can increase.

Joy Clancy provides a careful analysis of the issue of the possible relationships between biofuels and poverty [23]. She stresses that biofuels can either be pro-poor or can lead to increased poverty. She lays out policies and approaches to ensure that biofuels are pro-poor.

In some quarters, the "land-grab" issue also has been linked with biofuels, although the link is usually not clear. Much of the land grab began following the agricultural commodity price spikes in 2008, and most of it is linked to food and feed crops, not biofuels. It often is facilitated by corrupt local politicians who sell the rights to land to foreigners often for the production of food. The evidence is clear that biofuels are not the primary driver of the land grab.

Road to the future

The scientific community has concluded that global warming is real and is caused by human intervention. To prevent major costs being imposed on our economy and the global economy, we need to take action to reduce GHG emissions. Almost any economist would argue that a carbon tax is the most efficient way to stimulate actions that lead to reduced GHG emissions. However, to date it has been impossible to obtain consensus on that approach in Washington. A carbon tax is a market based approach to correcting

the external effects of increased GHG emissions. It is a way of pricing the emissions so that all of us take into consideration the carbon content of the goods we use in the economy. It leads to the most efficient and least cost path to reducing GHG emissions. Many corporations have endorsed emission reduction policies including a carbon tax. A carbon tax can be made revenue neutral so that it does not increase the size of government.

However, Washington continues to favor a regulatory approach instead of a market mechanism. Thus we have CAFE standards for fuel economy, a Clean Power Plan for electricity emissions, and a Renewable Fuel Standard for reducing emissions of automotive fuels through use of biofuels [24, 25]. So long as we continue to prefer the regulatory approach in lieu of a market based carbon pricing approach, then I think the Renewable Fuel Standard and the other regulations just mentioned are appropriate and effective ways to move our economy towards lower GHG emissions.

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Mr. GOSAR. I thank the gentleman.

And now our last witness, Mr. Loris, you are recognized for 5 minutes.

STATEMENT OF NICOLAS D. LORIS

Mr. LORIS. Thank you. Chairman Gosar, Chairman Jordan, Ranking Member Lawrence, Ranking Member Cartwright, and distinguished members of the subcommittees, thank you for this opportunity to discuss the Renewable Fuel Standard. The views I express in this testimony are my own and should not be construed as representing any official position of the Heritage Foundation.

Austrian economist Friedrich Hayek famously wrote that "The curious task of economics is to demonstrate to men how little they know about what they imagine they can design." Truer words could not be spoken about the Renewable Fuel Standard. The policy reveals the inability of the Federal Government to centrally plan energy markets and the unintended consequences it creates when doing so. The quota concentrates benefits to a select few and disperses the costs amongst the rest of us.

Even within the agricultural community, the RFS rewards special interests connected to the policy and adversely impacts much of rural America. No matter how brilliant or well-informed, politicians cannot predict the future of energy markets, and even though the EPA can adjust the biofuel targets, the blend wall concerns, and Congress grossly over predicting the commercial viability of cellulosic ethanol demonstrates why the government shouldn't set production quotas in the first place.

And the RFS is far from the only mechanism the government has used to prop up the biofuels market. We've spent billions on targeted tax credits, imposed tariffs on imported ethanol, provided loan guarantees to cellulosic ethanol plants, and continue to spend taxpayer dollars on biofuel infrastructure in attempting to commercialize advanced biofuels.

The RFS and these complementarity subsidies have not contributed to meaningful reductions in oil supply or oil consumption. However, the mandate's cost to Americans is a substantial, as we pay tens of billions of dollars more in higher food and gas prices each year. These higher prices hurt low-income families both here and abroad the most. These are the citizens that spend a disproportionately higher percentage of their budget on these goods.

The mandate distorts commodity production and prices and takes land away from competing crops. About 40 percent of America's corn crop goes to ethanol for fuel. In 2012 the amount of corn used to produce ethanol in the U.S. exceeded the consumption of the entire continent of Africa and every single country with the exception of China.

Biodiesel generated from soybeans presents the same food-for-fuel problem. In 2004, the year before Congress first created RFS, less than 1 percent of the soybean crop was used for biodiesel. By 2014 that figure jumped to 23 percent. Consequently, the diversion of crops to fuel raises the input prices for livestock producers. In total, the Congressional Budget Office estimates that Americans spend $3.5 billion more per year at the grocery store because of this mandate. Research from several universities finds the cost to

be significantly higher. Whatever the most accurate estimate is, the direction is always the same: We pay more.

The RFS drives up prices at the pump as well. Americans are paying $10 billion more annually to blend ethanol into our gasoline. According to DOE and EPA's own website, a motorist could spend an additional $450 per year to run a flex fuel vehicle on E85 compared to a regular gasoline blended with E10.

And the RFS has unintended environmental impacts. Even the EPA acknowledges that increases in soybean production as a result of the mandate can cause adverse effects to water quality, ecosystems, and habitat while increasing criterion pollutants like sulfur dioxide and nitrous oxide.

Furthermore, the alleged climate benefit from the RFS is dubious at best. Even under the assumption that switching from oil to biofuels significantly reduces greenhouse gas emissions, which is a very generous assumption, the impact on global temperatures would be negligible.

But the real problem with RFS is not the use of biofuels themselves. Rather, it is Washington deciding what goes in our gas tanks. Ethanol would likely exist in a world without the mandate, though clearly not in as great of quantity. But that should be for the market to determine.

Collectively, Americans spent hundreds of billions of dollars on gasoline each year. Globally, the transportation fuels market is a multi-trillion dollar opportunity. Any alternative energy source won't need a government program mandating its production and consumption. The profit incentive rewards cost-competitive fuels.

Broadly speaking, the RFS provides valuable lessons about the problems when the Federal Government intervenes in energy markets. Bad policies that award preferential treatment remain in place or expanded because of the supposed political importance trumps economic viability. Even former Vice President Al Gore admitted that he supported the corn ethanol mandate because he had a strong incentive to please his constituents in Tennessee and the farmers in Iowa. It was only until after he stopped running for office that he could call first-generation biofuels a mistake.

The RFS, and all other energy subsidies for that matter, create a vicious loop of politicians, lobbyists, and special interests protecting these policies and determining who produces what. The most effective solution to this problem is to eliminate the preferential treatment altogether.

In conclusion, Congress should recognize the entire mandate is a failure and the government has no legitimate role in propping up one energy source over another. The only viable reform is to repeal RFS in its entirety, and Congress should do so as part of fundamental reform that eliminates subsidies for all energy sources. Such reforms will empower the private sector and innovative companies to drive fuel competition and choice.

Thank you, and I look forward to your questions.

[Prepared statement of Mr. Loris follows:]

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CONGRESSIONAL TESTIMONY

Examining the Renewable Fuel Standard

The House of Representatives Committee on Oversight and Government Reform Subcommittee on the Interior and the Subcommittee on Healthcare, Benefits, and Administrative Rules

March 16, 2016

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The Heritage Foundation

My name is Nick Loris. I am the Herbert & Joyce Morgan Fellow at The Heritage Foundation. The views I express in this testimony are my own, and should not be construed as representing any official position of The Heritage Foundation.

I want to thank the members of the Committee of Oversight and Government Reform Subcommittees on the Interior and on Healthcare, Benefits, and Administrative Rules for this opportunity to address the Renewable Fuel Standard.

The federal government provides a wide range of subsidies to boost the production and consumption of biofuels. Over several decades, Congress has enacted special tax breaks, direct grants, government-backed loans and loan guarantees to generate a larger biofuel and biodiesel market.[1] The main component of the U.S.'s biofuel policy is the Renewable Fuel Standard (RFS), created in 2005 through the Energy Policy Act of 2005, and expanded in the Energy Independence and Security Act of 2007, mandating billions of gallons of ethanol be blended into gasoline each year, with a peak of 36 billion gallons in 2022. After 2022, the Environmental Protection Agency (EPA) has discretion to set the limit (within certain limitations).[2]

To rationalize the RFS, policymakers promised reduced dependence on foreign oil, a new source of cleaner energy to lower gas prices, a stronger economy, and an improved environment. None of this has materialized. Instead, the quota caters to special interest groups and has adverse effects on the economy and the environment. Subsidizing biofuel production benefits a select few and spreads the costs amongst the rest of American families and businesses. Even within the agricultural community, biofuel handouts reward those connected to the policy and adversely affect large parts of rural America.

The problem with the RFS is not the use of biofuels themselves but rather a policy that mandates the production and consumption of the fuel. Having politicians centrally plan energy decisions best left for the private sector distorts markets and demonstrates the high costs and unintended consequences of government control. The RFS distorts commodity production and prices, artificially raises the price of fuel and food, and has adverse environmental effects. The alleged climate benefit increasing biofuel use is dubious at best. Even under the assumption that switching from oil to biofuel would reduce greenhouse gas emissions, the impact of the switch on the earth's temperature would be negligible.

Congress should not tinker around the edges with attempts to reform the RFS. Policymakers should recognize the mandate is a failure and the government has no legitimate place propping up one energy source or technology over another. Congress should eliminate the RFS entirely and empower free enterprise to drive fuel competition and choice.

The Renewable Fuel Standard

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[1]U.S. Department of Energy, Alternative Fuels Data Center "Federal Laws and Incentives for Biodiesel," http://www.afdc.energy.gov/fuels/laws/BIOD/US (accessed November 13, 2015).

[2]Energy Independence and Security Act of 2007, 110th Cong., 1st Sess., §202, https://www.govtrack.us/congress/bills/110/hr6/text (accessed January 22, 2016).

The Renewable Fuel Standard is one of the most egregious examples of government meddling in the energy economy. The Energy Policy Act of 2005 first mandated that renewable fuels be mixed into America's gasoline supply, primarily using corn-based ethanol. The Energy Independence and Security Act of 2007 significantly increased the quotas. By 2022, there must be 15 billion gallons (and no more) of corn-based ethanol and a total of 36 billion gallons of biofuels blended into the nation's fuel supply, including soybean-based biodiesel. The program does not end in 2022, however, but grants the EPA the authority to set yearly targets.[3]

The biofuels mandate gives preferential treatment to the production of corn and soybeans at the expense of other agricultural products and artificially eliminates the risk and competition necessary to drive innovation and economic growth. The economic and environmental problems caused by the RFS have resulted in a diverse group opposing the mandate including environmental organizations, world hunger activists, economists, energy companies, and many in the agricultural community. Within the agriculture community, the National Chicken Council, National Cattlemen's Beef Association, National Pork Producers Council, National Turkey Federation, Milk Producers Council, to name but a few,[4] have called on Congress to repeal the standard. Other prominent groups like the American Petroleum Institute, National Resource Defense Council, American Fuel and Petrochemical Manufacturers, Environmental Working Group, Oxfam, and the United Nations have decried preferential treatment for corn ethanol.[5]

Besides the near universal outcry, the policy itself is reaching a breaking point as basic assumptions about the future on which it was built, such as national gasoline consumption and the commercial viability of advanced biofuels, are crumbling. Yet powerful biofuel lobbies have thus far successfully wooed Congress to withhold action on the RFS and its destructive economic and environmental effects.

Free Markets vs. Government Intervention in Energy Policy

While the exact relationship between energy consumption and gross domestic product (GDP) can vary, it is clear that energy is important to a nation's economic growth. Studies have shown that a causal relationship exists between energy consumption in economic growth; that is, energy availability can influence increases in gross domestic product or that causality moves in both directions.[6] When the free market operates, resource extraction and production expands greatly,

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[3]Ibid.

[4]National Pork Producers Council et al, "Petition for Waiver or Partial Waiver of Applicable Volume of Renewable Fuel," letter to EPA Administrator Lisa Jackson, July 30, 2012, http://www.nppc.org/wp-content/uploads/20120730-mf-Final-RFS-Waiver-Petition.pdf (accessed October 1, 2015).

[5]Carlton Carroll, "API and AFPM Tell EPA to Put Consumers First When Setting Ethanol Mandates," American Petroleum Institute July 27, 2015, http://www.api.org/news-and-media/news/newsitems/2015/july-2015/api-and-afpm-tell-epa-to-put-consumers-first-when-setting-ethanol-mandates (accessed November 12, 2015) . Natural Resources Defense Council, "Let the VEETC Expire: Save Billions in Tax Dollars Better Spent on Non-Polluting Energy Technologies," June 2010, http://www.nrdc.org/globalwarming/files/VEETCfs.pdf (accessed November 12, 2015). Sarah Kalloch, "Burning Down the House: Corn as Fuel, Not Food," Oxfam America, October 4, 2012, http://politicsofpoverty.oxfamamerica.org/2012/10/corn-as-fuel-not-food/ (accessed November 12, 2015). Environmental Working Group, "EPA's Biofuels Mandates are Unworkable," February 7, 2013, http://www.ewg.org/release/epa-s-proposed-biofuels-mandates-are-unworkable (accessed November 12, 2015).

[6]Ross McKitrick and Elmira Aliakbari, "Energy Abundance and Economic Growth: International and Canadian Evidence," Fraser Institute, May 15, 2014,

innovative technologies generate promising opportunities, and job creation and the economy grow robustly.

Over the years, federal policies have blocked access to opportunities, unnecessarily delayed projects, mandated expensive energy production, restricted choice, and given handouts to politically connected energy technologies. Politicians tout these programs as means to usher in new technologies that will provide jobs and stimulate the economy. The reality, however, is that these policies play favorites by allocating special benefits to the well-connected, rather than creating a playing field that provides opportunity for all to compete. The RFS is certainly an example of such favoritism.

Perhaps the most perverse part of these subsidies is that significantly obstruct the long-term success and viability of the technologies and energy sources they intend to promote. Instead of relying on a process that rewards competition, taxpayer subsidies prevent a company from truly understanding the price point at which the technology will be economically viable. When the government plays favorites, it traps valuable resources in unproductive places and allocates labor and capital away from other investments.

If biofuels are to succeed as a competitive transportation fuel, it will not be the result of any taxpayer-funded handout or government-imposed mandate. Whether the industry flourishes or fails, that is for private actors, using their own investment dollars, to determine. This holds true not just for biofuels, but for all energy resources and technologies. The U.S. has a robust, diverse energy market that can supply consumers with affordable and reliable energy without the taxpayers' help.

