

**EXAMINING TWO GAO REPORTS REGARDING THE
RENEWABLE FUEL STANDARD**

HEARING

BEFORE THE

SUBCOMMITTEE ON
REGULATORY AFFAIRS AND FEDERAL
MANAGEMENT

OF THE

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HOMELAND SECURITY AND
GOVERNMENTAL AFFAIRS
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EXAMINING TWO GAO REPORTS REGARDING THE RENEWABLE FUEL STANDARD

THURSDAY, DECEMBER 1, 2016

U.S. SENATE,
SUBCOMMITTEE ON REGULATORY,
AFFAIRS AND FEDERAL MANAGEMENT,
OF THE COMMITTEE ON HOMELAND SECURITY
AND GOVERNMENTAL AFFAIRS,
Washington, DC.

The Committee met, pursuant to notice, at 2:30 p.m., in room 342, Dirksen Senate Office Building, Hon. James Lankford, Chairman of the Subcommittee, presiding.

Present: Senators Lankford, Ernst, Sasse, Heitkamp, and Tester.

OPENING STATEMENT OF SENATOR LANKFORD

Senator LANKFORD. Good afternoon, everyone.

I want to welcome everyone to today's Subcommittee hearing titled Examining Two GAO Reports Regarding the Renewable Fuel Standards (RFS). Thanks for being here.

Today is this Subcommittee's second hearing on the Renewable Fuel Standard and my fourth hearing total on this topic since being elected to Congress, committed to continuing the oversight of the RFS until we find a solution to what has become this deeply flawed program.

In 2005, Congress established the RFS with the goals of reducing our Nation's dependence on foreign oil and lowering greenhouse gas emissions by mandating that biofuels be blended with domestic transportation fuel in increasing volumes until the year 2022. After that time, the Environmental Protection Agency (EPA) will have wide latitude to decide the volume of biofuels that must be blended into the gasoline supply.

However, the situation has changed pretty dramatically since the RFS enactment in 2005, and in subsequent 2007 revision. Demand for oil in the transportation sector is lower than originally predicted, in part due to heightened fuel economy standards and sluggish economic growth. Further, given the substantially increased domestic oil production resulting from the shale oil boom, the United States also imports much less oil than initially forecasted. For instance, in 2005 and 2007, we were importing 60 percent of our oil; now it is 27 percent.

Through a series of hearings, I have worked to determine the structure and viability of the RFS to achieve its goals. Specifically, I have tried to understand the RFS through the eyes of the EPA and appreciate how difficult it is for the agency to administer the

program. Congress created the unworkable RFS formula. The EPA is left trying to make it work anyway.

The EPA is required to release the final volumes of biofuels to be blended with the gasoline supply by November 30 of the preceding year, to allow industry participants and other stakeholders to comply and plan for the future. Between 2009 and 2015, EPA failed to meet this November 30 deadline and only finally released final mandated volumes for 2014 through 2016, on November 30, 2015, one year late for the 2015 volumes and two years late for the 2014 final volumes.

I would like to recognize the EPA has released its 2017 volumes on November 23, meeting the statutory deadline, in fact, beating it by all of seven days. You are making up ground.

Recognizing the difficulties the EPA faces with the RFS, on April 6, 2015, I asked the Government Accountability Office (GAO) to examine the viability of the RFS and determine whether the program will be able to meet its goals in the future. It has taken GAO approximately 19 months to conduct a thorough, independent analysis of the RFS and finalize its conclusions. In order to reach its conclusions, GAO, in coordination with the National Academy of Sciences, convened a group of stakeholder experts from industry, academia, and the nonprofit sector to produce two reports on the RFS, both of which were released Monday, November 28, 2016.

GAO's first report determined that advanced biofuel production is unlikely to meet the RFS's increasing production targets. GAO noted that advanced biofuels are still too expensive for stakeholders to produce it at necessary levels to meet the RFS increasing targets through 2022, even with government-funded research and development (R&D) and mandated subsidies.

Despite the Federal Government spending of \$1.1 billion between fiscal years (FY) 2013 and 2015, for advanced biofuel research and development, GAO determined that advanced biofuel targets are unattainable.

In its second report, GAO concluded that the RFS is unlikely to meet its goal of reducing greenhouse gas emissions. The production of advanced biofuels, which should reduce greenhouse gas emissions, will remain too limited to meet the program's greenhouse gas reduction targets. For example, in 2015, cellulosic biofuel, an advanced biofuel category, was produced at a meager 140 million gallons, less than five percent of the statutory target of three billion gallons.

This hearing will give GAO the opportunity to present its findings on the RFS from these two reports and the EPA to comment on the findings. With the release of the GAO reports, we have an independent government auditor's findings that confirm the stances many in Congress, including myself, have come to hold, that the RFS is not sustainable and will not meet its intended goals.

This program yields few benefits but it inflicts substantial cost on consumers. Rather than continuing with an unwieldy program which consistently fails to meet its targets and goals, it is time for Congress, the next administration, and the American public to do away with the RFS.

Here is my comparison. Last year, Congress looked again at education. Fifteen years ago, we created No Child Left Behind, in a very eager effort to do what is best for our kids in the future. There was a whole series of mandates that were put in place with No Child Left Behind. Fifteen years later, Congress looked at it again and said those mandates were the wrong way to go, and we fixed it. We came back in wide bipartisan majorities, after extensive research and examination, and said it is time that we do away with these mandates and do education a different way. It is not that we do not like education; we do. We just went a wrong direction with No Child Left Behind and we fixed it.

It is not that any of us are opposed to ethanol. It is a good fuel source. It is a good octane booster. It is in the fuel supply right now. It is not that I meet anyone that is opposed to ethanol. It is the series of mandates that were put in place and volume requirements that are not sustainable.

I am delighted to have the EPA's Janet McCabe and GAO's Frank Rusco here today as witnesses to engage in a productive conversation on the RFS.

I look forward to continuing this Subcommittee's oversight of the RFS with my colleagues and our witnesses today.

I will recognize the Ranking Member, Heidi Heitkamp, for her opening statement when she arrives. She is running a little bit behind, but as we always say, the lady is never late. So when she gets here I will allow her to be able to do her opening statements.

With that, let me swear in our witnesses.

If you would please stand.

Do you swear the testimony that you are about to give before this Subcommittee will be the truth, the whole truth, and nothing but the truth, so help you, God?

Ms. MCCABE. I do.

Mr. RUSCO. I do.

Senator LANKFORD. Thank you. Let the record reflect the witnesses answered in the affirmative. You may be seated.

Let me do a quick introduction for both of you, and then when Senator Heitkamp arrives, even if it is after your testimony, I am going to have her do an opening statement as well.

Frank Rusco is the Director of the Government Accountability Office's Natural Resources and Environment team, leading work on a broad spectrum of energy issues. Mr. Rusco holds both a master's degree and a Ph.D. in economics from the University of Washington in Seattle.

Janet McCabe is the Acting Assistant Administrator for the Environmental Protection Agency's Office of Air and Radiation (OAR), having previously served in the OAR's Principal Deputy to the Assistant Administrator. Ms. McCabe was also the Executive Director of Improving Kids' Environment, Inc., in Indianapolis, Indiana, and from 1993 to 2005, held leadership positions in the Indiana Department of Environmental Management's Office of Air Quality. Ms. McCabe served as Assistant Attorney General for environmental protection in Massachusetts and graduated from Harvard College in 1980 and Harvard Law School in 1983.

Thank you, both, for being here as well, and with that I would recognize the Ranking Member for opening statements.

OPENING STATEMENT OF SENATOR HEITKAMP

Senator HEITKAMP. Thank you, Mr. Chairman, and again my great apologies for being a little late. It has been a crazy day.

First off, I want to thank both of our witnesses for attending this hearing. This actually follows on our hearing last June on the RFS. In that hearing, we discussed, at length, issues we saw with the EPA's management of the program and the statute, and I am glad EPA took our words to heart, and that just last week the RFS is back on track and hit the levels required by law for calendar year 2017, for most fuels, and they even increased the volumes for biofuels and advanced biofuels. So thank you, Ms. McCabe, for your good work on that. We were grateful. Wish it would have come a little earlier, but we will take it when we can get it.

Of course, EPA did not meet the statutory levels for some advanced biofuels, allegedly because of the lack of production, and we want to hear more about that, and that really is what generated this discussion today.

Senator Ernst and I noted last June that such delays in setting up the program and in setting annual volume obligations really did lead to stalled investments in advanced biofuels, and so had we had more certainty in the marketplace we could have actually, I think, seen the kind of investment that it would have taken to get that product into the market.