Evidence indicates that certain biofuels are cost-competitive with traditional fuels and make a useful addition to gasoline without special privileges from Washington. Before any subsidies and the current biofuels mandates were put in place, ethanol already served as a valuable additive to gasoline to oxygenate fuel to burn it more cleanly and efficiently.[7] The use of biofuels is not new and does not originate from any government policy jumpstarting an infant industry; in fact, Henry Ford originally planned for the Model T to run off ethanol and, in 1897, Rudolf Diesel showcased a diesel engine running on peanut oil.[8]

In the year before the federal government mandated the production of ethanol, the U.S. produced over 81 million barrels of ethanol.[9] A recent report by the University of Tennessee Institute of Agriculture estimates that in a market with no RFS and no ethanol tax credit, demand for corn

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https://www.fraserinstitute.org/sites/default/files/energy-abundance-and-economic-growth.pdf (accessed November 13, 2015).

[7]U.S. Energy Information Administration, "Petroleum & Other Liquids: Ethanol Oxygenate," September 30, 2015, http://www.eia.gov/dnav/pet/pet_pnp_oxy_dc_nus_mbbl_a.htm (accessed October 1, 2015). U.S. Geological Survey, "Fuel Oxygenates," August 4, 2015, http://toxics.usgs.gov/definitions/fuel_oxygenates.html (accessed November 13, 2015).

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[9]U.S. Energy Information Administration, "Petroleum & Other Liquids: Ethanol Oxygenate.

ethanol as an oxygenate would be 4.34 billion gallons in 2014, or about 30 percent of corn ethanol production that year.[10]

By reducing government intervention in the biofuel sector and agricultural economy broadly, the most competitive elements of the biofuel industry could thrive in a free market. Competition driven by individuals will drive economic growth and benefit all of rural America—not just those special interest groups who are well-connected to Washington.

Private Benefits, Dispersed Costs

Despite the unique and diverse mix of organizations opposed to the ethanol mandate, the strong lobbying arm combined with the political importance of the geographic region where America produces corn make ethanol policy the perfect example of focusing on political profit as opposed to economic progress.

The RFS essentially mandates a market for corn, soybeans, and biofuels that eliminates much of the risk of investing in biofuels, risk which every industry manages as a matter of doing business and which ultimately is necessary for a healthy and growing economy. The mandate not only favors a select few commodities, but also benefits just a few states at the expense of the vast majority. Over 50 percent of ethanol production is concentrated in three states: Iowa, Nebraska, and Illinois.[11]

Importantly, the benefits enjoyed by biofuels interests are ultimately limited and do not help the industry in the long-run. The dependence on government to remain viable stunts the long-term growth of the industry by propping bioenergy up and distorting the true price point at which biofuels will be competitive in the market.

Addressing Chickens, Eggs and Market Barriers

One common justification for the Renewable Fuel Standard and complementary subsidies for biofuel refineries and fueling stations is that oil has a monopoly on the market and, without government intervention, the alternative market will break that barrier. Proponents of biofuel subsidies argue that even if biofuels are cost-competitive, no one will buy them because the infrastructure does not exist and—without subsidizing everything—a chicken-and-egg problem exists. The U.S. Department of Agriculture is spending $100 million on its Biofuels Infrastructure Partnership to build the blender pumps and necessary infrastructure to grow the biofuels market.[12]

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[10]Daniel De La Torre Ugarte and Burton English, "10-Year Review of the Renewable Fuel Standard: Impacts to the Environment, the Economy, and Advanced Biofuels Development," University of Tennessee Institute of Agriculture, October 14, 2015, http://accf.org/wp-content/uploads/2015/10/10-Year-Review-of-the-RFS.pdf (accessed November 13, 2015).

[11]Schnepf, "Agriculture-Based Biofuels."

[12] Press Release, "USDA to Invest Up to $100 Million to Boost Infrastructure for Renewable Fuel Use, Seeking to Double Number of Higher Blend Renewable Fuel Pumps," United States Department of Agriculture, May 29, 2015, http://www.usda.gov/wps/portal/usda/usdahome?contentid=2015/05/0156.xml (accessed March 9, 2016).

Good ideas overcome the chicken-and-egg program all the time without government assistance. It does not matter how many cell phones there are if there is no place to obtain a signal. But producers built cell phone towers and sold cell phones without a massive subsidy or government bureaucrats mandating its use. The same can happen with biofuels if they are economically viable ideas that meet real market needs. American households spend $2,000 to $2,500 a year on gasoline.[13] Globally, the transportation fuels market is a multi-trillion dollar opportunity. Any technology or fuel source that can capture just a sliver of that market will stand to benefit tremendously.

The Unintended Consequences of Biofuels Policy

The U.S.'s biofuels policy is a case study in the unintended consequences of government intervention. In contrast to what politicians and special interest groups promised, the RFS has cost taxpayers and drivers, had little to no impact on fuel prices, hurt rural economies, and had unforeseen environmental costs.

Biofuels Costs American Taxpayers and Drivers

Biofuel policies have cost Americans both as drivers and as taxpayers. Federal biofuel policies cost taxpayers $7.7 billion in 2011 and $1.3 billion in 2012 after the expiration of ethanol blenders tax credit, a 45-cent per gallon tax credit for blending ethanol into gasoline.[14] Over a 30-year timeframe ethanol subsidies have diverted $45 billion for ethanol.[15]

Furthermore, ethanol has had little to no effect on keeping fuel prices down, as proponents first argued,[16] or in achieving the nebulous goal of independence from foreign oil. Even though ethanol production has increased as mandated and has accounted for nearly one-third of the increase in domestic fuel production over the past few years, biofuels still constitute a small overall percentage in domestic gasoline consumption while costing consumers more in the end.

By its very nature, ethanol is not a perfect substitute for oil. Ethanol has only-two thirds the energy content of petroleum-based gasoline, and while biodiesel is closer to an even exchange at 92 percent the energy content of regular diesel, it is more expensive to fabricate.[17] During times of high gas prices, ethanol may appear less expensive, but after adjusting for the energy content

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[13]U.S. Energy Information Administration, "U.S. Household Gasoline Expenditures in 2015 on Track to Be the Lowest in 11 Years," December 16, 2014, http://www.eia.gov/todayinenergy/detail.cfm?id=19211 (accessed October 1, 2015).

[14] Schnepf, "Agriculture-Based Biofuels," pg 29.

[15] Nicolas Loris, "Congress Should Scale Back the Renewable Fuel Standard—to Zero," Heritage Foundation Issue Brief No 4012, August 13, 2013, http://www.heritage.org/research/reports/2013/08/renewable-fuel-standard-congress-should-scale-back-to-zero#_ftn5 .

[16] Christopher R. Knittel and Aaron Smith, "Ethanol Production and Gasoline Prices:

A Spurious Correlation," July 12, 2012, http://web.mit.edu/knittel/www/papers/knittelsmith_latest.pdf (accessed October 1, 2015).

[17] U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, "Ethanol," https://www.fueleconomy.gov/feg/ethanol.shtml (accessed November 13, 2015). Dan Edmunds and Philip Reed, "E85 vs. Gasoline Comparison Test," Edmunds.com, April 29, 2009, http://www.edmunds.com/fuel-economy/e85-vs-gasoline-comparison-test.html (accessed October 1, 2015).

difference, higher concentrations of ethanol fuels are pricier. For instance, as of January 2016, the current national average price of regular gasoline is $1.86 per gallon and E85 is $1.60 per gallon.[18] Adjusting for the E85's weaker energy density, however, pushes the price to $2.10 per gallon.[19] The Energy Information Administration (EIA) estimates that the energy content of gasoline has decreased three percent from 1993–2013 as ethanol use has increased due to federal mandates.[20]

The EPA and U.S. Department of Energy's (DOE) joint web site, fueleconomy.gov, provides eye-popping documentation of these costs to drivers. The size of the additional costs varies depending on ethanol and gasoline prices, but the big picture is always the same: the higher the ethanol content, the worse a car's gas mileage and the more drivers have to spend to go the same distance. As of September 2015, depending on make and model, the typical motorist could spend as much as an additional $450 per year to run his flex fuel vehicle on E85 rather than regular gasoline blended with E10.[21] Even when vehicles use premium gasoline, E85 is more expensive for drivers.

Biofuel Policies Fail to Deliver on Promise to Reduce Dependence on Oil

In addition to forcing drivers to pay for a less efficient fuel, the RFS has not delivered on the promise of reducing dependence on oil and protection from high prices. Because ethanol contributes such a small percentage of the overall transportation fuel market (a mere 5 percent in 2014), ethanol failed to tamp down prices which mostly continued to climb from 2002 to 2012, despite increased mandated ethanol use and high oil prices allegedly making ethanol more competitive.[22] Conversely, ethanol production has had little to do with the dramatic decrease in fuel prices starting in 2013 as a result of access to vast oil supplies in the U.S. and around the world, making the disparity between the cost and efficiency of ethanol versus petroleum-based fuel more apparent.

The large majority of transportation fuel has come from petroleum; even the relative explosion of growth in biofuels as a result of the mandate is dwarfed by the actual demand for fuel. Conversely, ethanol consumes a large share of the corn crop and diverts valuable crop land away from other agricultural products so while the impact of biofuels on fuel consumption are small the impacts on agriculture are large. The problem is that the land diversion was a result of the mandates and subsidies. Market forces may very well have moved farmers into this direction,

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[18] AAA Daily Fuel Gauge Report, "National Average Prices," AAA.com, http://fuelgaugereport.aaa.com/todays-gas-prices/ (accessed November 12, 2015).

[19] Ibid.

[20] U.S. Energy Information Administration, "Increasing Ethanol Use Has Reduced the Average Energy Content of Retail Motor Gasoline," October 27, 2014, http://www.eia.gov/todayinenergy/detail.cfm?id=18551 (accessed October 1, 2015).

[21] U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, "New Flex-Fuel Vehicles," http://www.fueleconomy.gov/feg/PowerSearch.do?action=noform&path=1&year1=2014&year2=2015&vtype=E85&srchtyp=newAfv (accessed November 13, 2015).

[22] U.S. Energy Information Administration, "U.S. Regular All Formulations Retail Gasoline Prices (Dollars per Gallon)," September 28, 2015, http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMM_EPMR_PTE_NUS_DPG&f=A (accessed October 1, 2015).

although not likely to such an extent. Nevertheless, the private sector is best suited to allocate those resources most efficiently.

The Negative Consequences when Government Policy Diverts Food to Fuel

The federal government's biofuels policy has diverted food away for fuel, increasing the cost of corn, soybeans, feedstocks, and overall food prices. This has hurt rural America and also the world's poorest citizens.

From 2010–2012, 49 percent of the U.S. corn crop was used in the food industry and feed for livestock; another 12 percent was exported. Over 40 percent was used to fabricate ethanol fuel to meet the RFS standard.[23] In 2012, the amount of corn used to produce ethanol in the U.S. exceeded the entire corn consumption of the continent of Africa and in any single country with the exception of China.[24] While the majority of biofuel-related food price increases have resulted from diverting corn to fuel, soybean crop diversion to biodiesel is similar.

Pressure on the price of corn is exacerbated by the mandate, which requires the use of ethanol or available credits (called RIN credits) *regardless of cost*, while ranchers, farmers, the food industry, and motorists must take increased corn prices into account. Those who perhaps most proportionally bear the costs of increased corn prices are farmers and ranchers using corn for feed, and countries importing corn from American, which accounts for over 50 percent of the world's corn exports.[25]

The inflated demand for corn created by the RFS and subsequent higher prices have incentivized farmers to grow more corn either by adding acreage, increasing productivity, or devoting less existing farmland to other crops. Increasing supply to meet higher demand, however, has had its own costs. The U.S. Department of Agriculture's (USDA) Economic Research Service notes that "increased corn prices draw land away from competing crops, raise input prices for livestock producers, and put moderate upward pressure on retail food prices."[26] This was no more acutely apparent than during the 2012 drought.

The 2012 summer drought in the United States destroyed a significant amount of crops, drove corn prices up 33 percent, and heightened concerns that the RFS and existing subsidies were needlessly diverting food to fuel.[27] Since corn is a staple ingredient for many foods and an

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[23]Randy Schnepf, "Agriculture-Based Biofuels: Overview and Emerging Issues," *Congressional Research Service Report* No. 41282, May 1, 2013, http://nationalaglawcenter.org/wp-content/uploads/assets/crs/R41282.pdf (accessed November 13, 2015).

[24]Colin Carter, Gordon Rausser, and Aaron Smith, "Commodity Storage and the Market Effects of Biofuel Policies," University of California–Davis, Department of Agricultural and Resource Economics, http://arefiles.ucdavis.edu/uploads/filer_public/81/ba/81ba961d-fe7b-4629-8511-1b78fdf3b527/carter_rausser_smith.pdf (accessed October 1, 2015).

[25]U.S. Census Bureau, "Statistical Abstract of the United States: 2012 Selected Farm Products—U.S. and World Production and Exports: 2000 to 2010," Table 852, https://www.census.gov/prod/2011pubs/12statab/agricult.pdf (accessed November 13, 2015).

[26]U.S. Department of Agriculture, Economic Research Service, "Bioenergy: Findings," March 11, 2014, http://www.ers.usda.gov/topics/farm-economy/bioenergy/findings.aspx (accessed November 13, 2015).

[27]Steve Hargreaves, "Calls to Scrap Ethanol Mandate Intensify with Drought," CNN Money, August 6, 2012, http://money.cnn.com/2012/08/06/news/economy/ethanol-drought/ (accessed November 13, 2015).

important feedstock for animals, many in the food industry (from cattle and chicken farmers to restaurant associations) expressed concern regarding the mandate's effect on food prices. Rather than going to where market demand valued corn most highly, roughly 40 percent of the corn crop in 2012 was used to create 12.98 billion gallons of corn-based biofuels, or 95 percent of the mandate.[28]

Between July and August 2012 governors from Arkansas, Delaware, Georgia, Maryland, New Mexico, North Carolina, Texas, Utah, Virginia, Wyoming, and Florida petitioned the EPA for a waiver of the RFS standards, which the EPA denied.[29] According to a recent study by economists from the University of Nebraska–Lincoln, "the drought's impact on corn prices could have been "fully negated" by reducing the Renewable Fuel Standard by 23 percent that year."[30]

Higher prices resulting from government-created market distortions have consequences that ripple well beyond the U.S. A number of organizations have demonstrated a link between biofuels policies and food prices and the adverse consequences these policies have on the world's poorest citizens. The Food and Agriculture Organization of the United Nations, ActionAid, World Resources Institute, Organization for Economic Co-operation and Development and The World Bank have all listed higher food prices as a concern of the quota.[31]

The full magnitude of the ethanol mandate's effect on corn prices and overall agricultural products is difficult to determine—in part because estimates are uncertain regarding how much ethanol would be used for fuel absent a mandate, the price impacts of other factors affecting the price of corn, and what other agricultural products farmers would grow absent the mandate. While the magnitude of the mandate's impact on corn prices may not be certain, the direction is clear: The RFS has increased demand for corn and consequently increased prices. According to

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[28]U.S. Department of Agriculture, Economic Research Service, "U.S. Bioenergy Statistics," Table 5, http://www.ers.usda.gov/data-products/us-bioenergy-statistics.aspx, and U.S. Environmental Protection Agency, "Fuels Registration, Reporting, and Compliance Help," September 28, 2015, http://www.epa.gov/otaq/fuels/rfsdata/2012emts.htm (accessed October 1, 2015).