So the reports that we are reviewing today do not necessarily come as a surprise. GAO found that we will not meet some of the statutory targets for advanced biofuels or greenhouse gas reductions, two measures which, arguably and do, go hand in hand. Again, this is not a surprise or even new, as we acknowledged at last year's hearing. It was part of the disruption that we saw in the marketplace as a result of uncertainty from earlier decisions.

Fortunately, the authors of the RFS made contingency plans if EPA ever found the industry was not ready to meet these targets, and the law allows EPA to reduce those annual obligations. This is why having annual rule-setting is helpful, though it also brings a level of uncertainty. We can adjust course when it is absolutely necessary. The authors put in place authorities for EPA to rewrite the statutory levels through the reset authority, and I look forward to discussing that here today with both of our witnesses.

So I look forward to hearing from the witnesses and discussing how we can work together with the industry and the administration, and we certainly note that President-Elect Trump supports the RFS, and we all know how important that is to markets and to certainty for our farmers.

So we are grateful that you are both here. This is will be an ongoing and continuing subject of discussion. But if you are going to be for all of the above, this is a key component to an energy policy that helps us diversify our energy sources, moving into the future. Congress was wise when they first enacted it, providing these incentives. I want to see that these incentives work.

And so thank you, Ms. McCabe, thank you, Mr. Rusco, for being here. I look forward to your testimony.

Thank you, Mr. Chairman.

Senator LANKFORD. Thank you as well.

Mr. Rusco, you are recognized for your opening statement.

TESTIMONY OF FRANK RUSCO,¹ DIRECTOR, NATURAL RESOURCES AND ENVIRONMENT, U.S. GOVERNMENT ACCOUNTABILITY OFFICE

Mr. RUSCO. Thank you, Chairman Lankford, Ranking Member Heitkamp, and Members of the Subcommittee. I am pleased to be here today to discuss GAO's two Reports on the Renewable Fuel Standard program.

In response to a request from Chairman Lankford, we undertook two studies on the RFS. One study reported on Federal efforts to support R&D for advanced biofuels and the current state of technology as well as prospects for meeting the RFS statutory targets for advanced biofuels production. The second study reported on EPA's administration of the program and how that administration could be improved as well as the prospects for meeting the RFS goals for reducing greenhouse gas emissions, among other things.

To do these studies, we entered into a contract with the National Academy of Sciences to identify a broad and comprehensive group of experts who could assist us in answering our questions. Last spring, we held a group meeting at the Academy with 20 of these experts and explored the state of technology and prospects for meeting production targets for advanced biofuels. We also met individually with 24 experts identified by the Academy, to evaluate EPA's administration of the program. In addition, we spoke with officials from the Department of Energy (DOE), Department of Agriculture (USDA), EPA, the National Science Foundation (NSF), and the Department of Defense (DOD). We also visited research laboratories in Iowa, Illinois, and Wisconsin, and interviewed representatives of 11 advanced biofuels producers that use a wide variety of feed stocks and conversion technologies. Finally, we reviewed numerous studies and reports pertinent to our questions.

The most salient finding of our reports is that it is unlikely that advanced biofuels can meet statutory targets for the RFS in the near to mid term. Specifically, production of advanced biofuels fell below statutory targets by well over one billion gallons in 2014, and is expected to be almost five billion gallons short by 2017. While there is some room for growth of advanced biofuels, particularly for the fuels that have already been commercialized, we found broad expert consensus that this growth potential in the near to mid term falls far short of RFS statutory targets.

The second major finding is that changes to law or EPA's administration could marginally improve the program and the investment climate for advanced biofuels. For example, experts said that changing obligated parties to blenders as opposed to oil refiners would improve the functioning of the Renewable Identification Number (RIN) market, reduce RIN fraud, and eliminate an asymmetric burden on small, independent refiners who are not also blenders of biofuels. In addition, providing Federal tax credits that do not expire periodically would reduce uncertainty.

However, there remained significant barriers to adding more biofuels to the transportation fuel network. These include the need to install costly infrastructure at retail stations, to educate consumers about how to value different blends of biofuels, and ad-

¹The prepared statement of Mr. Rusco appears in the Appendix on page 27.

addressing the risk that increased advanced biofuels use, if mandated, will lead to higher consumer fuel prices. These barriers, if not overcome, will constrain growth in biofuel use and also dampen investors' appetite for risk.

The third major finding is that because advanced biofuels production targets are unlikely to be met, so too are the goals set out for the RFS, including greenhouse gas reductions. Specifically, experts questioned the extent to which the RFS is achieving its goal of reducing greenhouse gas emissions, considering that most of the biofuels produced today come from cornstarch conversion technologies which do not yield large reductions in greenhouse gases.

With regard to reducing reliance on imported fuels, the United States has made great progress in recent years in reducing net imports of petroleum, in large part because domestic oil production has increased dramatically. Domestic biofuel production, net of imported biofuels, have also helped, but to a much smaller degree, and further progress would require breakthroughs in development of cost-competitive advanced biofuels.

Last, experts generally agreed that meeting goals of the RFS could be done more efficiently using other policies. In particular, a carbon tax or low carbon fuel standard (LCFS) would more directly incentivize greenhouse gas reductions than does the RFS, and would do so at lower cost.

GAO does not make any recommendations in these two reports because we feel there is no consensus among experts on how best to proceed with the policy, in general.

This ends my prepared statement. I will be happy to answer any questions you may have.

Senator LANKFORD. Thank you. Ms. McCabe.

TESTIMONY OF JANET MCCABE,¹ ACTING ASSISTANT ADMINISTRATOR FOR AIR AND RADIATION, U.S. ENVIRONMENTAL PROTECTION AGENCY

Ms. MCCABE. Thank you, Chairman Lankford, Ranking Member Heitkamp, and other Members of the Subcommittee. I also appreciate the opportunity to be here and testify on the Renewable Fuel Standard program and on EPA's recent final rule, setting the annual volume standards for 2017 and the biomass-based diesel volume requirement for 2018.

The RFS program began in 2006, under the Energy Policy Act of 2005, and was subsequently modified by the Energy Independence and Security Act of 2007. That law's stated goals include moving the United States toward greater energy independence and security and increasing production of clean renewable fuels. The law 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.

The Clean Air Act requires EPA to issue annual standards for four different categories of renewable fuels: total, advanced, bio-

¹The prepared statement of Ms. McCabe appears in the Appendix on page 41.

mass-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, and must be issued by November 30 of each year for the following year, and 14 months in advance for biomass-based diesel category.

EPA is committed to successful implementation of the RFS program, and the past year has been an active and productive one for the program.

One of our chief priorities, if not the chief priority, has been timely issuance of the annual volume rules, and we have stayed on schedule for the 2017 rule, as the Chairman acknowledged, and we just finalized that last week. The final rule incorporates the most up-to-date data available to us, and is informed by written stakeholder comments, by input provided during a public hearing we held this year in Kansas City, Missouri, and by our consultation with the Departments of Energy and Agriculture.

The 2017 volume final rule established requirements for cellulosic, advanced, and total renewable fuel for 2017, and includes a biomass-based diesel volume requirement for 2018. The 2017 final rule once again establishes ambitious but achievable targets for the RFS program, and becomes part of what is not a multi-year track record of growth. As finalized, total renewable fuel volumes would grow by nearly 1.2 billion gallons between 2016 and 2017. Advanced renewable fuel, which requires a minimum 50 percent lifecycle greenhouse gas emissions reductions, would grow by nearly 700 million gallons from 2016 to 2017. And while Congress did not establish specific goals for non-advanced or conventional biofuels, the established targets for total and advanced fuel means that conventional biofuels would read 15 billion gallons. The 2017 final rule achieves that level.

Biomass-based diesel, which must achieve at least 50 percent lifecycle emissions reductions, would grow by at least 100 million gallons from 2017 to 2018, and the final 2018 standard is more than double the congressionally mandated minimum level of one billion gallons. Finally, cellulosic biofuels, which requires 60 percent lifecycle carbon emissions reductions, would grow by 81 million gallons, or 35 percent, between 2016 and 2017.

Beyond the volume rule, the Agency remains active in multiple other areas of the program, and I would like to briefly mention two. On November 16, we published the “Renewables Enhancement and Growth Support” (REGS) proposed rule, a collection of proposed revisions to the fuel regulations that will support market growth of advanced and other biofuels in the United States. That proposal, among other things, would establish an updated regulatory structure that would allow biofuel producers to partially process renewable feedstocks at one facility and further process them into renewable fuels at another facility under existing pathways. This would improve the economics and efficiency for the production of biofuels, particularly advanced and cellulosic fuels. The proposal strongly reflects input we have received from many stakeholders in recent years, and we are looking forward to people’s comments in January.

The second thing to mention is that over the past year, EPA has received several petitions from RFS stakeholders asking us to

change the point of obligation under the program. That has already been mentioned. Currently, refiners and importers of gasoline and diesel are the regulated parties under the RFS program, and certain stakeholders have asked us to initiate a rulemaking to change that point of regulation to a point further downstream, such as blenders. There has been a huge amount of input from a wide range of stakeholders with widely divergent views, and on November 10 of this year we issued a proposed denial of these positions that examines the issue in depth and, importantly, provides an opportunity for the public to provide comment to the Agency, which was a strong request as well. So we are, again, looking forward to people's input on that.

And just recently, the GAO issued these two reports. We provided responses to drafts of both reports and appreciate that opportunity, and those comments are included as part of the final report. Broadly speaking, the reports examine the same challenges that we have recognized and that we have talked about before, associated with reaching greater levels of advanced biofuel production, especially cellulosic fuels, and we welcome the discussion in the reports and certainly the discussion today.

So we recognize that there are opportunities and challenges ahead. We are committed to implementing Congress's statute the best way we can, to achieve Congress's goal, and look forward to the conversation today and appreciate the opportunity to be here.

Senator LANKFORD. All right. Thank you.

The Ranking Member and I are deferring our questions to the end.

We recognize Senator Ernst.

OPENING STATEMENT OF SENATOR ERNST

Senator ERNST. Great. Thank you, Mr. Chair, and thank you to both of you for appearing today.

This is an interesting topic for a number of us, and especially for me, coming from the Midwest, where this is a great part of our economy. So, again, I always appreciate the opportunity that we have to discuss the RFS, and it really has spurred investment in domestic energy production. It has helped grow our economy throughout the Midwest, especially in those rural areas. And it has brought a lot of competition, needed competition, to the gas pump, saves American consumers money, and reduces reliance on foreign oil sources.

So while some of the aggressive production targets for advanced biofuels originally envisioned by Congress have not been achieved—and I think we all recognize that—it is certainly not time to hit the panic button and pull the rug out from under this burgeoning industry. We are really just getting started, is how I feel about this.

And so, Mr. Rusco, one of the reports that GAO had, states that bolt-on cellulosic technology at existing plants is the most cost-effective means for generating those advanced biofuels, and I did visit one of those facilities, one of the bolt-on facilities, in Galva, Iowa, earlier this year, and they are using corn fiber, which is a byproduct of the ethanol process, to create cellulosic ethanol. And this is a great example of what this was originally intended to do.

It was to support the expansion of conventional biofuels as a springboard for those advanced biofuels. And if we create further uncertainty about the future of the RFS and our commitment to biofuels, it will only serve to slow our research and investment down toward attaining these goals originally set by Congress.

So my question to you would be, what are the most effective things that we can do, as a Federal Government, to provide certainty so that these companies want to invest in the advanced biofuel production process? What can we do to provide certainty?

Mr. RUSCO. So we did hear from a number of people that—certainly, certainty about the availability of Federal tax credits, the \$1 per gallon tax credits. We also heard from a lot of the producers that they really relied on Federal funding for R&D because there really is not available investment funding from the private sector that is sufficient to do a lot of the research that they need. But we also heard that even with those changes, they are many years away from bringing even the technologies that they understand very well, like cellulosic ethanol, and for which there are currently a couple of commercial plants, they are many years away from bringing costs down to where they would be competitive in a market sense.

Senator ERNST. OK. Thank you.

And Ms. McCabe, I want to first applaud, just as the Vice Chair did, for the EPA getting RFS back on track last week. We appreciate that, and the issuance of the final 2017 Renewable Volume Obligation (RVOs). And can you highlight the factors that led to the Agency increasing the blending targets from the proposed levels to the final rule?

Ms. MCCABE. Yes. So the major factor that we look at, and we update it throughout the year, is expected gasoline usage, and so there were—we rely on Energy Information Administration (EIA) for their estimates of that. And so it was predicted that there would be additional gasoline usage in 2017, which allowed us to grow those volumes. And we just continually update our expectations about the ability of the industry to produce volumes, and so when we put all that together, that is the way the numbers fell out, that we were able to increase those volumes.

Senator ERNST. OK. Very good. Well, I appreciate that very much.

We do have some challenges in the industry, but again, I think providing certainty, going back, is an important part of ensuring that we can stay on target with the production of ethanol and biofuels, advanced biofuels. And we have seen other concessions made within the Federal Government, other tax credits for other petroleum-based products. We see it with fracking. I do not see why we should not continue with research and development in this area, especially when it has done a great deal to support the economy, especially when we have downturns in the agricultural economy, like we have seen in the last number of years.

So I encourage you to continue supporting the RFS. Let us look at ways we can further research and development in this industry. I think it is a valuable part of our American economy.

But I want to thank you both for being here today and answering our questions. Thank you.

Thank you, Mr. Chair.

Senator LANKFORD. All right. Senator Heitkamp.

Senator HEITKAMP. Thank you, Mr. Chairman. Before I begin my questions, I just want to ask that the letter that I am going to hand to you is, in fact, introduced into the record.¹ It is signed by a number of groups who frequently you will not find their names on the same letter. They are suggesting and expressing their unified position in opposition of efforts by petitioners to move the point of obligation on compliance. You have API and the RFA on the same letter. That is pretty remarkable.

Senator LANKFORD. Without objection.

Senator HEITKAMP [continuing]. That might speak some volumes in terms of answering the petition, and obviously we hope that you give full consideration, but these interest groups have been long involved in this, and for them to share a common opinion might put a little more weight on what they are doing, or what they are suggesting.

So I think we are all trying to get a handle on how we do not have this happen again, where the market is unresponsive, or is in a position of uncertainty given the lack of certainty on where we are headed, in terms of numbers. And so in order to prevent that from happening again, I think we have to better understand why the market did not respond and come to numbers that were adequate to meet the quotas or meet the levels.

So I guess my first question would be for you, Mr. Rusco. In your opinion, what was the most significant contributor to the delay in advanced biofuels production? Was it delays in setting up the RFS program, initially, uncertainty related to the RVOs' timing from the litigation and flawed—what I believe was flawed—reading of the statutory waivers, or was it really more about tax uncertainty, or was it something all together? And in your opinion, in the work that you did, do you believe that had we had maintained a level of statutory certainty, or certainty in meeting those statutory requirements, we would have seen the level of investment that would have been able to meet the standards?

Mr. RUSCO. I think that it is pretty clear from most of the people that we spoke with, including producers of advanced biofuels and researchers in that area, that, sort of, the biggest issue is the price of oil. So if the price of oil is very high, then there is going to be more investment in alternatives to that, and when the price was high a number of years ago, even some oil companies were diversifying and investing in biofuel technology. But when the bottom fell out of the market for oil, and also with reductions and slower growth since then of motor fuel demand in the United States, investors just looked at biofuels as not as viable an investment as other things, so money flowed elsewhere.

I do think that in the margin, things like—regulatory uncertainty and uncertainty about tax credits, do play a role, but what we have found is that, for example, cellulosic ethanol, which is probably the most likely advanced biofuel to be technologically and commercially ready in the near to mid term, it will require multiple generations of plants to achieve the kinds of efficiencies that might

¹The letter submitted by Senator Heitkamp appears in the Appendix on page 45.

bring it down to where it is commercially viable. But that also, then, depends on, again, on the underlying price of motor fuels. And so that, I think, is the biggest.

Senator HEITKAMP. I mean, I understand what you are saying, that a lower-price competitor can drive investment someplace else and cause people a lot of concern, but so can regulatory uncertainty. And I think when we look at advanced—not to put a fine point on it, but this is a building block industry, as you look at other potential available growth in advanced manufacturing for ag products. I used to say, well, we want to move beyond food, fiber, and fuel, and the pushback I always got is that this technology that can be developed, and the plants that can be developed, really provide the building block for other opportunities, whether it is Styrofoam or whether it is seat covers or all of that begins at this level of innovation.

And so I think there is, beyond an all-of-the-above energy policy that really works for the United States and gives us the diversity in our fuel choices, we have to realize that this is also technology that is very transferrable to other kinds of renewable manufacturing, and it is critical, as we look into the future, of how we utilize natural resources, especially the natural resource of the soils and the stuff that we grow in our country. So we are hopeful that we will have consistency now going forward which will lead to predictability.