[29]National Pork Producers Council et al, "Petition for Waiver or Partial Waiver of Applicable Volume of Renewable Fuel."

[30]Sunil Dhoubhadel, Azzeddine Azzam, and Matthew Stockton, "The Impact of Biofuels Policy and Drought on the U.S. Grain and Livestock Markets," *Journal of Agricultural and Applied Economics*, Vol. 47, No. 1 (2015), pp. 77–103, http://journals.cambridge.org/download.php?file=%2F8525_9D6722650751042F2D7DB0A810DBD0D5_journals_AAE_AAE47_01_S1074070814000066a.pdf&cover=Y&code=868fed2c0e9a45018eb4aa14d4bda045 (accessed November 13, 2015).

[31]See, for instance, Aziz Elbehri, Anna Segerstedt, and Pascal Liu, "Biofuels and the Sustainability Challenge: A Global Assessment of Sustainability Issues, Trends and Policies for Biofuels and Related Feedstocks," Trade and Markets Division, Food and Agriculture Organization of the United Nations, 2013, http://www.fao.org/docrep/017/i3126e/i3126e.pdf, Tim Searchinger (accessed November 13, 2015). Ralph Heimlich, "Avoiding Bioenergy Competition for Food Crops and Land," World Resources Institute, January 2015, http://www.wri.org/publication/avoiding-bioenergy-competition-food-crops-and-land, (accessed November 13, 2015). Richard Doornbosch and Ronald Steenblik, "Biofuels: Is the Cure Worse Than the Disease?" Organisation for Economic Co-operation and Development, September 2007, http://www.oecd.org/sd-roundtable/39411732.pdf (accessed November 13, 2015). "How Global Biofuel Expansion Could Affect the Economy, Environment and Food Supply," The World Bank, June 27, 2011, http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/0,,contentMDK:22946809~pagePK:64165401~piPK:64165026~theSitePK:469372,00.html (accessed November 13, 2015).

separate analyses, one by University of California–Davis economists and another by a Heritage Foundation economist, the mandate accounts for an increase in corn prices by 30 percent or even as much as 68 percent, respectively.[32] Though there are other factors at work in the price of corn —weather, global markets, and changing food choice preferences for instance—the RFS has certainly contributed to increased prices.[33]

Proponents of the RFS and preferential treatment for biofuels sold the policies as a way to support economic growth in rural communities. Rather than supporting rural communities however, the federal government has supported corn growers at the expense of livestock producers and diverted resources to an industry that is not self-sustaining. Taking such a crutch away will be painful for farmers.

Because of the RFS, fuel is now an indirect competitor with corn producers.[34] This connection is not insignificant: some 41 percent of the U.S. corn crop was dedicated to ethanol production in 2010–2012, compared to 14 percent when Congress mandated the original quota in 2005.[35] Without the mandate, ethanol and thus corn-for-fuel becomes less competitive, especially if more energy efficient gasoline remains inexpensive.

Ethanol consumption is currently at historic highs simply because the federal government mandates its consumption. As the Institute for Energy Research wrote: "If someone forces vegetarians to buy hamburgers, or non-smokers to buy cigarettes, that might look like 'economic growth' and 'job creation' but it doesn't actually make Americans better off. By the same token, if the government forces people to use ethanol, that's not genuine prosperity."[36] The fact that EPA can use its own discretion to set biofuel targets after 2022 is all the more reason for Congress to act now.

Ultimately, the RFS has less to do with price or customer choice and much more to do with meeting a government quota regardless of costs. While it may someday be that biofuel technologies will prove to be a preferred fuel choice by Americans, biofuels have proved to be expensive to produce and less energy dense than gasoline and diesel. Federal subsidies and mandates have shifted those costs to motorists, the food industry, and sectors of the agriculture

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[32]Colin A. Carter and K. Aleks Schaefer, "U.S. Biofuels Policy, Global Food Prices, and International Trade Obligations," American Enterprise Institute, May 2015, https://www.aei.org/wp-content/uploads/2015/05/US-biofuels-policy.pdf (accessed November 13, 2015). David W. Kreutzer, "Renewable Fuel Standard, Ethanol Use, and Corn Prices," Heritage Foundation *Backgrounder* No. 2727, September 17, 2012, http://www.heritage.org/research/reports/2012/09/the-renewable-fuel-standard-ethanol-use-and-corn-prices.

[33]The Congressional Research Service reports that "most economists and market analysts…also are nearly universally agreed that the strong, steady growth in ethanol demand for corn has had an important and sustained upward price effect, not just on the price of corn, but in other agricultural markets including food, feed, fuel, and land." Schnepf, "Agriculture-Based Biofuels."

[34] U.S. Department of Agriculture, Economic Research Service, "Bioenergy: Findings," http://www.ers.usda.gov/topics/farm-economy/bioenergy/findings.aspx (accessed November 13, 2015).

[35]Schnepf, "Agriculture-Based Biofuels." Carter, Rausser, and Smith, "Commodity Storage and the Market Effects of Biofuel Policies."

[36]Institute for Energy Research, "How Big Ethanol Hopes You're a Dope," September 3, 2013, http://instituteforenergyresearch.org/analysis/how-big-ethanol-hopes-youre-a-dope-2/ (accessed October 2, 2015).

community depending on corn and soy for feed, while benefits are concentrated with a select few.

Ethanol and Price Volatility

Price volatility in and of itself is no reason to stop using biofuels in transportation fuel. However, proponents of alternative fuel use have used the volatility of oil markets to champion the government's use of biofuels. Yet ethanol has been subject to its own price volatility, especially since the passage of RFS and had done little to curb the effects of oil price volatility. Most importantly, although agricultural commodities have much lower price volatility than other commodities, markets free of government intervention can best respond to any price volatility, large or small.

Corn prices reached record highs in 2008 only to freefall during the financial crisis. Again in 2012, drought in the U.S. caused corn prices to rise steeply and the first decline in US ethanol production since 1996 as ethanol producers stalled plants.[37] As the Congressional Research Service (CRS) notes of the 2008 price spike, "The experience of $7.00-per-bushel corn, albeit temporary, shattered the idea that biofuels were a panacea for solving the nation's energy security problems and left concerns about the potential for unintended consequences from future biofuels expansion."[38]

Unintended Adverse Environmental Consequences

Policymakers sold biofuel programs and the RFS in part on the purported environmental benefits of improving the environment with a cleaner fuel and reducing greenhouse emissions that allegedly contribute to climate change. Regardless of the merits of such a goal, the contribution of biofuels, and particularly ethanol, to improving the environment and reducing greenhouse gas emissions has been unclear and controversial at best.

According to the EIA, biofuel carbon dioxide emissions are "considered to be part of the natural carbon cycle."[39] However, this assumption may be too broad.

After accounting for land-use conversion, the use of fertilizers, insecticides, and pesticides, as well as the fossil fuels used for production and distribution, biofuel production is quite carbon-intensive.[40] The growing popularity of biofuel policies led the U.N.'s Food and Agriculture Organization (FAO) to focus on the issue in the 2008 Food and Agriculture Report. Citing several studies published in *Science*, the FAO reported that converting non-cropland to produce corn ethanol released at least 17 times more emissions than what is cut in carbon dioxide

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[37]Schnepf, "Agriculture-Based Biofuels."

[38]Ibid.

[39]U.S. Energy Information Administration, "Emissions of Greenhouse Gases in the U. S." March 31, 2011 http://www.eia.gov/environment/emissions/ghg_report/ghg_overview.cfm (accessed October 2, 2015).

[40]James A. Baker III, "Fundamentals of a Sustainable U.S. Biofuels Policy," Rice University, Institute for Public Policy, January 2010, http://www.bakerinstitute.org/publications/EF-pub-BioFuelsWhitePaper-010510.pdf and Adam J. Liska et al, "Biofuels from Crop Residue Can Reduce Soil Carbon and Increase CO2 Emissions," *Nature Climate Change* 4, 2014, pp. 398–401, http://www.nature.com/nclimate/journal/v4/n5/full/nclimate2187.html (accessed November 13, 2015).

emissions by using biofuels, or a "carbon debt" of 48 years.[41] Once hailing biofuels as an important tool to mitigate climate change, the U.N.'s 2007 Intergovernmental Panel on Climate Change's report acknowledged that biofuel policy negatively impacts the lives of the poor, diverts land to produce biofuels, has adverse environmental and climate consequences.[42]

Meanwhile, Congress has seemingly ignored apparent increases in real pollutants attributed to the RFS. Ethanol does have some benefits as a fuel additive that helps gasoline burn more cleanly and efficiently. But, in its first of three reports to Congress, the EPA projected that nitrous oxides, hydrocarbons, sulfur dioxide, particulate matter, ground level ozone, and ethanol vapor emissions, among other air pollutants, would increase at different points in the production and use of ethanol.[43] A study by Iowa State University researchers concluded that incentivizing more biofuel production with government policies leads to more adverse environmental consequences caused by farming, the use of fertilizers, and land-use conversion for agricultural production, resulting in increased soil erosion, sedimentation, and nitrogen and phosphorous runoff into lakes and streams.[44]

The unwanted environmental costs from agricultural production are a solvable problem. Almost all industrial output has unwanted byproducts, whether it is air pollutants, or run off and discharge from the use of fertilizers. These are not necessarily a reason to eliminate an activity; doing so could reverse prosperity and progress. The real problem is that biofuels have been sold to policymakers and the public as "green" fuels whereas, in fact, they can be more environmentally-damaging than petroleum-based fuels

Renewable Fuel Standard: The Folly of Central Planning

The RFS mandate demonstrates just how bad the government is at understanding what the market can bear in terms of production and consumption. Austrian economist F.A. Hayek famously said, "The curious task of economics is to demonstrate to men how little they know

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[41]U.N. Food and Agriculture Organization, *The State of Food and Agriculture, 2008* (Rome, Italy: Food and Agriculture Organization, 2008), pp. 55–59, http://www.fao.org/3/a-i0100e.pdf (accessed November 18, 2015).

[42]Intergovernmental Panel on Climate Change, Working Group II, "Livelihoods and Poverty," March 31, 2014, http://ipcc-wg2.gov/AR5/images/uploads/WGIIAR5-Chap13_FGDall.pdf (accessed November 13, 2015).

[43]For example, Environmental Protection Agency, "Biofuels and the Environment: The First Triennial Report to Congress," 2011, http://cfpub.epa.gov/ncea/biofuels/recordisplay.cfm?deid=235881 (accessed November 13, 2015). Other studies have examined the impact of increased corn or cellulosic ethanol (independent of the mandate) on individual air pollutants like particulate matter or ozone. Jason Hill et al., "Climate change and Health Costs of Air Emissions from Biofuels and Gasoline," Proceedings of the National Academy of the Sciences of America, December 16, 2008, http://www.pnas.org/content/106/6/2077.full.pdf+html (accessed November 13, 2015). Diana L. Ginnebaugh and Mark Z. Jacobson, "Examining the Impacts of Ethanol (E85) Versus Gasoline Photochemical Production of Smog in a Fog Using Near Explicit Gas- and Aqueous-Chemistry Mechanisms," *Environmental Research Letters*, Vol. 7, No. 4 (November 6, 2012), http://iopscience.iop.org/article/10.1088/1748-9326/7/4/045901/pdf (accessed November 13, 2015).

[44]Amani Elobeid et al, "Greenhouse Gas and Nitrogen Fertilizer Scenarios for U.S. Agriculture and Global Biofuels," Iowa State University, Center for Agricultural and Rural Development, June 2011, http://ageconsearch.umn.edu/bitstream/107043/2/11-WP_524.Jun6Revise.pdf (accessed November 13, 2015).

about what they imagine they can design."[45] Politicians and bureaucrats, no matter how brilliant or well-informed with data, cannot plan markets and consumer needs. Basic assumptions about the RFS have proved to be shortsighted, revealing the inability of government to centrally plan energy markets.

The Blend Wall

As the RFS has reached the mid-point to its final target in 2022, petroleum refiners have come up against what is known as the "blend wall." Because overall gasoline consumption has leveled off from a slower economy and increased fuel efficiency, and because the RFS mandates ever-increasing amounts of ethanol, continued compliance with the RFS would force refiners to blend more ethanol than the market would bear.

According to the RFS, each refiner in the United States has to meet a requirement that a certain percentage of domestic sales contain blended ethanol, called a renewable volume obligation (RVO).[46] Refiners have an option to meet part of their requirement by buying credits rather than blending more ethanol. In order to track the renewable fuel quotas, the EPA requires a renewable identification number (RIN) to track the amount of biofuel reaching the market and to hold refiners accountable for blending enough ethanol. Refiners can hold on to these credits and meet up to 20 percent of the RFS requirement in RIN credits, or refiners can purchase RIN credits from other refiners when they fail to meet the requirement. Different RIN prices exist for different forms of biofuels.

The RIN trading system has resulted in fraud where refineries bought fake credits with made-up RIN numbers for millions of dollars. Since refineries now face the blend wall, increased trading for RIN credits has driven up the price of the credit from pennies to over a dollar in 2013.[47] Bloomberg projects that over-mandating—requiring the use of more ethanol than can be blended—and forcing the purchase of RINs, could cost consumers an additional $13 billion at the pump—an artificial increase of 10 cents per gallon, if RIN credit prices stay above one dollar.[48] Even if the price of RIN credits falls to 50 cents per credit, however, the cost to consumers is a multi-billion dollar price tag. Corn-based ethanol RIN prices were more than 70 cents in April 2015 but have fallen to approximately 40 cents in November 2015.[49]

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[45]Friedrich Hayek, *The Fatal Conceit: Errors of Socialism*, vol. 1 of *The Collected Works of Friedrich August Hayek*, ed. W.W. Bartley III (London: Routledge, 1988), p. 76, http://www.libertarianismo.org/livros/fahtfc.pdf (accessed November 13, 2015).

[46]U.S. Energy Information Administration, "RINs and RVOs Are Used to Implement the Renewable Fuel Standard," June 3, 2013, http://www.eia.gov/todayinenergy/detail.cfm?id=11511 (accessed November 12, 2015).

[47]U.S. Energy Information Administration, "What Caused the Run-up in Ethanol RIN Prices During Early 2013?" June 13, 2013, http://www.eia.gov/todayinenergy/detail.cfm?id=11671 (accessed October 2, 2015).

[48]Bradley Olson and Dan Murtaugh, "Ethanol Upending Refiners Pushes $13 Billion on U.S. Drivers," Bloomberg, March 19, 2013, http://www.bloomberg.com/news/2013-03-18/refiners-pay-price-as-traders-hoard-ethanol-credits-valero-says.html (accessed November 13, 2015).

[49]Progressive Fuels Limited, "PFL Weekly RIN Recap," http://www.progressivefuelslimited.com/web_data/PFL_RIN_Recap.pdf (accessed November 12, 2015).

The economic consulting firm NERA warns that attempting to ramp up requirements to where the targets were originally set in the Energy Independence and Security Act of 2007 would result in intensified economic damage:

> When the required biofuel volume standards are too severe, as with the statute scenario, the market becomes disrupted because there are an insufficient number of RINs to allow compliance. "Forcing" additional volumes of biofuels into the market beyond those that would be "absorbed" by the market based on economics alone at the levels required by the statute scenario will result in severe economic harm.[50]

The possibility of "too much" ethanol creates an economic problem for ethanol producers that will become more pressing as corn based ethanol reaches the statutory cap of 15 billion gallons and if gas prices remain low. As the CRS states:

> "In volumes above the RFS total renewable mandate, biofuels use is no longer obligatory and it must compete directly in the marketplace with its petroleum-based counterpart. As a result, once they have met their RFS blending mandates, fuel blenders, seeking to maximize their profits, are very sensitive to price relationships between petroleum-based fuels and biofuels. This is particularly important for ethanol since it contains only about 68% of the energy content of gasoline. As a result, value-conscious consumers could be expected to willingly pay only about 68% of the price of gasoline for ethanol."

Higher economic growth and therefore higher fuel consumption could alleviate some blend wall concerns, however increased fuel efficiency standards and higher volume targets for biofuels could result in the blend wall problem persisting. Flex fuel vehicles capable of using E85 offer little economic relief for the blend wall Demand for these vehicles is very low[51] and drivers who own flex-fuel vehicles often fill their tanks with E10 as opposed to E85 because the energy content in E85 is lower. Adjusted for energy content, E10 makes more financial sense than E85. Most importantly, the future is uncertain for economic growth and fuel consumption, which is why the government should not predict what markets will bear in 2022 with a law passed in in 2005.

Problems with Advanced Biofuels

While corn-based ethanol has outpaced the "blend wall," the production of other biofuels to meet the RFS mandate have woefully underperformed.[52] The production of cellulosic ethanol, made from non-food sources, is nowhere near to meeting its targets, even though the RFS mandates 16 billion gallons to be used by 2022. High capital costs and difficulty scaling up cellulosic biofuel

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[50]Nera Economic Consulting, "Economic Impacts Resulting from Implementation of the RFS2 Program," prepared for the American Petroleum Institute, July 27, 2015, http://www.nera.com/content/dam/nera/publications/2015/NERA_FINAL_API_RFS2_July27.pdf (accessed November 13, 2015).

[52]One of the purported reasons Congress capped corn-based ethanol targets at 15 billion gallons annually was to address concerns that the mandate would divert corn used for fuel. Consequently, cellulosic biofuels were introduced into the mandate.

conversion plants to meet largescale demand have prevented non-food-sourced ethanol from being an economically viable option.

The EPA, which administers the RFS, has reduced Congress' original annual quotas for cellulosic ethanol every year, as required by the mandate, because not enough was available on the market. EPA adjusted Congress' first cellulosic target from 100 million gallons in 2010 to just 6.5 million. However, even the adjusted mandate was a stretch compared with reality; in fact, zero gallons were produced that year and the following year.[53]

Consequently, refiners had to pay millions of dollars in waiver credits or surcharges for failure to comply with the EPA's minimum volume requirements. Refiners necessarily passed those costs on to the consumer. In January 2013, the D.C. Circuit Court of Appeals ruled that EPA "let its aspirations for a self-fulfilling prophecy divert it from a neutral methodology" and that the target was an "unreasonable exercise of agency discretion."[54] It vacated the cellulosic ethanol requirement required by the RFS for the year 2012. The EPA has since proposed cellulosic mandates for 2014-2016 that are equally as out of touch with market realities.

Conclusion

Longtime proponents of the ethanol mandate have since recognized the problems corn-based ethanol. In fact, several Members of Congress have introduced legislation to repeal only the corn requirement of the Renewable Fuel Standard.[55] Removing corn's share of the requirement, perhaps the most economically viable part of the mandate, is problematic for several reasons. Biodiesel generated from soybeans presents the same food-for-fuel problem that the corn ethanol mandate does. Advanced biofuels from non-food based sources are the least economically competitive and demonstrate just how incompetent the federal government is at centrally planning what the market can bear. Furthermore, each part of the Renewable Fuel Standard and the federal government's promotion of biofuels create unintended environmental concerns.

Congress should repeal the ethanol mandate in its entirety and allow consumers a choice at the pump. Biofuels have existed long before the Renewable Fuel Standard and if economically competitive, will remain long after it. Removing the mandate will spur a healthier market that promotes risk taking and entrepreneurial activity rather than government dependence for near-term survival through favorable policies and tax treatment. Importantly, policymakers should not just repeal the corn-based part of the ethanol mandate, leaving the least competitive part, the cellulosic requirement.

Furthermore, Congress should use the repeal of the mandate as momentum for greater reform in the energy sector that further levels the playing field for all energy companies and technologies.

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[53]U.S. Environmental Protection Agency, "Fuels Registration, Reporting, and Compliance Help," September 28, 2015, http://www.epa.gov/otaq/fuels/rfsdata/2010emts.htm (accessed November 13, 2015).

[54]U.S. Court of Appeals for the District of Columbia Circuit, *American Petroleum Institute vs. Environmental Protection Agency*, January 25, 2013, http://www.cadc.uscourts.gov/internet/opinions.nsf/A57AB46B228054BD85257AFE00556B45/$file/12-1139-1417101.pdf

[55]Press release, "Toomey, Feinstein Introduce Bill to Repeal Ethanol Mandate," February 26, 2015, http://www.toomey.senate.gov/?p=news&id=1496 (accessed October 2, 2015).

Congress should remove preferential treatment for all transportation fuels and technologies. America needs policies that open access to markets, eliminate preferential treatment for all energy sources, and reduce the regulatory burden that chokes investment and innovation.

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Mr. GOSAR. I thank the gentleman.

The chair notes the presence today of our fellow OGR member Mr. Welch. We appreciate your interest in this topic and welcome your full participation in the hearing.

Without objection, so ordered.

I would like to first recognize the gentleman from Colorado, Mr. Buck, for his questions.

Mr. BUCK. Thank you, Mr. Chairman.

Mr. Grundler, I have three different ethanol producers in my district. One of them tells me that the RFS is a ceiling, and the other one tells me the RFS is a floor. And I have received so much conflicting information on this. I have a few, I think, fairly straightforward questions for you.

When does the RFS expire? You mentioned 2022. Is that the date that people agree on that the RFS expires?

Mr. GRUNDLER. The RFS does not expire.

Mr. BUCK. Okay. Well, when you mentioned 2022, what happens in 2022?

Mr. GRUNDLER. In 2022, the statutory mandates, the specified volumes that Congress put in the law and EPA is required to, after 2022, establish what the appropriate volumes should be.

Mr. BUCK. When does the market kick in? When does the consumer get the chance to say I want E85, I want E10, I want to E0?

Mr. GRUNDLER. The consumer has that choice today, sir.

Mr. BUCK. We don't have to have E10 in our car?

Mr. GRUNDLER. I'm sorry, the consumer has a choice of using all of those fuels with respect to E10. The refining industry and the transportation fuels of this industry have been using ethanol as an octane enhancer, as a volume extender for many, many years.

Mr. BUCK. So many of us believe the RFS is a failure because we have standards that are arbitrarily set and somehow the marketplace is supposed to react. Why is EPA in any better position in 2022 to do something that Congress failed to do properly up until 2022?

Mr. GRUNDLER. Well, the Congress did give the administrator a long list of factors to consider for what those future standards or volumes should be comprised of, including environmental impacts, the impacts on energy security, impacts on cost to consumers, the impacts on agriculture, the impacts on transportation ——

Mr. BUCK. Let me ask you this. There are blender pumps going in all across America right now, and blender pumps give individual consumers the ability to make choices between whatever level—actually, whatever level the law allows but hopefully someday whatever level they choose. Isn't that a better way to determine ethanol consumption in this country than to have either Congress or the EPA make that decision for consumers?

Mr. GRUNDLER. Well, sir, you know, our job that you directed us to do is to implement this law as ——

Mr. BUCK. I actually asked you for an opinion and not what the law was this time. Wouldn't that be a better way, given our marketplace in America, to allow consumers to make those choices?

Mr. GRUNDLER. Sir, I'm not here to provide an opinion or advice on how to change the law. I'm representing the Agency, and we do not have a position on that.

Mr. BUCK. Under the system as it is currently set up, does a refiner pay an ethanol producer if the refiner doesn't use a certain amount of ethanol each year?

Mr. GRUNDLER. No, the refiner buys—the refiner actually has a choice to either buy the ethanol, and along with that comes a credit, which is used to measure compliance, or the refiner can go to the marketplace and buy a credit. It's called a renewable—a RIN to ——

Mr. BUCK. Who gets the money from that RIN?

Mr. GRUNDLER. Who gets the money from that RIN? Whoever the refiner is buying it. He could be buying it from another refiner, it could be—they're—it's a marketplace. These are private transactions.

Mr. BUCK. Ms. Stone, I have a question for you. Just sort of summarize your testimony. You indicated that the ethanol production raises food prices. And I understand that there are other factors. There's water use and chemical use and other things, but is that a fair summary?

Ms. STONE. Yes, that ——

Mr. BUCK. Okay.

Ms. STONE. Yes.

Mr. BUCK. And that demand for ethanol drives up food prices?

Ms. STONE. Yes.

Mr. BUCK. Is there any other demand out there that you would like to manipulate to drive down prices? And I paid a lot for my iPhone. I am just wondering if you could help me. Could we drive down demand for iPhones? And my car was really expensive also. Are there things that we could do to reduce the price of other things and perhaps not just blame farmers who are making more money as a result of ethanol being used, but we could blame high-tech companies, we could blame all kinds of producers in this country for the cost and the benefit that they receive.

Ms. STONE. I appreciate the Congressman's question because I do want to be very clear that I in no way hold American farmers responsible for the impacts of the RFS. They are quite rightfully responding to a market that Congress has created.

But what I am saying is that this energy policy is having detrimental impacts on the most vulnerable and poorest in the world and that I—and that it's also not achieving the goals that Congress set out for it initially. And so that is time to move away from food-based biofuels.

Mr. BUCK. I thank the chairman. I yield back.

Mr. GOSAR. I thank the gentleman, and I now recognize the gentlewoman from Michigan, Mrs. Lawrence.

Mrs. LAWRENCE. Thank you, Mr. Chair.

Supporters of the RFS point to its success. For instance, according to the biotechnology industry that RFS displaced nearly 1.9 billion barrels of fuel. Mr.—is it Grunder?

Mr. GRUNDLER. Grundler.

Mrs. LAWRENCE. Grundler. I understand that the EPA recognizes that currently, market limitations are limitations to the increased use of higher-ethanol-content fuels, including current market, its near-terms limits on fueling infrastructure. What assurances can you provide to this committee that the new rules, as well as the

future rules, will not cripple the RFS program's ability to encourage infrastructure investments?

Mr. GRUNDLER. Thank you, ma'am. The final stats we put in place by no means cripple this industry or its future. I'm not in a position to speculate what 2017 or 2018 or 2019 standards will be. That will be up to the administrator. We're doing the analysis right now for the 2017 volumes. But the trends are going up. We foresee steady growth in these fuels as competition increases and as more facilities come online to produce these advanced fuels.

Mrs. LAWRENCE. Ms. Stone, you urge the committee to support reforming RFS, is that correct?

Ms. STONE. That's correct.

Mrs. LAWRENCE. So give us some suggestions. What would you like to offer to reform it?

Ms. STONE. So what ActionAid USA would like to see moving forward with the RFS is an end to food-based biofuel mandates because of the reasons I outlined in my statement. They aren't working for the environment, but they are harming people.

We would also like to see sustainability measures in place, both social and environmental, to ensure that land use, it does not compete with food production globally.

Mrs. LAWRENCE. Okay.

Ms. STONE. And that's also part of the reason that we have supported removing, at least at first, the corn ethanol mandate as a good first step.

Mrs. LAWRENCE. Thank you.

Dr. Tyner, in your prepared statement, you stated that the RFS has achieved its stated objectives. Do you believe that the RFS rules announced in 2015 will help to restore confidence within the biotechnology industry to make sure new infrastructure investments in the renewable fuel industry?

Mr. TYNER. Frankly, yes, I—in general, I think that's correct. We have to recognize that the corn ethanol industry is a mature industry. It's already reached the capacity to produce RFS level. It's not going to grow beyond where it is very much at least. The framework that EPA is using for cellulosic biofuels, basically "build it and we will come," does create the incentive structure for new companies to enter and come into the business. And the same is true with biodiesel.

Mrs. LAWRENCE. My last question to Dr. Grundler, right, I understand that both the U.S. Departments of Agriculture and Energy have programs supporting biofuels and biofuels infrastructure and that you work closely with these agencies to implement these statutes. Can you elaborate on what specific programs you collaborated with with the Department of Agriculture and Energy to support the biofuels and the biofuel infrastructure?

Mr. GRUNDLER. Yes. The primary cooperation is in setting these annual fuel volumes. We rely on expert advice with respect to future gasoline demand and what the potential is for the market to respond to different scenarios of volumes.

We also work very closely with experts across these two agencies with respect to new biofuel pathways, what are the right assumptions we should be making about ag inputs into our modeling and so on, so it's a very close relationship. The Energy Department also

sponsors quite a bit of research into advanced second-generation biofuels.