But I want to get to the reset authority. I only have so much time and I think it is important that we remember that the reset authority, when we have this discussion around reports and not meeting advanced fuel mandates, just because, for a variety of reasons, we do not meet the targets does not mean the law is either a failure or needs amendment.

We have a process in place to, I think, correct, if necessary. I think, Ms. McCabe, the 2007 law that Congress passed included the reset provision to allow EPA to adjust the RFS mandates after 2016, if the volume totals in the table had gone below the law by 20 percent in two consecutive years, or by 50 percent in one year. Has this authority been triggered for any of the tables in the law today, and since the authority—I guess I would just like you to explain where you see the reset authority today and the likelihood of reset, and if—what role this disruption played in getting to the reset authority.

Ms. MCCABE. So just to explain what Congress laid out, you have it exactly right—20 percent in two years or 50 percent in one year. So those levels have been triggered for cellulosic and for advanced, but not for total. And so the Agency has not—and we have just finished—we are just finishing 2016—the Agency has not embarked upon a reset rule. We, of course, are paying close attention to it. A couple of things are going on that cause us to think really hard about how to proceed with that. One is the idea of moving forward with one or two, but not all of the volume standards, seems like it could be very disruptive to the market because of the careful balance that Congress established with the relationship of those nested standards. We also still have some ongoing uncertainty because of pending litigation about our authorities with respect to the waiver, in particular, but other things as well.

So we have not hit even the first-year trigger for total, so it would be at least two more years before that—all three would be triggered, and that is kind of where we are with the reset.

Senator HEITKAMP. Yes, and we do not want a self-fulfilling prophecy, which is the reset happens because we have reset.

So, Mr. Rusco, was this reset discussed by your panelists, and would the reset not make the report on not meeting increasing targets moot since the law already addresses this?

Mr. RUSCO. It did come up but our report just is focused on what is likely to be available in terms of how much volumes will be available, not necessarily whether or not the industry will be in compliance.

Senator HEITKAMP. We keep talking in circles, because one of the problems that we have, and that we have had from the beginning, is what is available depends on regulatory certainty, and I recognize the marketplace, and we were a big producer of oil so we understand what is happening with oil. But, the frustration for me is that we say, well, “What is available? What is available?” What is available is going to depend on what there is capital investment for and whether there is capital investment and innovation is going to depend on regulatory certainty.

So we are in this kind of spiral that deeply concerns me, and I am wondering, when you discussed the reset, was this, the, well, what if we had not had regulatory uncertainty, what if these targets had remained available, we would then have the ability to amp up and meet the requirements under the law or the targets under the law?

Mr. RUSCO. So I do not think that we heard a lot of people say that if EPA had maintained the statutory targets that they would have been met. I do not think anybody said that. What they did say is that, going forward, reducing regulatory uncertainty improves marginally the investment climate. But I think that they also did not say that that would sort of fix the problem and that there would be adequate investment to get there.

Senator HEITKAMP. Where they would have been likely to say a \$100 a barrel will fix the investment problem. They were not willing to say, \$40 to \$50 a barrel with regulatory uncertainty was not causation for the problem?

Mr. RUSCO. Well, in the report where we talked about R&D and the sort of state of science, they are just well up the curve on commercialization and bringing costs down. They are far above the market rate. They are many years from that under the most optimistic scenarios. So even if you threw money at it, a lot of money at it, which right now there is not a lot of money being thrown at this, you would be many generations of plants, even for the already sort of commercial scale operations, you are many generations away from achieving the efficiencies that are available, and the current cost at which they can produce is so high that you would need many generations in order to bring those costs down, if it is possible at all. And so—

Senator HEITKAMP. So the discussion really went to technological impossibility, at this point in time.

Mr. RUSCO. Not impossibility, but that it is just far away from—the cost, currently, given the state of technology, is very much higher than a market competitive price of motor fuels.

Senator HEITKAMP. Well, I think we are going to have an ongoing discussion, given that we have reached the trigger on the reset, and I know the Chairman has been discussing this quite a bit, and we need to live in reality. I get that. But we also need to understand that this was designed to create an environment, a regulatory environment, and a regulatory certainty that would grow investment and grow technology. And I think we have missed a couple of years here because of the uncertainty that has been in the market.

So with that I will yield to the Chairman.

Senator LANKFORD. Let me pose a few questions and then I would like to just open this up, as we typically do in our committee, to more open conversation from there.

Ms. McCabe, the statute itself, the way that it was designed in 2007, had a high volume for corn-based ethanol at the beginning and then a decreasing amount. If I remember correctly, the number was around 44 percent by the time we get to the end of the window. That is the other part of the statute that is the battle for you, because while you are trying to follow a statute that was written in an unworkable way, and this put you in an untenable situation to be in waiver-land, to constantly have to work with every side of an argument to try to figure out how to be able to match this when there is really—the statute itself does not work with the gallons requirement, based on the gallons that we are using—so you are having to work through this process.

How are you balancing this issue of the statute requires we use much less corn ethanol and much more cellulosic and advanced, when the technology does not exist yet for large-scale production of the advanced and for cellulosic? So, literally, for you to be able to keep a total amount and not do a reset of total amount, you are having to violate a different part of the statute, which requires we use less of this one. How does that conversation go for you all?

Ms. MCCABE. Well, that is exactly the point I was making a minute ago about our concern about moving forward with reset on two of the categories and not the third, because of that balance. The goals of the statute, as I understand it, Senator, are really to focus, in the long term, on advanced biofuels, and in particular on cellulosic biofuels that provide the most opportunity for greenhouse gas reductions. And as has been discussed already here, that is an industry that is just starting, as compared to the petroleum institute—industry, or the ethanol industry, where those technologies have been around for quite a long time.

So I think it was a tall order, and this is what Congress does, in establishing the aspirational legislation to move things in a certain direction—I do not mean aspirational in the sense that we are not supposed to do it, but it was a vision, and an ambitious one.

So our focus, and the Administrator's focus, all along, in every rule, has been we need to be providing as much encouragement as possible to advanced biofuels, to cellulosic biofuels, as we can, and because we are just at the point now, with this rule, where we have gotten to that maximum conventional amount, we are now moving

to the area where hopefully those volumes will continue to grow, continue to grow, and move toward that ultimate proportion that you mentioned.

Senator LANKFORD. Some of this has been a redefinition of what is included in cellulosic and what is included in advanced fuels, as you have expanded more the biogas and some of those things. So give me a percentage for the advanced fuels, of what is—what was defined as an advanced fuel, let us say, four or five years ago, and then some of the changes that have been made to be able to add in some of the other types of fuels.

Ms. MCCABE. Well, it is not quite a redefinition because the statute says in order to count as cellulosic you have to get a 60 percent reduction, and advanced, a 50 percent reduction. So there are processes in the rule which we are implementing as expeditiously as we can to identify and approve, when people come to us with pathways. And so for each one of those we look at what the applicant comes to us with, and what does this mean in terms of the reduction, and does it qualify as a cellulosic fuel or does it qualify?

So things that have been approved recently, one of the most promising is biogas, which qualifies as a cellulosic fuel and has allowed us to increase volumes of cellulosic quite significantly, and we continue to look for those technologies, and as they fit into different categories we will put them in the right category.

Senator LANKFORD. In that particular area, and it is promising on the biogas to be able to see that, the feedstock for that and the ability, that has been some of the challenge with biodiesel, is that it has been very productive, it has exceeded its targets on it, but the amount that we actually produce of feedstock is the problem for that. You have to be able to literally kill more hogs or find more way to get grease or something else to be able to go after that, to be able to get more of it.

Are we going to have the same issue with the biogas as well? Is there a cap in the amount of feedstock that is out there?

Ms. MCCABE. I do not know the answer to that. I would be happy to find out. I mean, certainly with any of these feedstocks, that is a part of the analysis, is how much is available—how much more can and should be encouraged and is cost-efficient to encourage, and that is where the market comes into play in a significant way, and people continue to innovate also.

Senator LANKFORD. And the innovation we want to be able to maintain. Obviously that is part of where we are. We always want to be able to innovate in energy.

Ms. MCCABE. Right.

Senator LANKFORD. Mr. Rusco, as I go through the two reports, the key takeaways that I get from the two reports, one is, based on where we are, what is happening, the production levels, we are not seeing a reduction in greenhouse gases and we will not see that in the foreseeable future unless there is a very significant change in the advanced fuel and cellulosic. Is that correct?

Mr. RUSCO. The reduction in greenhouse gas emissions is uncertain in terms of conventional biofuels, in large part because most of the conventional biofuel production was already in place before the requirement to have a 20 percent reduction. So we do not know

how much reduction there is. It really just depends on what technologies they are using, and that has not been measured.