Mrs. LAWRENCE. Thank you. I yield back.

Mr. GOSAR. I thank the gentlewoman and now recognize the gentleman from Ohio, Mr. Jordan.

Mr. JORDAN. Thank you, Mr. Chairman.

Okay, Mr. Lawrence, tell me what part of the story I got wrong. A few years ago, politicians get together and they decide they are going to determine what levels of ethanol should be put into the market and should be mandated usage by the American consumer. They do this for a number of energy sources. We have the Department of Energy Loan Guarantee Program where they gave all kinds of money, billions of dollars to 28 different companies. Twenty-two had a credit rating of BB minus. A bunch of them went bankrupt, companies like Beacon Power and Solyndra.

This year in the ethanol program, the mandated schedule that all these smart politicians decided on a few years ago, that they were smarter than the market, is now going to hit the blend wall, which means it can't really work. That is not your conclusion or even Dr. DeCicco's conclusion. That is the EPA's conclusion, as evidenced by the testimony Mr. Grundler gave just a few years ago.

Now, the EPA can change, they can waive the level. They have to set—actually, there is a notice time, right? They have to notice each year what level it is going to be. And in the 8 years this law has been in place, they have only had that date—they have only complied with the law three times out of 8 years, right? So even though they can change—they couldn't figure it out. They could even tell us at the appropriate time schedule what the law lays out.

And this year, when they did tell us what level they were going to use, they said, well, we are also going to tell you what level we were going to use in 2013 and 2014. So they went back retroactively. It is hard to tell you what you are going to use when you have already used it, right? You can't change the past, but that is what they did in November of 2015.

And then to add insult to injury, as Dr. DeCicco pointed out, all this actually increases greenhouse gases. Now, I mean, this would be like a comedy, right? You couldn't make a movie—sometimes fact is actually stranger than fiction. And the clincher is this, because Mr. Grundler in answering Mr. Buck's question, in 2022 EPA is completely in control, right? Only three times in 8 years could they actually tell us what the level is. Now, the level is going to be too much for the market to even—it won't work. But now in 2022 they are completely in charge. Now, what part of that story do I have wrong?

Mr. LORIS. None of it. In fact, after your opening statement I was just going to say ditto and forgo my opening remarks because you're spot on. And again, this speaks to the government trying to force technologies into the market. Even when gas prices were high, were $4 a gallon, these fuels couldn't compete with oil. When gas prices are consistently high in Europe, you don't see biofuels overtaking those markets.

So as much as the Federal Government wants to try and force alternative technologies into the market, they're just not cost-com-

petitive, and it's cost us as taxpayers, as energy consumers, and with this policy, as food consumers.

Mr. JORDAN. Yes, so what is going to happen in 2022 when the EPA is totally running the show? They can decide the number? They can decide when they are going to tell us? What is going to happen?

Mr. LORIS. That is a great question, and ostensibly, whoever is in control of the administration at that point is going to continue to tell the EPA to ramp up those targets, which makes the opportunities to repeal the failed program now all that much more important.

Mr. JORDAN. Dr. DeCicco, do you want to add anything?

Mr. DECICCO. I very much agree. Clearly, Dr. Tyner and myself have a difference of perspective on the success of this policy. You know, I wouldn't call it a comedy as much as I'd call it a tragedy.

You know, I think in many ways there were some good intentions. I mean, after all, when EISA was passed—I don't remember the vote in this chamber, but it went through the Senate 86 to 8. A lot of people felt that that policy was going to be beneficial for a variety of reasons.

But this particular part of the policy, you know, as Dr. Tyner said, there's kind of a three-legged stool here, rural economic interests—or I would be more specific—certain rural economic interests, I think, is as well-known. Not everybody in the agricultural sector is at all pleased with this policy. Certain parts of the sector do benefit from it, clearly, though. So you have a partial leg of that first leg on certain parts of the agricultural community.

I think in energy security the cost of this policy, enormous costs, both monetary and environmental, make it an extremely cost-effective way. Sure, it's displaced some oil, but just in the last 2 years the expansion we've had, the market-driven expansion in domestic oil production due to technology advances that the oil and gas industry itself put into place have put in more than three times the volume of fuel into the market than was forced and over the last 10 years by the RFS. So sure, it has displaced some oil, but the market has done a much better job of supplying our energy needs.

When it comes to the environment, something like greenhouse gas emissions, that's an externality. Government intervention is required. The market is not going to fix that problem on its own. But that intervention needs to be very judicious. Much more thought needs to be given about how to address the part of emissions associated with petroleum fuel use.

As I said, the types of analyses on which, as Dr. Tyner points out, everyone has relied, I don't disagree that all the agencies here and abroad have been using lifecycle analysis for this. My academic work shows that that method is inherently flawed, and I think we need to go back to the drawing board on that score because the—not—one of the things I want to take issue with, you know, Wally said that this measure—this analysis is used to measure. It doesn't measure. It models. These are computer simulations, computer scenarios. They're not like taking a gallon of fuel, you can measure how much sulfur or lead are in that fuel for chemical analysis. That's not what's going on here. It's not measurement. It's com-

puter modeling. And unfortunately, in spite of good intentions, the models are just plain wrong.

Mr. JORDAN. Thank you.

Mr. GOSAR. I thank the gentleman.

I now acknowledge our colleague, Mr. Cartwright, from Pennsylvania. By the way, the current score is 5–0 law over low.

Mr. CARTWRIGHT. Cellulosic is the correct pronunciation.

Mr. GOSAR. So we have got zero.

[Laughter.]

Mr. CARTWRIGHT. Well, thank you, Mr. Chairman. And you know what, Dr. DeCicco, I want to open up with you. I said in my opening statement, and I kind of parroted something that I got from the biotechnology innovation organization, and that was this: Over its 10-year lifespan, the Renewable Fuel Standard has reduced U.S. transportation-related carbon emissions by 589.33 million metric tons, and that really just begs the question that you are raising because I see that that was done using a GREET 1 2013 model, which is a form of lifecycle analysis that you are criticizing. Have I stated that correctly?

Mr. DECICCO. That's correct.

Mr. CARTWRIGHT. Okay. And you have also gone so far as to say just now that the lifecycle analysis is the one generally employed by the Department of Energy, by the EPA, et cetera, correct?

Mr. DECICCO. That's right.

Mr. CARTWRIGHT. That is sort of the conventional wisdom?

Mr. DECICCO. It is.

Mr. CARTWRIGHT. And you are bucking that ——

Mr. DECICCO. Yes.

Mr. CARTWRIGHT.—and you are doing that based on your own research over how many years?

Mr. DECICCO. Well, you know, true confession here, over ——

Mr. CARTWRIGHT. We are looking for the truth generally.

Mr. DECICCO. Right. That's right. Over 20 years ago at an earlier stage of my looking at transportation energy use and emissions, I wrote the first paper coauthored with a professor at Dartmouth that called for the use of lifecycle analysis to assess the emissions from transportation fuels, including biofuels. We were taken with the technique at the time. It was developed in the late '80s.

Mr. CARTWRIGHT. So it is not completely crazy.

Mr. DECICCO. So it's—it seemed to make sense at a certain level, and I went along with that. About 10 years ago, actually before EISA was passed ——

Mr. CARTWRIGHT. Dr. DeCicco ——

Mr. DECICCO.—I began questioning that ——

Mr. CARTWRIGHT.—unfortunately, I only have 5 minutes ——

Mr. DECICCO. Okay.

Mr. CARTWRIGHT.—so we can't make short stories long around here.

Mr. DECICCO. Okay. Well, the basic point is I've been thinking and analyzing these issues very deeply for 25 years.

Mr. CARTWRIGHT. And please forgive me for asking this question, but it is something that we do around here. May I ask who has been funding your research?

Mr. DECICCO. Sure. I do have currently a 1-year grant from the American Petroleum Institute on this. They're not the only funder. The work—the core work ——

Mr. CARTWRIGHT. And let me interrupt you for a moment there.

Mr. DECICCO. Sure.

Mr. CARTWRIGHT. Is it a matter of complete indifference to you whether the American Petroleum Institute continues to fund your research into the future?

Mr. DECICCO. Yes, it is.

Mr. CARTWRIGHT. Okay.

Mr. DECICCO. And my position on this issue, in fact, my, you know, position against the RFS predates by a good number of years funding from the American Petroleum Institute.

Mr. CARTWRIGHT. Thank you, sir.

Now, Mr. Grundler, on behalf of the EPA, can you address from an environmental perspective why EPA encourages the production and use of ethanol in biomass-based diesel by including them in the RFS?

Mr. GRUNDLER. Thank you, sir. Our job is to administer the statute that Congress has written. And it is the Congress who has established the goals in the law and set these very ambitious levels of advanced and total renewable fuel. Congress did not establish an ethanol standard. Congress established a total and an advanced standard and a cellulosic standard and a biomass-based diesel standard.

I'd also just like to point out that Congress also directed EPA to utilize lifecycle analysis to understand land-use impacts both direct and indirect from the increased use of biofuels.

Mr. CARTWRIGHT. Very good. Thank you for that, Mr. Grundler.

And, Dr. Tyner, I wanted to give you a chance to weigh in on this. Using the GREET 1 2013 lifecycle analysis, in your view, is that appropriate?

Mr. TYNER. GREET is a model that it—it's called an attributional analysis. It measures the direct emissions. It does not take into account the land-use change emissions. So it is the state-of-the-art for measuring direct emissions.

Mr. CARTWRIGHT. Well, I thank you for that. And again, thank you to all of our witnesses for appearing today.

And I yield back, Mr. Chairman.

Mr. GOSAR. I thank the gentleman. We are still 5–0.

I would like to acknowledge my colleague from Oklahoma, Mr. Russell.

Mr. RUSSELL. Thank you, Mr. Chairman, and thank you to all of the witnesses here today. My questions would be directed initially to Dr. Tyner.

We have heard today that 1.9 billion barrels of equivalent fuel has been produced over the last 10 years with these biofuels, cellulosic or -losic, whatever it might be. When we look at the annual consumption of fuel and barrel production, we consume about 7 billion barrels a year. So in other words, 1.9 billion, while that sounds like an extraordinarily large number, is actually 13 weeks over a decade. So that will be kind of the frame up after a decade we have produced 13 weeks of fuel.

My question, sir, is can you make plastic out of corn?

Mr. TYNER. I'm not a plastic corn scientist, but I have read that it can be done, yes.

Mr. RUSSELL. Okay. Can you make asphalt out of corn?

Mr. TYNER. I do not know.

Mr. RUSSELL. Can you make rubber out of corn?

Mr. TYNER. I do not know.

Mr. RUSSELL. Can you make frames for computer chips out of corn?

Mr. TYNER. I do not know.

Mr. RUSSELL. Okay. How much ethanol-based fuel is used for jet fuel?

Mr. TYNER. None.

Mr. RUSSELL. Oh, I see. Did you know that there is 25 percent less BTUs in ethanol as opposed to petroleum-based fuel?

Mr. TYNER. It's actually 33, sir.

Mr. RUSSELL. Okay. I will take your word on that. But do you also acknowledge that there is a higher smog effect also on the production of ethanol?

Mr. TYNER. My understanding of the analyses that have been done on that is that it depends on the study that was done and time of year it was done, so it's still uncertain, I think.

Mr. RUSSELL. Well, it wasn't uncertain in the 1995 Third Circuit Court of Appeals in the ATI v. the EPA. It might be worth noting that.

Did you know that it takes 50 acres of corn for a gallon of ethanol to be produced?

Mr. TYNER. That's not true.

Mr. RUSSELL. It is not true? Oh, I see. Or 75 gallons of water per gallon of ethanol?

Mr. TYNER. I don't know the water metric.

Mr. RUSSELL. So I guess, you know, for all of that and all of our lifestyle that we enjoy as Americans and, you know, the not taking into account the farm implements, the labor, the water, the use of food supply, the impact on our defense, the fact that we wouldn't have water bottles, cell phones, computers, computer chips, synthetic clothing, roads. I mean I could go on. We could look around this room and identify practically everything that has some basis to our quality of life. Are you still of the firm belief that we need to eliminate petroleum with biofuel?

Mr. TYNER. I never said that we should eliminate petroleum with biofuel, and in fact, it's impossible to eliminate petroleum with biofuel.

Mr. RUSSELL. So now it gets back to one of efficiency and what is best for the environment. Do you think consuming the world's food supply and putting it in a gas tank is good for human beings?

Mr. TYNER. I think that we have an obligation to our children and our grandchildren to reduce greenhouse gases. We have a few

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Mr. RUSSELL. I have an obligation to feed them as well.

Mr. TYNER. And we're doing a good job of it.

Mr. RUSSELL. Yes.

Mr. TYNER. The United States has the most productive agricultural system in the world. American consumers eat for less than

10 percent of their disposable income, the lowest in the world. We're doing a very effective job of reducing both food and fuel.

Mr. RUSSELL. And wouldn't it be great if we could send those corn sacks, a gift from the United States of America, maybe to people who aren't as productive as we are?

Now, you made a bold statement at the beginning of your testimony where you said that all of these biofuels have reduced imports on petroleum. I mean, what basis do you mount that on, 13 weeks of production?

Mr. TYNER. I didn't say how large the increase was, sir. I said that there was a reduction in imports.

Mr. RUSSELL. I see. So shale energy revolution had nothing to do with the reduction in imports?

Mr. TYNER. We've studied shale oil and gas and we've estimated the economic benefit for the country, and it is huge.

Mr. RUSSELL. It is a huge impact ——

Mr. TYNER. Yes, it made—that it's ——

Mr. RUSSELL.—to have shale oil revolution, and it also bolstered our economy. I would suggest to you, sir, that the American way of life, the material good that we do to the entire world, the ability to fight disease, the ability to make pharmaceuticals from petroleum, there are so many good things.

And I just, Mr. Chairman, appreciate, you know, us having this committee hearing today. I think we need to take a realistic look at all of the good that we provide the world, and we are not doing a bad job with the oil and gas industry.

And with that, I yield back.

Mr. GOSAR. I thank the gentleman.

I would like to acknowledge Mr. DeSaulnier from California. You are next.

Mr. DESAULNIER. Thank you, Mr. Chairman.

Dr. Tyner, I am struggling with coming from California and many years ago when I was a Republican I was actually appointed by Governor Wilson to the California Air Resources Board, and as we developed the low-carbon fuel standard, along with our renewable standards, and having four refineries in my district, I have a good relationship with the petroleum industry.

So I am trying to figure out—and having been in many meetings about the low-carbon fuel standard—in California, although we have had issues, particularly with the refining process, we are getting huge investment. We have had lots of venture capitalists come and say they are coming to Berkeley Laboratory. I have been down a few times to look at these synthetic biofuels that they are developing, which they tell me they are for the DOE interventions and support. They are really on the cusp of being able to do some really significant things. This would help to cause some of the criticisms about both this program but low-carbon fuel standards.

So from my perspective, although there have been challenges to this kind of process, both the carrot and the stick, that it is worth continuing to work on, knowing that it is not perfect in the first place.

So, first of all, are you familiar with some of our struggles in California? And by the way, the low-carbon fuel standard was signed into law by a Republican Governor, Governor

Schwarzenegger. So all of our hearings anticipated much of the conversation here today. It is different because we were looking at carbon reductions, which I think at the Air Resources Board when we did our best work, irrespective of whether it was a Republican administration, it was driven on what you got reductions either in traditional pollutants. This is a different approach, but it is sort of the same thing.

So maybe you can help me with trying to understand—we are being pretty successful in California, and this is a process that is not dissimilar, and I am trying to struggle with what are the things we have already lived through that we could sort of apply to the renewable standard nationally?

Mr. TYNER. Well, the California low-carbon fuel standard gives credit for every reduction ——

Mr. DESAULNIER. Right.

Mr. TYNER.—and that's different from the U.S. Renewable Fuel Standard. The Renewable Fuel Standard sets thresholds, 20 percent for corn ethanol, 50 percent for biodiesels, 60 percent for cellulosic biofuels. So if you get 80 percent, you get no more credit. If you get 30 percent for corn, you get no more credit. In California, you get credit for every percentage reduction that your fuel achieves.

So it's, again, a market—more market-oriented system that—and we've worked with the California Air Resources Board. We've worked with them in getting the induced land use change estimates that go into their standard. It's a standard that's being considered by other States around the country, as you probably know. And its advantage is that it does give credit for all the reductions achieved and not just surmounting a threshold.

Mr. DESAULNIER. But it is more market-based ——

Mr. TYNER. It's market-based.

Mr. DESAULNIER.—than doing so ——

Mr. TYNER. Right.

Mr. DESAULNIER. In the context of that it was an evolution, and I am, like all of us, parochial in my own experience, but we did learn from going through these, including the drivability index when we talk to the car manufacturers. We want to be able to pass the standards so that the fuel doesn't constrain or inhibit the sale of automobiles and their drivability.

So it strikes me in the context of this hearing, and again, from my perspective, this is an iterative process, and why wouldn't we continue? And maybe, Mr. Grundler, you could put your two cents' worth in. Probably this law needs to be modified, but how can we learn from other experiences both in States and around the world to make it work better, including for the marketplace?

Mr. GRUNDLER. My office works very, very closely with the California Air Resources Board across a wide variety of different work, trucks, cars, lawnmowers, fuels. We're very familiar with the California low-carbon fuel standard. It is a very different approach in that it is a performance standard-based approach, whereas the Congress chose to decide very specific volume targets every year, which change over time and, as Dr. Tyner mentioned, as these thresholds.

I think we are learning a lot from the California experience, and there have been some bumps along the road, but I think by and large it's been successful for some of the reasons that Dr. Tyner suggested. But it is very different from the law as Congress wrote it, and I'll just leave it at that.

Mr. DESAULNIER. And I will just leave it at this as well. It is not—and I apologize for showing my prejudice over California, not if anybody is watching at home, but it seems to me that this is a process, and I agree with my Republican colleagues that we should probably look at it and revisit it to make it work better, including for the marketplace. But there are other iterations around the country and the world that seem to be working through, so maybe less prescriptive and more market-based but with the ultimate goal being the same.

Thank you, Mr. Chairman.

Mr. GOSAR. I thank the gentleman.

I would like to acknowledge now the gentleman from Florida, Mr. DeSantis.

Mr. DESANTIS. Thank you, Mr. Chairman.

Mr. Grundler, why have the EPA's estimates of cellulosic ethanol production been so poor? I mean, if you go from 2010, 2011, just is way off the base. So why is that?

Mr. GRUNDLER. Thank you for that question. We work very closely with individual producers, individual plants to—having made those estimates over the past few years, and we relied on estimates that we got directly from the producers and what their schedules were and what their production volumes were. And it turned out that those producers and that information that they provided us was too optimistic. We've changed ——

Mr. DESANTIS. Yes. Well, I mean, I think it is difficult to centrally plan this stuff. Now, you revised the definition, and now in 2014 there was 140 million cellulosic biofuel RINs generated. However, Congress had mandated 3 billion gallons, so is there any way that—does EPA believe there is any way that they will be able to generate the billions that are called for?

Mr. GRUNDLER. Not between now and the end of 2016.

Mr. DESANTIS. Yes. No, I think that that is right. Dr. DeCicco, when this was created, environment was one of the main things, and so, you know, it causes problems with food, energy price, all that, but it is, okay, you are going to get environmental benefit. But I think you make an effective case. I mean, it is actually not good for the environment, is it?

Mr. DECICCO. That's correct. The environmental premises of this have turned out to be incorrect.

Mr. DESANTIS. And, Ms. Stone, you point out, I think very correctly, that when you are raising food prices artificially, you know, that has an effect. You know, someone, a blue-collar person in America, they are going to have to stretch their family budget, but you point out some of these people around the world, you know, if food prices go up, I don't know, 5, 10 percent, what does that mean for someone in a really destitute part of the world?

Ms. STONE. It's a significant impact. In sub-Saharan Africa and Asia, people spend, as I said, between 60 and 80 percent of their

income on food, and so even small increases can mean that they don't have enough to feed their families.

And I also want to emphasize what not—what that really means. Children who do not receive food—enough nutritious food before their second birthday can be permanently physically and mentally stunted.

Mr. DESANTIS. And it ——

Ms. STONE. Food is ——

Mr. DESANTIS. Well, Dr. Tyner pointed out, hey, you know, in some of these poor areas, you know, you may have people who are in agriculture and they may benefit from this. And let's just assume that is true. In your experience, what is the number of people that would benefit from producing versus the number of consumers who would be harmed? I mean, it seems like you are harming way, way, way more poor people than you are helping poor farmers, correct?

Ms. STONE. Yes. And in our experience, if prices of inputs go up for these small-holder farmers, then that outweighs any cost benefits they may receive. But also, many of these farmers are sustenance farmers. They eat most of what they grow.

Mr. DESANTIS. Mr. Loris, the price that people pay at the pump is higher as a result of the ethanol mandate, correct?

Mr. LORIS. Yes, that's correct.

Mr. DESANTIS. And so, you know, you are getting hit environmentally, you are getting hit at the grocery store, you are getting hit there. The quality of the gasoline, though, is also, I think, something interesting. What is your opinion on whether the fuel with the ethanol in it is better for car and boat engines than the purer blend?

Mr. LORIS. Well, we've seen obvious failures with some of these smaller engines with boats. You know, if they can bear higher ethanol contents, then that's fine, but we shouldn't try to rush and increase the allowable content of ethanol because of this blend wall or because we're trying to force more biofuels on the market. That's another unintended consequence of this mandate.

Mr. DESANTIS. Yes, I mean as somebody that represents a coastline, you know, our boaters, our fishermen, it hurts their engines. I mean, there is just no doubt about it, so that imposes costs on them if they have to replace it or do repairs.

Look, I think the proper solution is just recognize that this policy was a mistake. Let's repeal the mandate. But here is the thing. Let's repeal all of these energy mandates. We will do solar, oil/gas, ethanol, everything, and let's actually let people compete in the marketplace. Let's give relief to consumers. Let's get out of this business of where people in Washington are picking winners and losers, dictating from on high. We don't do a good job of it. And let's let people make the decisions. But I would be fine getting rid of all of this in the energy market and let's just return to a free market. I think, ultimately, that will be better for consumers. I think it will be ultimately be better for the environment because I think it will allow innovation to really take hold.

And with that, I yield back.

Mr. GOSAR. I thank the gentleman.

I now acknowledge Mr. Walker from North Carolina.

Mr. WALKER. I want to pick up from where Congressman DeSantis left off. I want to come back to you, Mr. Loris, a two-part question. With RFS, it did not lower the fuel prices from 2010 to 2012. I would like for you to explain why you believe that is, and then after 2013 why it has been ineffective as far as reducing oil prices there. Would you mind addressing both of those?

Mr. LORIS. Sure. Well, the fact that ethanol is less energy-dense contributes to higher prices. You have to pay more to drive the same amount effectively, so that's contributing to the higher fuel prices that we pay at the pump.

And, again, this ripples throughout the economy. You know, this is something that, when you pay more at the pump, you can't have disposable income into other parts of the economy. So this has tremendous ripple effects that hits consumers again and again.

Mr. WALKER. Sure. Ms. Stone, again, what we were just talking about as far as poverty and some of the needs, I have worked in some of the refugee camps in Europe and have seen it firsthand. In your testimony you describe some of the more unfamiliar effects of RFS. Could you explain the effects on the efforts to combat hunger? I know you just mentioned that, but could you get a little bit more background?

Ms. STONE. I'm sorry. On the effects to combat—how the RFS is impacting hunger broadly?

Mr. WALKER. Correct.

Ms. STONE. So one of the things that—in addition to food price, as I mentioned earlier, many people—many poor people in the developing world are sustenance farmers, and they rely on land and having secure ownership of that land to grow that food. Biofuels mandates for food-based biofuels incentivize large plantations of one crop of biofuels. And so what happens is these small family farmers are forced off of their land to make way for these large plantations. And so that directly impacts their ability to grow food for themselves and their family but also the community at large.

Mr. WALKER. Would you say that is the same or could you expand a little bit when it comes to clean drinking water?

Ms. STONE. Yes. When it comes to drinking water, it does depend on the type of biofuel feedstock, but what we have found is that expanding biofuel production requires more water, and so less water is available to the community to grow their own food. It also means that there's less available for them to use for other basic needs such as drinking and hygiene.

Mr. WALKER. Mr. DeCicco, I have got a lengthy question here, about four or five lines, but I want to get it out to you before my time expires. In your testimony you state that corn ethanol lifecycle analysis claiming a 40 percent reduction in greenhouse gas emissions compared to gasoline was not accurate. Rather, your research found that corn ethanol results in no significant reduction of emissions. Can you take a minute and elaborate on that? Is that correct?

Mr. DECICCO. That's correct.

Mr. WALKER. Okay.

Mr. DECICCO. Yes, that's correct. The basic principle to look about this correctly is to realize that when biofuels are burned in a car, that has very little effect on how much carbon dioxide comes

out of the tailpipe. It's a—that's just basic chemistry. You burn a liquid fuel, you get about the same amount of CO2 from the tailpipe for unit of useful energy.

My shorthand way to, you know, have people remember that is that if biofuels have a benefit for climate, it's not when they're burned. So you can set that aside, say, okay, the action isn't happening at the car. In oil industry parlance, any potential benefit is not happening downstream.

So you have to ask the question, okay, if there is a net reduction of carbon in the atmosphere, where might that happen? And the only place that can happen is on the land where feedstocks are grown. If a cornfield this year is growing corn that's being used for the food and feed market, it's removing a certain amount of carbon from the air. Now, if you take that corn harvest and next year shift it to make ethanol, other things being equal, that cornfield hasn't pulled more carbon out of the air. So you say where's the benefit?

Mr. WALKER. Yes.

Mr. DECICCO. If there is a benefit, you can only find it with Mr. Tyner's models that try to look at these commodity shifts all around the world that introduces very large uncertainties, but at the other end of that chain, there's also some deforestation.

Mr. WALKER. Sure.

Mr. DECICCO. So the bottom line is there is no direct emissions benefit ——

Mr. WALKER. Okay.

Mr. DECICCO.—within the United States.

Mr. WALKER. Well, it is amazing when common sense and science kind of fuses together like that.

I have one question. Dr. Tyner, do you refute the testimony of Dr. DeCicco, Ms. Stone, Mr. Loris? Do you disagree with that? And I guess if you want to expand on that as my time expires here, even with the right intentions, do you believe these programs are now flawed?

Mr. TYNER. I do disagree with them. I think that there are greenhouse gas emissions savings. I think the land grab and things like that have not been largely attributable to biofuels. I've worked in 15 different developing countries and I've never seen that kind of action in the 15 countries that I've worked in. So I think there are greenhouse gas emissions savings. I think it's about greenhouse gas emissions.

I think there have been food price increases, and that has adversely affected urban consumers, as I said, but there've also been positive implications. We've seen substantial supply response in the developing world, in sub-Saharan Africa and in South America, where poor farmers in those regions are growing more crops and getting higher incomes. There's two sides to that story. There's the urban side and the rural side, and we have to look at both sides.

Mr. GOSAR. I thank the gentleman.

I now acknowledge the gentleman from Georgia, Mr. Carter.

Mr. CARTER. Thank you, Mr. Chairman, and thank all of you for being here today.

I want to change the subject for just a second, or not the subject but kind of the focus. We have been focused on automobiles and we have been focused on the agriculture part of it, but I represent the

coast of Georgia. I represent over 100 miles of coastal area in Georgia. Therefore, as you can imagine, boating is very popular in my district. And as one who grew up in the district, I have spent a lot of my life on the water.

And let me start with you, Mr. Loris, and ask you, you are aware, Mr. Loris, of the unique challenges that ethanol-blended fuels can present to marine engines, particularly overheating and engine failure, correct?

Mr. LORIS. Absolutely.

Mr. CARTER. So you are also aware that while some of the marine engines can—that are on the market today, they can utilize the E10 fuel, but if you get above that, I am not aware of any that would be able to utilize a blend more than E10.

Mr. LORIS. None that I know of.

Mr. CARTER. So there is a risk that is associated, and I hope you all understand where I am coming from. There is really a very serious risk that is associated with using fuels with ethanol in marine engines and particularly outboard engines, which a lot of people have outboard engines even up here, but particularly on the coast of Georgia, particularly when you are talking about being out in the ocean.

And, you know, when you are in a boat and you have engine trouble, it is different than when you are in a car and you have engine trouble. I mean, when you are stranded out on the water and you have engine trouble that, you know, the weather can change suddenly, a number of things could happen. It is a serious, serious problem.

And this is what we are running into here. So this is where my focus is at right now is the impact this—the real impact that this is having on marine engines, and it is having that impact now. We are having overheating. We are having engine failure as a result of having to use this fuel.