For the small proportion that are subject to that 20 percent reduction, then there is still a little bit of debate about how much of a reduction there is with conventional ethanol because some people think that EPA's model has not effectively taken into account indirect land use, the effects on carbon emissions. But that aside, if you assume that that part has 20 percent and then the advanced biofuels that are in the market are 50 or more percent, then there has been a modest reduction in greenhouse gas emissions, but it will only grow significantly with growth of advanced biofuels.

Senator LANKFORD. OK. Ms. McCabe, let me follow up on one thing on that, because Mr. Rusco brings up one of the issues and that is about land use. The original design of this was to make sure that grasslands did not suddenly have corn planted on them as well, and have expansion. Are you confident that right now, we do not have things that used to be grasslands being now used for corn, based on the ethanol requirement, and if so, how are you monitoring and assuring that?

Ms. MCCABE. That is something that we look at every year, for every rule, and we work with our fellow Federal agencies to make sure that we have the best information possible on that, and that, indeed, was the expectation, and in each rule we provide our analysis and the background information of how we have come to our conclusion that that is not happening.

Senator LANKFORD. So if I remember correctly, and again, it is off the top of my head, about eight million additional acres are now corn that used to not be corn. So your confidence is that those were acres that were planted with wheat or with soybean or something else that are now corn. They were not just originally grasslands. They have now been transferred into corn use?

Ms. MCCABE. Well, I think I would like to have the opportunity to get back to you with more specifics on exactly what our analysis showed and the reasons for our conclusions.

Senator LANKFORD. OK. That would be terrific.

The one thing that I heard over and over again was, one of the reasons that we are not seeing the gain in ethanol is because the price of gasoline is too cheap, that if gasoline was \$5 a gallon there would be not necessarily more incentive but the cost of the ethanol and the cellulosic would be closer in price, meaning that the more that we put some of the ethanol into gasoline now, with the lower price of gasoline that we face now, we are actually paying more per gallon for a gallon of gas with the ethanol blend than we would if it was 100 percent gasoline and was typical on it.

Have you all been able to run any numbers on the cost—and again, that changes every day, with multiple features, based on the RINs prices, the price of crude oil, the price of the ethanol, where it is coming from. I get that. Have you all had any opportunity to be able to look at just snapshots of different days, what the differences in price are, based on ethanol or non-ethanol, and what that would be for the consumer?

Mr. RUSCO. We have not done that in the course of this work. In looking at past work, we did have an opportunity, years ago, to look at ethanol and gasoline prices and ethanol use. Most of this

did not make it into a report, but we—and it was not really our objective—but just as we looked at it, you could see what looked like a strong correlation between the use of ethanol—when ethanol was below its—below the blend wall, significantly below the blend wall, and you would see that when ethanol prices were below gasoline prices there was more blending. So you would see that the market would work, that people were seeking the lowest cost fuel.

But when you are at the blend wall and you have to blend that 10 percent, then that ability to blend less if the price of ethanol is higher than gasoline is gone, and so there you would see—if there are fluctuations you would see differences in the price of the final fuel that would reflect that.

Senator LANKFORD. So the Congressional Budget Office (CBO) did a study in 2014. That is the most recent one that I could find and I have asked around, trying to be able to identify it, because this is a very complicated issue when you deal with the cost of fuel per day, and what that is and how that blends out. The most recent I could find was the CBO study in 2014. They looked at the RFS program and they tried to determine three alternative solutions or scenarios. One was compliance with total renewable fuel and advanced fuel mandates, corn ethanol cap as set by the RFS; the second one was hold future volume requirements at levels previously proposed, so the lower levels; and a third options was just repeal the RFS.

This is the statement: “The study evaluated the impacts of these three options on ethanol production and motor fuel prices. According to CBO, if the RFS was repealed or if its future mandates were kept at previously proposed 2014 levels, corn-based ethanol production would remain at 13 billion gallons”—it would still stay high—“and American consumers would have lower gas prices.”

The numbers that they ran behind that was that with a mandate—and then pulling the mandate away, if they removed the mandate it could reduce the price by up to 26 cents a gallon. Now this was, again, a study that was done in 2014, and then, for diesel, it could reduce it as much as 51 cents a gallon. Now that was a snapshot that they did at that point.

The challenge that we have is trying to determine where we are with greenhouse gas emissions, and where we are with price to consumers. If they even dropped that down to a dime, if we have a dime a gallon more in cost right now, per gallon, for every gallon, with the mandate, and the study that they did, they said even if you repealed the RFS, at that time they were estimating that we would still use 13 billion gallons, tells me it is in the market, it is still out there, it is going to be used. It is not as if the mandate, if it is pulled away, suddenly no one will use ethanol. It seems to me that a lot of people like using ethanol, and it is a good fuel source, and it is an especially good source for octane boost, and it is plentiful, especially in the easier-to-produce areas like corn-based ethanol.

So my question still comes back to, it seems to be raising the prices and not hitting the totals that we need for the greenhouse gas emissions, and if we remove the mandate we will still use it anyway. What am I missing here? Why is the mandate so important?

Mr. RUSCO. I cannot answer that, but you will definitely still use a lot of ethanol, as an oxygenative, an octane boost, if for no other reason. There is another thing that might happen but it will take a lot of other changes, and that is that auto makers could make high-compression fuels that would burn 30 percent ethanol and get great fuel economy, but that—again, there is no current market for that. But there is a lot of possibility to use ethanol. It is just not clear to us exactly how much would be used.

Senator LANKFORD. If that would the primary fuel out there, then my folks in Oklahoma could not drive their 1978 Silverado Chevy pickup, because they would not have a good fuel option for that as well, and that is the other challenge that is in this.

Ms. McCabe, why the mandate? Why is the mandate essential? If it is a good fuel, it is in the system, and it is out there, and we know it raises costs, why maintain the mandate?

Ms. MCCABE. Well, Senator, I also cannot answer on behalf of Congress, but I will reflect that my understanding of what Congress was also trying to do was to bring advanced and cellulosic fuels into the marketplace, and they were not already there, like ethanol, and those were new industries. They needed the push. They needed the mandate. They needed the subsidy, essentially, that the RFS provided in comparison to readily available petroleum fuels, and that that fit the goals of energy security and lower greenhouse gases, and Congress chose to use a mandate approach in order to achieve those goals.

Senator LANKFORD. I would tell you, looking back on it, 10 years later, we obviously have seen great progress in corn-based ethanol. We have seen some progress in cellulosic and some progress in the advanced, and obviously progress in the biodiesel programs. But if the tax for that is 10 cents a gallon for every gallon of gasoline to be able to accomplish that, I am not sure most consumers would say so far that has been worth the cost, because that is a pretty high cost to pay, especially for those that are in poverty and on very limited incomes.

So I would just challenge us, as Congress, to look again at ethanol and the mandate, and to be able to evaluate, is there a better way to accomplish the same thing, to incentivize fuel, without actually punishing the consumer so much every single gallon of gas, and a different alternative.

I do not want to hog the time. I know we have several things to talk about still.

Senator HEITKAMP. Mr. Chairman, I think that we should always have a willingness to think about and reopen and explore new ideas on how we can do things better.

I do dispute somewhat the notion that the only value that the mandate has had is, those expressed in the statute itself, which is greenhouse gas, which is looking at energy independence. I think that a variety of fuel sources, especially in transportation fuel, that up to this point there has not been the diversity that we have seen. We are seeing more electric cars. We are seeing more compressed natural gas as natural gas prices stay low, especially in fleet vehicles, especially in locomotives. Burlington Northern had a big project converting to compressed natural gas, when we saw that differential between natural gas prices and oil prices, diesel prices.

So I think that one of the problems that we always have in this country is that we make decisions based on too short of a frame of our history, and I think that it was Congress's judgment that incentivizing and providing a market for biofuels was essential for our long-term economic well-being, both in terms of transportation fuels but, as I said in the past, in terms of developing technology which really can be extraordinary as we go to the next generation of advanced manufacturing as it relates to agricultural products. We move beyond fuel, fiber, and food, and we go into using this as a base for growth long-term, growth in advanced manufacturing and value-added manufacturing in agriculture.

So I get what you are saying and I get that we need to have a broader discussion, but I also think that we have not had the time, given the disruption that we have had in looking at this, and the marketplace, and fluctuations in oil prices, to really see this experiment and to really see this whole system from a big picture, mile-high, beneficial value.

I do not disagree with you, Mr. Chairman, that at 10-cent, if, in fact, you and I could agree on that number, a 10-cent cost to consumers is something we need to take very seriously, because it is, in aggregate, very high. But then what is the benefit to the economy long term, and not just in a five-or six-year window but in a 20-, 30-, 40-year window?