Mr. Grundler, would you agree that the EPA is bound by the Renewable Fuel Standards to keep increasing the amount of ethanol that is in our fuel stocks?

Mr. GRUNDLER. I would disagree with that, sir.

Mr. CARTER. You would disagree that the EPA is bound to—do you think that the EPA is going to be attempting to increase the amount?

Mr. GRUNDLER. The job that Congress gave us was to increase the total amount of renewable fuels. The marketplace will choose

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Mr. CARTER. That is not what I asked you. What I asked you was specifically do you think that EPA is going to continue to attempt to increase the amount of ethanol in our fuels?

Mr. GRUNDLER. It is not a question of ethanol. We do not set an ethanol entered, sir.

Mr. CARTER. Then, what is the—that is what we talked about all day is the fact that the Renewable Fuel Standards, that you are going to continually try to increase that. Now, I want you to understand what a dire strait this is going to put marine engines in and particularly people who utilize outboard engines and the impact that this is going to have.

Mr. GRUNDLER. No, I ——

Mr. CARTER. If we continue to breach the blend wall and it is no longer economically feasible for producers to use the RINs that you referred to earlier today, earlier in this testimony, then we are not going to have any more ethanol-free fuel, and boaters are just going to simply be out of luck here. They are not going to be able to use their outboard engines, and if they do, they are going to be in danger of being broke down out on the water. This is a serious, serious threat.

So this is more than just the economic impact. Obviously, we all understand the economic impact this is going to have it. But this is putting people's safety at risk here.

Mr. GRUNDLER. I'm very sensitive to those concerns, sir. I come from Michigan. We do a lot of boating. I'm a boater. I'm aware of the risks of using high ethanol blends in outboard motors. That's not permitted. All boat engines today are designed and calibrated to use E10. And as we consider these standards, we do look at what the marine environment needs and what the marine market needs for lower ethanol blends.

Mr. CARTER. Well, you know, as you move forward, I hope that you will keep in mind that you have an impact. When you increase this, you impact the marketplace. I mean, the producers are not going to continue to produce the ethanol-free fuels if there is not a market for it, if they are being required to produce the blended fuels. And this is going to have a big impact on boaters all across the country, whether it be in Michigan or especially whether it be on the coast of Georgia.

And this is of concern to me because, again, I reiterate, it is different when you get broke down in a boat than when you get broke down in a car.

Mr. GRUNDLER. I ——

Mr. CARTER. It is a big, big difference.

Mr. GRUNDLER. I completely get that. I've been stuck out in the middle of Lake Michigan.

Mr. CARTER. Well, and you ought to be stuck out in the middle of the Atlantic Ocean.

Mr. GRUNDLER. I've been there, too, sir, but not stuck fortunately. But I want to ——

Mr. CARTER. Well, I have been, and I can tell you, it is not a good feeling.

Mr. GRUNDLER. Thank goodness for the Coast Guard.

But what I'd like to just point out is that the marketplace does have choices, and obligated parties can choose to ——

Mr. CARTER. But ——

Mr. GRUNDLER.—blend biodiesel rather than ——

Mr. CARTER.—with all due respect, Mr. Grundler, you have an impact on it. The EPA and your rules and your regulations have a big impact on it, and I hope you keep that in consideration.

And, Mr. Chairman, I appreciate your indulgence and I yield back.

Mr. GOSAR. I think it would only benefit you if you ——

Mr. GRUNDLER. Thank you for your comments.

Mr. GOSAR.—if you worked in the Bermuda Triangle. That might be trouble for you.

I would like to acknowledge the gentleman from Georgia, Mr. Hice.

Mr. HICE. Thank you, Mr. Chairman, and I appreciate this hearing.

Mr. Grundler, I would like to continue with you in a similar train of thought dealing with the likely breach of the blend wall. As you know, the EPA has approved E15 for vehicle manufacturers from 2001 to the present. However, most of the manufacturers are clear that they do not recommend E15 for the vast majority of vehicles. In fact, I have got a chart that I wanted to see if we could put up here that indicates just the number of vehicles that cannot use E15 versus those that can.

[Slide.]

Mr. HICE. And as you can see, it is just a handful, literally a handful of vehicles that could utilize E15. Certainly no vehicle that I have according to this chart could utilize E15.

You also testified in front of the Senate Environment and Public Works Committee in 2013 that the blend wall had been reached and that, according to your testimony, "It is not feasible for the system to absorb that much ethanol." Well, this fear certainly has become true now with the 2016 rule breaching that blend wall. And of course that raises concern.

But here is the thing that I want to ask you specifically. The 2007 Energy Independence and Security does allow the EPA to have authority to waive the RFS requirements if—and this is a direct quote from the statute—"if implementation of a requirement would severely harm the economy or environment of a State, region, or the United States."

Now, based on the chart that we just looked at and all these other things that have been discussed, how can it not be recognized that the 2016 rule is going to have a negative impact on the economy?

Mr. GRUNDLER. We have exercised the tools that Congress provided to adjust the numbers in the law substantially downward but only to the extent that we thought was necessary. We put a lot of effort in—which is all described in the final rule. So while the final standards we believe do go above this blend wall, the marketplace will have choices on how to achieve those standards. We think they are achievable. We think we've done it in a responsible way.

Mr. HICE. Well, according to the chart that we put up, you are going to create an enormous economic problem for the vast majority of vehicle owners in this country.

Let me just ask you, Mr. Loris, a similar question just to get your input. What would you consider would be the economic impact of breaching the blend wall?

Mr. LORIS. It'll be significant. As we've seen in the past when we have a drought, too, you know, if these RIN prices are driven up, that just exacerbates all of the cost we talked about throughout this hearing in terms of higher prices. So not only will gas prices be more expensive, but you'll be paying more as these RIN prices increase, which we've seen in the past. And it speaks to the need to revise these standards and mandates down to zero.

Getting rid of just the corn part of the mandate is a bad idea, too, because you're getting rid of the most economically competitive

part of the mandate. As Dr. Tyner pointed out, this is the most mature part of the industry. So if we just leave it up to the mandate for cellulosic ethanol, that's the stuff that has difficulty becoming commercially viable and is going to be very prohibitive in terms of costs to meet any potential targets that the EPA sets.

Mr. HICE. So say on a scale of 1 to 10, 10 being extremely severe, what kind of impact would you rate the breaching of the blend wall?

Mr. LORIS. I would say it was as high as a 10. You know, you never know what the market will bear. You know, and fortunately, we've been blessed with the shale revolution to have lower gas prices, so that's tampered some of the effects of this—the adverse effects of this mandate.

That said, if we continue to breach the blend wall, if refiners are fined for not meeting any type of cellulosic requirements, it gets worse and worse as the targets go higher and higher.

Mr. HICE. Back to you, Mr. Grundler. You testified last month at the Senate Environment and Public Works Committee that you indicated that there may be a shift of the point of obligation from the refiner to the blender. Do you intended to address this as part of the 2017 rule?

Mr. GRUNDLER. I believe you're referring to my boss's testimony in front of the Senate. We have received that as part of our comments to our—the rule we just finalized. People—a number of people have come in and suggested that we consider that. We decided that that is outside the scope of these annual rulemakings. We're considering it, but we believe such a major change in the regulation and the law should not be part of this annual rulemaking process.

Mr. HICE. So you have no intention of addressing that question at all?

Mr. GRUNDLER. We are talking to people. We are analyzing the question. If we were to address it, it would be not through an annual RBO standard-setting process.

Mr. HICE. Thank you, Mr. Chairman.

Mr. GOSAR. I thank the gentleman.

I now recognize the gentleman from Vermont, Mr. Welch.

Mr. WELCH. Thank you very much, Mr. Chairman.

I am delighted that you are having this hearing, and I really appreciate you waving me on. I have listened to the testimony that I was here for, which is quite a bit, read your comments, and I want to thank the witnesses for focusing on this. I just want to make a couple of comments.

You know, I think that the ethanol situation has been good for the corn farmers who produce ethanol, and I like farmers. I come from a dairy State. But it is an astonishing development where you had this market that was created by A) a tax subsidy, 54 cents a gallon. That has since been repealed; B) essentially, a tariff barrier that kept out competition from Brazil worth 45 cents a gallon; and then finally, a very unusual thing, a requirement by government that consumers purchase this product, the mandate.

And it is a bit of a head-scratcher for me and developed with the best of intentions to try to use our agricultural sector presumably to cut down on greenhouse gas emissions. My view is that after we

have seen this operate as long as we have, it is time to acknowledge it is a well-intended flop.

Environmentally, I think the evidence is pretty compelling that at least with respect to the U.S.—I don't know about world markets, Dr. Tyner, and all the modeling that you are talking about. It is really complicated, so it makes it tough to be compelling. But there is a lot of water inputs that go into it, there is a lot of energy inputs that go into it, and at the end of the day, the best evidence I have seen it that there is more greenhouse gas that is created rather than saved.

And then, secondly, this is good if you are a corn farmer. It is not good if you are a dairy farmer. You are paying higher feed costs. And one of the things that brought my attention to this was when I was traveling around northern Vermont where we have a lot of dairy farmers, and they were getting hammered a few years ago with low dairy prices and high grain prices. And it is just beyond, I think, comprehension to argue that with 40 percent of the corn product is going into ethanol that the mandate doesn't have an impact on prices, whatever the price of corn is, and that fluctuates. It was up to $8. It is down quite a bit from that now.

And then the next thing—so you have got the environmental issue that has not been achieved, the goal, you have got the impact on farmers. You have anybody who buys food, whether it is going to a grocery store or going to a chain restaurant, those food costs are a good deal higher, and studies I have seen say that our chains spend about $18,000 to $28,000 more per unit. And that is real money for the consumers.

And then finally, Mr. Carter was talking about the small engines, and it is wrecking our chainsaws, and I am kind of upset about that because I had a pretty good chainsaw until ethanol wrecked it.

And so, you know, I was hearing from my farmers and it got me concerned, I was hearing from our consumers, it got me concerned, and when they wrecked my chainsaw, I had to get involved.

[Laughter.]

Mr. WELCH. And here I am. So my hope is that we will be able to build on the foundation of the work of this committee, and I think Congress should have a debate on this. You know, there is the Goodlatte-Womack-Welch-Costa bill that would repeal the corn-based ethanol mandate. And let's have a debate and see what the will of the House is.

So I thank all the witnesses. This was tremendous testimony. And those consequences on food-insecure countries, I am so glad you are bringing attention to that. It is a couple of billion dollars in Guatemala. They don't have money to throw around. So that is a tough aspect here, too.

So would this be one of those strange convergences of Democrats and Republicans, Mr. Gosar, it takes you to bring us together on?

Mr. GOSAR. You know what, whatever harmonics it takes.

I have just got one question for you. And what kind of chainsaw do you have?

Mr. WELCH. I have a Jonsered.

Mr. GOSAR. I was just going to say that. Okay.

Mr. WELCH. Yes.

Mr. GOSAR. Well, I am going to go last.

So, Mr. Grundler, after 2022 the RFS mandates set by Congress and the EISA stop increasing and discretion of the program with few limitations is handed over to EPA. We are only now a few years away from this. What plans does the Agency have to deal with this, and what has EPA come up with to manage this?

Mr. GRUNDLER. Sir, 2022 is quite a ways off.

Mr. GOSAR. Whoa, not really.

Mr. GRUNDLER. We've had a hard enough time setting standards, you know, one year in the future. Setting them in—figuring out what the world is going to look like in 2022 is pretty challenging. So the honest answer is we have no plans on what the standard should look like post-2022.

I would quibble with your characterization, though, that the Congress didn't provide us any direction on how to do so. You did. There's a long list of factors, as well as deadlines associated with when we need to set those standards.

Mr. GOSAR. Well, I find it interesting that, you know, in other committee hearings we hear about this forecasting 5, 10 years out, and I am a businessman, I am a dentist impersonating a politician, so, you know, I hear this forecasting, and yet I turned to your testimony and yet we are not forecasting. So that is kind of odd to me.

Dr. DeCicco, you are not the average person, are you?

Mr. DECICCO. I'll leave that to others to judge.

Mr. GOSAR. No, no, no, no, no. Can you tell me a little bit—you were a senior fellow for what?

Mr. DECICCO. Well, I was a senior fellow for automotive strategies at the Environmental Defense Fund from 2001 through 2009.

Mr. GOSAR. So you are an actual scientist?

Mr. DECICCO. I am, yes.

Mr. GOSAR. Dr. Tyner, are you a scientist?

Mr. TYNER. I'm an economist.

Mr. GOSAR. So we are refereeing a match here on science that you are not the referee, he is, right?

Mr. TYNER. It's not a referee on science, sir, it's a referee on market-mediated changes ——

Mr. GOSAR. No, no, no, no, no, no, no, because you are talking about models, and in the science world we take models and we compare them against facts to see—I mean, this is in my ballpark now, too. So we actually look at these modeling for outcomes, but then we come back to correct them based upon factual bases. Is that not true?

Mr. TYNER. That's correct, and we do that all the time.

Mr. GOSAR. Well, I think economics—and I want to come back to the actual facts about what is happening on the ground, Dr. DeCicco.

So when you come to this point, you have seen it from the very infancy of standards all the way to today, so you are very well-rounded. You don't have a bias one way or another. You have actually pinpointed this based on the facts, right?

Mr. DECICCO. That's correct.

Mr. GOSAR. So let me ask you another question. You know, I have seen some rumors. I mean, we have kind of hedged it here. When we have combustion of these alternative fuels, is there any-

thing that occurs that is alarming, that there is something else that it goes into combination that is a byproduct?

Mr. DECICCO. Well, combustion produces a variety of pollutants that we need to clean up. There is traditional pollutants or ones that cause smog, create fine particles, and EPA has done really an outstanding job over the years of tightening the standards, you know, down so that those pollutants are with the best vehicles now running on reformulated gasoline, have standards many orders of magnitude of what cars were, you know, when we were kids.

Mr. GOSAR. Well, I understand, but, you know, when we look at the combustion of these alternative fuels, some of the chemistry is not exactly good, is it?

Mr. DECICCO. Well, it's—let me put it this way. It's more challenging. You take a fuel like ethanol, it has some combustion benefits. It is a very high octane fuel, but it doesn't—it has less energy per gallon ——

Mr. GOSAR. Right.

Mr. DECICCO.—so that's another issue. Environmentally speaking, there's no compelling reason, no reason to force an alternative fuel such as ethanol into the market to burn instead of gasoline. Reformulated gasoline today is an extremely clean fuel at the tailpipe. So, yes, different fuels have different properties, but I think the main point is that there's no compelling environmental reason to put ethanol at the point of combustion. And again, there's no CO2 benefit at the point of combustion. So I'll leave it at that.

Mr. GOSAR. Sounds good. Well, I am going to summarize. It is important for Congress and the administration to use a commonsense approach when dealing with these biofuels. Congress shouldn't be in the business of helping some industries at the expense of others. Causing unnecessary harm to domestic shipping, agriculture, food production, and other industries that are affected by these regulations defies common sense. The RFS ultimately hurts American consumers by increasing prices and decreasing the quality of fuel used by American consumers and by the majority of gas-powered equipment across America.

Ultimately, I am an adamant supporter of free market principles, and I am philosophically opposed to picking winners and losers in the American energy sectors. I will continue to fight for the repeal of RFS and for the production of market-based solutions in relation to biofuels.

I also have biofuels from algae in my world in Yuma, believe it or not.

Mr. Grundler, one last question. You understand why so many people have a negative image of the EPA, and I am going to leave you with this. Trust is a series of promises kept. Tell me why we should trust the EPA when we look at Flint, when we look at Durango, Colorado? Over and over again we see distrust because we see an overreaching and overbearing agency. So go back and look in the mirror, and I hope that you will come up with a whole different attitude because I am looking forward to seeing your boss tomorrow.

With that, with no further conversation or questions, I would like to thank the witnesses for taking time today to appear before us.

If there is no further business, without objection, the subcommittee stands adjourned.

[Whereupon, at 3:48 p.m., the subcommittees were adjourned.]

APPENDIX

MATERIAL SUBMITTED FOR THE HEARING RECORD

Statement for the record from Rep. Rod Blum of Iowa

I wish to thank the House Committee on Oversight and Government Reform, jointly held on the Subcommittee on Interior and the Subcommittee on Health Care, Benefits and Administrative Rules, especially Chairman Lummis, Chairman Jordan, Ranking Member Lawrence, and Ranking Member Cartwright, for holding this important hearing today on "Examining the Renewable Fuel Standard." The Renewable Fuel Standard (RFS) is an important part of the "all of the above" approach to U.S. energy policy and is particularly important to my constituents back in the First District of Iowa.

Biofuels, especially traditional ethanol, cellulosic ethanol, and biodiesel, are a growing part of the domestic U.S. energy supply. Due to important policies like the RFS to promote access and choice for consumers – all while decreasing demand for imported fuel sources and creating jobs, these industries are beginning to compete with the traditional petroleum monopoly here in the U.S. and around the world.

Last year, the U.S. consumed 20.5 billion gallons of biofuels, which was blended with traditional gasoline and diesel. Without policies like the RFS, these producers of biofuels would be unable to compete against the established infrastructure of traditional petroleum. Consumers, whom ultimately set the market, would have little choice on where to purchase fuel for their vehicles. Additionally, the use of biofuels saves consumers money. Various mixtures available for public purchase can lead to savings at the pump and more disposable income in their wallets.

Renewable fuels are a domestic industry, frequently using domestic feedstocks, allowing production to take place completely within the U.S. By reducing reliance on foreign oil, we are utilizing U.S. domestic resources and moving closer to energy independence. The investments and profits here are flowing to U.S. workers and farmers rather than foreign governments. In addition to our domestic market, the U.S. exports approximately 20 million barrels of biofuels a year – quickly becoming the leader in biofuels production, thanks to policies like the RFS.

The biofuels industry directly supports 87,000 jobs in the U.S. and I see the impact of this growing industry as I travel throughout my District and around Iowa. Investments continue to be made in new technology, new infrastructure, and new job creation through the Midwest. It would be unfair to those invested in the industry, either through employment or capital, to suddenly change course, given their reliance in their decision on policies like the RFS.

The RFS is a driver of economic growth in rural areas of the country, providing additional markets for farmers, developing infrastructure, and creating high paying jobs. As a domestic energy source, biofuels move the U.S. forward on energy independence and reduce consumption of foreign oil, all while U.S. producers export to markets around the globe. Policies like the RFS encourage further investment, innovation, and development of these nascent industries and should be maintained until Congress can accurately determine the success or failure of our previous legislation.

I have the privilege of witnessing the current success up close in my district and support such policies which will lead to continued growth in my District. I thank the Subcommittees for their

interest in the matter and I urge my colleagues to consider the importance of the RFS as a key part of our domestic energy policy.

To: Christopher Grundler
Director, Office of Transportation and Air Quality
U.S. Environmental Protection Agency

From: Representative Cynthia Lummis
Chairman
Subcommittee on the Interior

Hearing: Subcommittee on the Interior Hearing titled, "Examining the Renewable Fuel Standard"

Date: March 16, 2016

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1. This past November was one of the few times in the history of the RFS program that a deadline was met when EPA released the numbers for 2016. However, the Agency was still extremely late in producing its 2014 and 2015 numbers. Why has the EPA repeatedly missed its statutory deadlines for releasing the final rules for blending requirements?

Response: The RFS program is complex, and this complexity has only grown as the statute's volume targets have increased. The magnitude of the statutory volumes for 2014 introduced new and challenging issues regarding RFS program implementation. We laid out those challenges in our November 29, 2013 proposal for the 2014 standards, which generated a substantial amount of input and dialogue. The process of responding to public comments and addressing the issues raised caused such a delay that by the time the proposal could be finalized, a re-proposal was appropriate.

2. Last November, EPA released the numbers for 2014, 2015, and 2016 at the same time. Will EPA continue to use this same methodology of releasing multiple years' requirements simultaneously?

Response: In the final rulemaking that the EPA issued on November 30, 2015, establishing the standards for 2014, 2015, and 2016, EPA set the standards effectively at what the market produced for 2014 and 2015, due to the fact that the EPA had not met the statutory deadlines for those years. This resulted in 3 years being finalized simultaneously. We do not anticipate this situation (i.e., needing to issue standards for multiple years due to missed years) will arise again, since it is our intention to stay on the statutory schedule in issuing subsequent annual rules establishing renewable volume obligations.

3. When does EPA plan to issue a final rule for the 2017 renewable fuel volumes?

Response: We are on track to issue the final rule for the 2017 standards (and the 2018 biomass-based diesel volume) by November 30, 2016.

4. What needs to happen for EPA to follow the law and release its final rules on time? Are there any legislative fixes that Congress can provide to help the EPA better administer the RFS and achieve the original goals of the program as intended by Congress?

Response: It is our intention to meet the statutory deadlines for issuing the annual volume standards under the RFS program for 2017 and future years.

5. When the EPA repeatedly misses its deadlines for releasing final volumes for the RFS and issues retroactive mandates as it has several times since the creation of the program, how can the regulated community plan their compliance and deal with this uncertainty?

Response: As described in the 2010 final rule which created the current RFS program, the fact that EPA has missed a statutory deadline for setting the annual standards does not excuse the EPA from the obligation to set standards. However, in such cases, the EPA has a responsibility to consider the capabilities of the market given the tardiness of the standards, and to adjust the applicable standards accordingly if appropriate. In 2010 and 2013, for instance, our assessment of the market led us to conclude that the statutory volume targets for advanced biofuel and total renewable fuel could be achieved despite the fact that the statutory deadlines had been missed. For 2014 and 2015, however, our assessment of the market led us to conclude that the statutory volume targets for these fuel types could not be achieved, and we adjusted them appropriately by using the waiver authority provided in the law. The volume requirements for 2014 for all fuel types were based on a determination of what the market actually achieved in the absence of RFS standards, not what it might have achieved had the standards been in place earlier. This was also largely the case for 2015, but the volume requirement was based in part on a projection of what the market would accomplish on its own in the few months of 2015 for which data were not available at the time of the rulemaking.

6. Why do you believe it has been so difficult for advanced and cellulosic biofuels to achieve success even though there has been a mandate to aid their development for about 10 years now?

Response: There are always significant challenges in developing a new technology and bringing it to market, and this has certainly been the case for advanced and cellulosic biofuels. There are a number of factors that have affected the availability of advanced and cellulosic biofuels in the United States, including the need for advanced research and development to make these fuels economical, high capital costs for construction of production facilities (at a time when the economy was slow and investment dollars in short supply), the availability of affordable feedstocks and the need for new businesses and business relationships to be formed to bring them to market, and in some cases insufficient infrastructure for increased distribution and use of these fuels. For cellulosic biofuels in particular, the primary challenge has been the development of technology that can reliably and economically produce cellulosic biofuel at commercial scale. While the RFS program has incentivized the investment of significant resources in the development of cellulosic biofuel production technologies from both government and private entities, production of cellulosic biofuel has remained far below the ambitious targets established by Congress in the Energy Independence and Security Act (EISA).

7. Why does the EPA continue to miss the cellulosic volumes by such large margins? Is the EPA taking any steps to fix its inflated estimates that it continues to make year after year?

Response: Projecting the performance of a nascent industry is inherently difficult. In the early years of the RFS program, very few facilities were in a position to potentially produce cellulosic biofuel, and these were mainly technology demonstration facilities, not commercial scale production facilities. As a result, unexpected delays or difficulties by a small number of facilities, or even a single production facility, had a significant impact on the accuracy of the EPA's projections. The EPA has continued to adjust the methodology used to project cellulosic biofuel production to better account for the uncertainties associated with the production of cellulosic biofuel. In recent years, as the market has begun to mature, the accuracy of our cellulosic biofuel production projections has significantly improved.

8. In the final rules released last November, it appears that EPA triggers its reset authority for advanced biofuels and cellulosic biofuels. What does EPA plan to do with its reset authority? Will it take into consideration that cellulosic and advanced biofuels have not taken off as successfully as conventional biofuel has?

9. If you do plan to use your reset authority, do you intend to adjust the total renewable fuel category as well?

Response (8-9): While the final volumes for 2016 have met the requirements to trigger the reset provisions for the advanced biofuel volumes in addition to the cellulosic biofuel volumes, they did not yet meet the requirements to trigger the reset provisions for the total renewable fuel volumes. We believe it is best for program implementation to conduct a reset rulemaking for all the standards simultaneously, which would mean after the total renewable fuel volume reset requirements have been met. Nevertheless, we have begun preliminary internal discussions on development of a reset rule.

10. What does the Agency intend to do should the reset authority for ethanol be triggered?

Response: The statutory requirement to "reset" the volumes under certain conditions applies to the four categories of renewable fuel specified in the statute: cellulosic biofuel, biomass-based diesel, advanced biofuel, and total renewable fuel. There is no explicit standard, per se, for ethanol or conventional biofuel, and thus neither are subject to the statutory reset provisions. As noted above, we are in the preliminary stages of discussing the reset provisions as established in the law.

11. The Energy Independence and Security Act of 2007 (EISA) requires that EPA conduct a study to determine if the RFS has an adverse impact on air quality. The study was supposed to be completed 18 months after the law's enactment and regulations were required to be issued 3 years later in 2010, yet EPA has not completed either of these. Why has EPA delayed so long in completing this mandatory study? Does EPA plan to

finish this study in the near future and issue regulations? If so, when will it be concluded?

12. If this study finds an adverse impact on air quality, how does EPA believe that will impact the future of the RFS program?

Response (11-12): EPA has taken important initial steps in the development of the statute's required anti-backsliding study. For example, the EPA collaborated with the Department of Energy and the Coordinating Research Council to complete the "EPAct Study," looking at the impact of fuel parameters on emissions from vehicles. The EPAct Study is foundational for the anti-backsliding study, allowing the EPA to model emission effects of any real-world gasoline and therefore characterize emissions impacts specifically related to increases in renewable fuels. Although the EPAct study is now complete, other long lead time elements such as emissions modeling and air quality modeling need to be completed before the anti-backsliding study can be completed.

13. According to recent media reports, there have been cases where people have been convicted for selling millions of dollars in RINs for biofuels that were never produced. What oversight does EPA have in place to prevent this kind of fraud from occurring? How often does EPA find cases of RIN fraud?

Response: The RFS program is structured so that each party involved in RIN generation, RIN distribution and RIN use is obligated to help ensure that the RINs they transfer are valid – incorporating the eyes and ears of most RFS stakeholders to help monitor the program. We have also created a third-party Quality Assurance Program (QAP) that gives private industry a tool to monitor and help ensure the fuel is compliant. Importantly, we have also developed and implemented a sophisticated database system to track and monitor renewable fuel credits. Finally, the EPA, along with DOJ and other law enforcement partners, is aggressively pursuing both civil and criminal enforcement of those individuals that have fraudulently generated RINs in this program and are holding them accountable to the full extent of the law. Over 150 million fraudulent RINs have been replaced. To date, thirteen individual defendants have been sentenced to serve over 97 years of incarceration for their roles in criminal schemes involving RINs and related tax credits. In many cases, the sentencing courts have also issued forfeiture and restitution orders directing convicted defendants to give up criminally obtained assets and to pay back what they stole. The orders pertain to tens of millions of dollars in fraud loss and the restitution orders offer victims of RFS fraud a path to recover some of what these criminals took. Unfortunately, as is often the case in large fraud schemes, the criminals dissipated much of what they took during the course of their crimes. I cannot emphasize enough how seriously I personally, and my office in general, take our compliance assurance responsibilities to deliver the environmental protection the public expects and to create the level playing field the industry deserves.

14. Would higher octane levels in gasoline help auto companies meet aggressive fuel economy requirements regulated by EPA, the National Highway Traffic Safety Administration, and the California Air Resources Board (CARB)?

Response: The current light-duty vehicle greenhouse gas and CAFE standards, which cover

and extend through model year 2025 cars and trucks, were developed assuming current fuel octane levels. These standards can be achieved using existing vehicle and engine technologies, with no need for any change to gasoline parameters. If vehicle manufacturers were to develop vehicles with engines with higher compression ratios that depend on the availability of higher octane blend, that may provide another path towards achieving greenhouse gas reductions and increased fuel economy.

15. Has EPA estimated the cost, assuming lowest cost path to raise octane, to raise the octane level on a per-gallon basis?

Response: We are aware of various industry studies looking at this general topic, but EPA has not yet evaluated the issue in detail.

16. Does EPA have authority to raise octane levels in gasoline?

Response: The EPA has general authority under section 211(c) of the Clean Air Act to set standards for fuel and fuel additives provided certain requirements can be met. Whether the EPA has authority to set octane levels in gasoline would depend on the basis and rationale for the regulation. The EPA does not currently regulate octane levels.

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