And, not to get on my high horse here, but I am well familiar with a facility called Great Plains Natural Gas. I have served on their board of directors. It is a syngas. It was a 1970s project that was done in response to the oil embargo, where we looked at what is our fuel that is abundant in this country? And we saw a lot of coal. We said, well, how about we gasify coal because we think we are going to be in a natural gas shortage?

So we went about that and eventually the consortium that made the investment bowed out because we deregulated natural gas. Natural gas prices literally went below a dollar an MCF. We found that we had too much natural gas on the market, again, a market manipulation that really was not reflecting true market conditions.

But that facility chugged away, looking at byproducts, looking at how we could be part of the CO₂ discussion, with CO₂ injection. And, as a result, now we have a facility that has created huge economies in gasification of coal which could, in fact, lead to CO₂ reductions overall as it relates to kind of the global economy. So how long did that take? The facility went online in 1984, and here we are, 30 years later, really having a meaningful discussion about the value of that facility.

And so I just think that there is a real impulse in this country to look so short-sighted in terms of the time period, and these technologies can be extraordinarily important, and there is an incentive beyond just simply transportation fuels that I think need to be considered. Now, obviously, we have to go with the statute we have, which identifies what those goals are.

And so, we will continue to have that discussion, but we also have to have the statute be enforced the way the statute was intended, to really evaluate the economic success. And, it is certainly not the first time the Chairman and I have disagreed about this subject, and it will not be the last. But I think that the issues that

have been raised here are ongoing, and the issues that have been raised by the Chairman are issues that we need to stand ready to defend the statute going into the future.

I am concerned about the reset. I am concerned that that creates more uncertainty in the market, and that because we have had this earlier market disruption that, as we look for investment, that is the sweet spot in all of this and we do not want to hinder and encumber the development of those technologies too quickly.

So, Mr. Chairman, that is my—

Senator LANKFORD. That is your story and you are sticking to it.

Senator HEITKAMP. Yes. You have it.

Senator LANKFORD. Yes. I just want to remind you that the Department of Energy gave a \$500 million-dollar grant to do a cellulosic facility in Kansas, that Shell just bought for \$28 million recently, because it just did not prove to be viable long-term, and they may very well use that \$28 million and convert that into something else in the future that may be very viable, and I hope they do.

Senator HEITKAMP. Yes. And I would suggest that if you looked at the history of Great Plains, it is exactly that—Federal loan guarantees that through negotiations, pennies on the dollar back to the Federal Government. But I would maintain that that facility on the prairie has enormous R&D benefit to our country.

Senator LANKFORD. Mr. Rusco, give us a guess. For the cellulosic, you talk about the multiple generations to be able to move. All of this as you talk to people in the industry and you talked to the experts and the science folks, give us a guess of how many years it would take for a viability for cellulosic, and do you feel like it could reach any of the target numbers by 2022?

Mr. RUSCO. So I cannot guess how many years. So what we heard is—

Senator LANKFORD. Come on. That is what we do. We are in Congress. We guess. [Laughter.]

Mr. RUSCO. I will do my best. So it would take three to four, even five years to build a second-generation plant, and they think they might be able to achieve—some of the crews think they might be able to achieve, with a second-generation plant, maybe 25 percent efficiencies, but they are going to need to achieve well over 100 percent efficiencies to get close to that, and each generation they have to be able to achieve that.

So if you figure they have to go four or five generations, even if they can get that low, right now they can see that the next generation might get them 25 percent lower in cost, but they need to be a lot—they need to cut costs by a lot more than that. If they can see this one and it is going to be three, four, five years out, if they can get the money to build it, then they have to figure out how to operate that and get that up and running, and then they have to build another generation and another one after that, so not by 2022.

Senator LANKFORD. OK. Ms. McCabe, let us talk about the authorities the administration would have, any future administration, whatever it may be, between now and 2022, and then 2022 and beyond, for the reset. How broad are the authorities to be able to reset the numbers for the EPA?

Ms. MCCABE. So the statute gives some guidance to the Agency. I brought it right here, because I thought you might ask. But it is broad. It says that if those triggers are set that the Agency needs to look at recalculating the numbers all the way through 2022 for whatever category is being reset, and it gives a series of factors that the agency is supposed to consider.

Senator LANKFORD. Did they reconsider all three categories?

Ms. MCCABE. I am sorry?

Senator LANKFORD. You talked about if they could reset the total amount, or any of the individual categories, or do all of the above?

Ms. MCCABE. Right. I mean, whatever categories that have been triggered that the Agency is moving forward with. Our thought is it is better to do them all at once, because of the interconnecting relationships. So we would undertake a notice and comment rule-making and background work to look at all of those factors, to put forward a proposal based on the experience of the program to date and the expectations going forward, and as Mr. Rusco has said, there are just so many factors, and we do not know what is going to happen with oil prices in the future, and just a variety of other things. But we would have a public process to do that so everybody could weigh in.

Senator LANKFORD. A couple of quick questions. We are going to run out of time but I want to be able to honor everyone's time. One of the main goals of the RFS was to get us off any imported energy sources. What percentage right now of RFS volume uses any imported source, whether that be Brazilian sugar cane, or any other outside of the United States feedstock source?

Ms. MCCABE. Yes. I do not have a precise number for you but we can get you a number. It is small.

Senator LANKFORD. But there are some things that are foreign sources, that are actually being permitted right now?

Ms. MCCABE. Yes. The statute does not distinguish between imported and domestic, and it really varies a lot, depending on all kinds of different factors that have nothing to do with RFS or domestic policy. But it is small.

Senator LANKFORD. You had mentioned as well, Ms. McCabe, about the obligated parties, and I am not going to try to work you into a corner—I am really not—on this. Help us understand the decision for the denial at this point, and to just say no, we are going to deny this, and help us understand what brought you to that point. As you know, both sides of the argument have expressed this to you very clearly, obviously. Some of the independent refiners that I know of have told me, point blank, the second most expensive part of their operation are RINs. It is crude oil and RINs. After that it is the energy for their facility and personnel and health care. But the second most expensive thing they have is something that is paper, that does not really exist anywhere except in the world of government, and that is the RINs purchase.

So help us understand just the process that you went through to make this decision.

Ms. MCCABE. Yes. So let me talk about the process first. So when we get petitions, it is up to the Agency to grant or deny them, and we not required to go through a proposal process to do that. In this case, we felt it was important, for one reason, because people

across the board asked for a public forum to be able to put information forward and have that conversation, but also because we felt that it was an opportunity for us to put forward our best thinking, at this moment, of the information that we have received. And as you have acknowledged, people are in very different places, and they are not only clear, they are vehement, and I have sat in many meetings, my staff have gone to some of these facilities, we have had many conversations where people will come in with the same exact data and say one thing to us one day, and then another group will look at the same data and say exactly the opposite to us.

And so we are trying to sort all this through, and one of the questions that I was getting from people, as I was having these meetings, was, "Well, tell us what you think about what you are seeing." So we thought it was fair to do that, and to put our thinking out in a proposal. So rather than just say—to open it up for, "We do not know whether we are going to grant or deny it, but give us your thoughts"—we thought it would be a more meaningful opportunity for input if people could understand our thinking currently.

We tried to lay it out very clearly, our analysis of the objections and the points that people were making to us. Nobody is denying that RINs are a significant cost for businesses that buy them, but there is a complicated interplay between whether the value of that RIN is recovered through the products that they sell—and again, there is a wide range—

Senator LANKFORD. Which is then passed on to the consumer.

Ms. McCABE. Well, or maybe not. That is complicated too, and I think it bears a lot of discussion by people who are much smarter on the economics of this than I am. I would not presume to be an expert on that. But I think there is a range of views on whether the consumer does see those costs or whether they are passed back and forth among the regulated industry.

So people have different views on this and we wanted to try to lay that out as best we could. I know we will get lots and lots of input.

Senator LANKFORD. I am all for an open process on it. It is a complicated, difficult issue. I am exceptionally skeptical that any industry could have a \$200 million cost, for instance, for a small manufacturer, or for a small refiner, and that that would not be then passed on to the consumer in some ways. If your second-highest cost of your business is an item, you do not swallow that and the other folks do not swallow that. The consumer does at the end. That is part of that 10-cent increase that we see just in cost that is sitting out there, if we can agree on a simple number, because that ongoing cost has to go somewhere.

So that will be part of—by the way, I do not think that goes away if you shift the obligation. I am not saying that it does. So I am not arguing one way or the other. What I hear from people is, just tell us how the process is going, and the more open the process can be, or not, is better. I had integrated retail folks that have, as a part of their business model, the RINs that they produce and then sell, and it is part of their business model now, and it is exceptionally helpful to them as a company. And I have other groups that are refiners, that struggle exceptionally under this.

So I get that part of the business. The hard part is just the consistency, and trying to guess how to predict a RINs price, and it is, as you know, very hard to predict a RINs price, and when it is such a large part of your business, everyone wants to know how to plan for the next year, and it is tough to do that when the RINs move so much.

Ms. MCCABE. Yes. I will add, Senator, too, that we made a clear point that if we are looking for certainty in the system, changing the point of obligation now will completely undermine that. It would take multiple years to get that fixed. People will be arguing about how we should do it. So that is a consideration—

Senator LANKFORD. It is so much simpler if we just do away with the mandate entirely. That just fixes that entirely on both sides. [Laughter.]

Senator HEITKAMP. I want to make a point about transparency in the RIN market. I think EPA has long recognized the potential for fraud and the concern about lack of transparency and volatility. You have implemented the quality assurance program, and I do not think we should leave this subject without acknowledging that and at least getting some feedback from you on whether that quality assurance project has worked.

But you have also been working with Commodity Futures Trading Commission (CFTC) on a memorandum of understanding related to transparency and oversight. And so I do not know that we need to comment, given our short period of time, but I did want to acknowledge the work that you are doing outside of this debate, about, who has the obligation to try and make the program more transparent, to try and work cooperatively with the CFTC, to guarantee minimization of speculation and fraud.

Ms. MCCABE. Yes. Thank you, Senator. We are looking at those opportunities every day, to try to provide more transparency.

Senator LANKFORD. The only thing worse than a RIN is fake RIN, and that is what takes it away. [Laughter.]

Senator HEITKAMP. Yes. Buy a fake RIN, that is pretty miserable.

Senator LANKFORD. The last question that I have, unless you all had other comments, as well, Ms. McCabe, you and I, when we spoke last, you were in the process of dealing with the requirements for ozone in the ambient air quality, at the same time that you are dealing with the RFS, and we talked about the conflict between the two. Help me catch up on where that conversation is going right now, because, as you produce more ethanol it produces more ozone in those areas in the production part of it, at the same time we are dealing with reducing ozone nationwide as well.

Ms. MCCABE. Yes. So back in 2010, when we did our analysis, when we put the rule in place, we did note that there were places and times where ozone air quality could be increased. It is not uniform, it is not across the board, it is not necessarily in places where the ozone standard is not met already, so those are all complicating factors.

And, Senator, I think we are about where we were last time, which is that States and cities are working to meet the ozone standard. Most of those areas that are ozone non-attainment areas are large metropolitan areas, and so the contributors to ozone are

overwhelmingly motor vehicles, generally, industry power plants, and large emitters. But I am certainly not denying that we have found that there could be some increases in ozone as a result of ethanol.

Senator LANKFORD. I did notice, as well, that you and others had very different—the EIA had a number for what is E-0, at quite a bit higher, while you all have estimated what the E-0 number is as well. I think we are around 200 million and they were somewhere around five billion or something.

Ms. MCCABE. Yes. It was order of magnitude. So that is the kind of discrepancy that gets people sitting down and talking to one another, which we did, and worked out that we were looking at different points in the process. So we were looking at the retail level. Their numbers were reflecting a point higher up in the supply chain.

So we feel we have resolved that discrepancy between the two agencies.

Senator LANKFORD. I would assume, then, the higher number still is used in the United States, or the lower number is what is used in the United States?

Ms. MCCABE. We were looking at what is used at retail, what is expected to be needed at retail—

Senator LANKFORD. Right.

Ms. MCCABE [continuing]. In terms of people buying E-0, as opposed to E-0 somewhere else in the supply chain then being blended later.

Senator LANKFORD. OK.

Ms. MCCABE. If that makes sense.

Senator LANKFORD. It does make sense then.

Any other final comments that the two of you need to make, that we did not cover?

Ms. MCCABE. Nope.

Senator LANKFORD. Mr. Rusco, your report is very thorough. I appreciate that. And hopefully in the days ahead we can get some good consistency on numbers and costs, because that is one of the areas that is missing, still, is to try to figure out this number—what does it really cost the consumer? We have some estimates but industry has not been able to do an estimate, we have not been able to get an independent estimate, and we are all kind of guessing what that would be at this point, based on some numbers that are several years old.

And so it would be extremely helpful for us to be able to get a good snapshot, even if it was literally grabbing one day a month for a year, and then just snapshotting those days, this is what the estimated cost would be with or without the mandate, or with or without ethanol, because I would assume some days that it is less expensive, and it depends on the price of oil at that time. But I would also assume many days it is more expensive, especially with a lower oil price right now, with what we have.

So hopefully in the days ahead we can get that kind of number. Any final comments?

Senator HEITKAMP. No. Thank you.

Senator LANKFORD. Thank you, both. Let me see if I have got a very formal closing statement for you to be able to make.

That concludes today's hearing. There is my formal statement. I would like to thank the witnesses for their testimony. The hearing record will remain open for 15 days until the close of business on December 16, for submission of statements and questions for the record.

What that, this hearing is adjourned.

[Whereupon, at 3:50 p.m., the Subcommittee was adjourned.]

APPENDIX



December 1, 2016

Opening Statement of Senator James Lankford

Homeland Security and Governmental Affairs Subcommittee on Regulatory Affairs and Federal Management Hearing titled:

“Examining Two GAO Reports Regarding the Renewable Fuel Standard”

Good afternoon. I want to welcome everyone to today’s Subcommittee hearing titled “Examining Two GAO Reports Regarding the Renewable Fuel Standard.” Today is this subcommittee’s second hearing on the Renewable Fuel Standard, and my fourth hearing on this topic since being elected to Congress. I am committed to continuing oversight of the RFS until we find a solution for this deeply flawed program.

In 2005, Congress established the RFS with the goals of reducing our nation’s dependence on foreign oil and lowering greenhouse gas emissions by mandating that biofuels be blended with domestic transportation fuel in increasing volumes through the year 2022. After that time, the Environmental Protection Agency will have wide latitude to decide the volume of biofuels that must be blended into the gasoline supply.

However, the situation has changed dramatically since the RFS’s enactment in 2005 and subsequent 2007 revision. Demand for oil in the transportation sector is lower than originally predicted, in part due to heightened fuel economy standards and sluggish economic growth. Further, given the substantially increased domestic oil production resulting from the shale oil boom, the U.S. also imports much less oil than initially forecasted.

Through a series of hearings, I have worked to determine the structure and viability of the RFS to achieve its goals. Specifically, I have tried to understand the RFS through the eyes of the EPA and appreciate how difficult it is for the agency to administer the program. Congress created the unworkable RFS formula—EPA is left trying to make it work anyway.

EPA is required to release the final volumes of biofuels to be blended into the gasoline supply by November 30 of the preceding year to allow industry participants and other stakeholders to comply and plan for the future. Between 2009 and 2015, EPA failed to meet this November 30 deadline and only finally released final mandated volumes for 2014 through 2016 on November 30, 2015—one year late for the 2015 final volumes and two years late for the 2014 final volumes.

I would like to recognize that EPA released its 2017 volumes on November 23rd, thus meeting the statutory deadline.

1

Recognizing the difficulties the EPA faces with the RFS, on April 6, 2015 I asked GAO to examine the viability of the RFS and determine whether the program will be able to meet its goals in the future. It has taken GAO approximately nineteen months to conduct a thorough independent analysis of the RFS and finalize its conclusions. In order to reach its conclusions, GAO, in coordination with the National Academy of Sciences, convened a group of stakeholder experts from industry, academia, and the non-profit sector to produce two reports on the RFS, both of which were released on Monday, November 28, 2016.

GAO's first report determined that advanced biofuels production is unlikely to meet the RFS's increasing production targets. GAO noted that advanced biofuels are still too expensive for stakeholders to produce at necessary levels to meet the RFS's increasing targets through 2022. Even with government funded R&D and mandated subsidies. Despite the federal government spending \$1.1 billion between fiscal years 2013 and 2015 for advanced biofuels research and development, GAO determined that advanced biofuels targets are unattainable.

In its second report, GAO concluded that the RFS is unlikely to meet its goal of reducing greenhouse gas emissions. The production of advanced biofuels, which should reduce greenhouse gas emissions, will remain too limited to meet the program's greenhouse gas reduction targets. For example, in 2015, cellulosic biofuel, an advanced biofuel category, was produced at a meager 142 million gallons—less than 5 percent of the statutory target of 3 billion gallons.

This hearing will give GAO the opportunity to present its findings on the RFS from these two reports and for the EPA to comment on the findings. With the release of the GAO reports we have an independent government auditor's findings that confirm the stances many in Congress, including myself, have come to hold – that is the RFS is not sustainable and will not meet its intended goals. This program yields few benefits but it inflicts substantial costs on consumers.

Rather than continuing with an unwieldy program which consistently fails to meet its targets and goals, it is time for Congress, the next Administration, and the American public to do away with the RFS. Last year Congress admitted that the education mandates in No Child Left Behind did more harm than good, so we repealed the law and implemented the Every Student Succeeds Act. I believe, it is time that we do the same for the Renewable Fuel Standard.

I am delighted to have the EPA's Ms. Janet McCabe and GAO's Mr. Frank Rusco here today as witnesses to engage in a productive discussion on the RFS. I look forward to continuing this Subcommittee's oversight of the RFS with my colleagues and our witnesses today.

With that, I now recognize Ranking Member Heitkamp for her opening statement.

United States Government Accountability Office



Testimony

Before the Subcommittee on Regulatory
Affairs and Federal Management,
Committee on Homeland Security and
Governmental Affairs, U.S. Senate

For Release on Delivery
Expected at 2:30 p.m. ET
Thursday, December 1, 2016

RENEWABLE FUEL STANDARD

Program Unlikely to Meet Production or Greenhouse Gas Reduction Targets

Statement of Frank Rusco, Director, Natural Resources
and Environment

GAO Highlights

Highlights of GAO-17-264T, a testimony before the Subcommittee on Regulatory Affairs and Federal Management, Committee on Homeland Security and Governmental Affairs, U.S. Senate

Why GAO Did This Study

Since 2006 the RFS has required that transportation fuels—typically gasoline and diesel—sold in the United States be blended with increasing volumes of biofuels to meet environmental and energy goals. Annual targets for the volumes of biofuels to be blended are set by statute. EPA is responsible for adjusting the statutory targets through 2022 to reflect expected U.S. industry production levels, among other factors, and for setting volume targets after 2022. Biofuels included in the RFS are either conventional (primarily corn-starch ethanol) or advanced biofuels (e.g., cellulosic ethanol and biomass-based diesel). Advanced biofuels emit fewer greenhouse gases than petroleum-based fuels and corn-starch ethanol.

In November 2016, GAO issued two reports on the RFS. This testimony is based on those two reports: GAO-17-94 and GAO-17-108. It provides information on whether the RFS is expected to meet its production and other targets, as well as expert views on any federal actions that could improve the RFS framework, among other things.

For the reports on which this testimony is based, GAO analyzed legal requirements and EPA data. In addition, GAO worked with the National Academy of Sciences to convene a meeting of experts from industry, academia, and research organizations in May 2016. GAO also contracted with the National Academy of Sciences for a list of experts on issues related to the RFS. Further information on how GAO conducted its work is contained in the reports.

View GAO-17-264T. For more information, contact Frank Rusco at (202) 512-3841 or ruscof@gao.gov

December 1, 2016

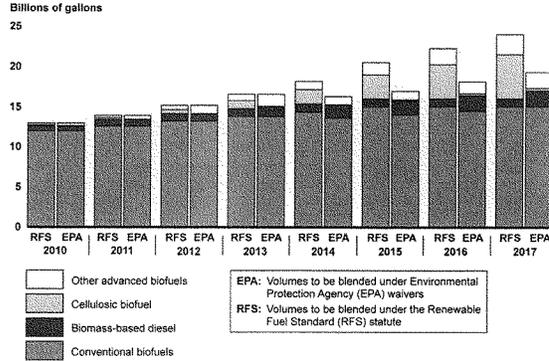
RENEWABLE FUEL STANDARD

Program Unlikely to Meet Production or Greenhouse Gas Reduction Targets

What GAO Found

It is unlikely that the goals of the Renewable Fuel Standard (RFS)—to reduce greenhouse gas emissions and expand the nation's renewable fuels sector while reducing reliance on imported oil—will be met as envisioned because there is limited production of advanced biofuels and limited potential for expanded production by 2022. Advanced biofuels, such as cellulosic ethanol and biomass-based diesel, achieve greater greenhouse gas reductions than conventional biofuels (primarily corn-starch ethanol), but the latter account for most of the biofuel blended into domestic transportation fuels under the RFS. As a result, the RFS is unlikely to achieve the targeted level of greenhouse gas emissions reductions. For example, the cellulosic biofuel blended into the transportation fuel supply in 2015 was less than 5 percent of the statutory target of 3 billion gallons. Partly as a result of low production of advanced biofuels, the Environmental Protection Agency (EPA), which administers the RFS in consultation with other agencies, has reduced the RFS targets for such fuels through waivers in each of the last 4 years (see figure). According to experts GAO interviewed, the shortfall of advanced biofuels is due to high production costs. The investments required to make these fuels more cost-competitive with petroleum-based fuels, even in the longer run, are unlikely in the current investment climate, according to experts.

Volumes of All Biofuels to Be Blended into Domestic Transportation Fuel, as Set by the Renewable Fuel Standard Statute and by EPA, 2010 through 2017



Source: GAO analysis of legal requirements and EPA data. | GAO-17-264T

Chairman Lankford, Ranking Member Heitkamp, and Members of the Subcommittee:

I am pleased to be here today to discuss our recent work on advanced biofuels and the Renewable Fuel Standard (RFS). As you know, since 2006, the RFS has required that transportation fuels—typically gasoline and diesel—sold in the United States contain annually increasing amounts of renewable fuels to achieve key environmental and energy goals.¹ For conventional renewable fuels, primarily ethanol derived from corn starch, the amount blended into transportation fuels has nearly reached the maximum called for under the RFS. To count toward this target amount, conventional renewable fuels are generally required to reduce greenhouse gas emissions by 20 percent compared with petroleum-based fuels.² Additional increases in the use of renewable fuels are to come from advanced biofuels, a category that the RFS requires to reduce life-cycle greenhouse gas emissions by at least 50 percent compared with petroleum-based fuels. However, production of advanced biofuels, such as cellulosic biofuels, has not kept pace with targets in the RFS.

In this context, my testimony today discusses the findings from our two November 2016 reports on the RFS. Accordingly, it provides information on (1) how the federal government has supported advanced biofuels research and development (R&D) in fiscal years 2013 through 2015 and where its efforts have been targeted, (2) expert views on the extent to which advanced biofuels are technologically understood and the factors that will affect the speed and volume of production,³ (3) whether the RFS is expected to meet its goals, (4) expert views on any federal actions that

¹The Environmental Protection Agency, which is responsible for implementing the RFS, defines the goals of the RFS as to (1) reduce greenhouse gas emissions and (2) expand the nation's renewable fuel (or biofuel) sector while reducing reliance on imported oil.

²Corn-starch ethanol plants that were in operation or under construction before December 19, 2007, are not subject to the requirement to reduce greenhouse gas emissions by at least 20 percent.

³GAO, *Renewable Fuel Standard: Low Expected Production Volumes Make It Unlikely That Advanced Biofuels Can Meet Increasing Targets*, GAO-17-108 (Washington, D.C.: Nov. 28, 2016).

could improve the RFS, and (5) policy alternatives experts suggested to better meet the goals of the RFS in the future.⁴

To conduct this work, we worked with the National Academy of Sciences to convene a meeting of experts from industry, academia, and research organizations in May 2016. We also contracted with the National Academy of Sciences for a list of experts on issues related to the RFS. We analyzed the content of the experts' responses to our questions, coding their responses into categories pertinent to our objectives. In addition, we reviewed the public comments from stakeholders, relevant legislation, and agency documents pertaining to annual volume requirements. We also interviewed officials from the Departments of Agriculture (USDA), Defense (DOD), and Energy (DOE); the Environmental Protection Agency (EPA); and the National Science Foundation (NSF). Our November 2016 reports include detailed explanations of the methods used to conduct our work. We conducted the work on which this testimony is based in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

Congress established the RFS as part of the Energy Policy Act of 2005, in response to concerns about the nation's dependence on imported oil. The RFS initially required that a minimum of 4 billion gallons of renewable fuels be blended into transportation fuels in 2006, ramping up to 7.5 billion gallons by 2012. Two years later, the Energy Independence and Security Act of 2007 (EISA) increased and expanded the statutory target volumes for renewable fuels and extended the ramp-up period through 2022. More specifically, the act established overall target volumes for renewable fuels that increase from 9 billion gallons in 2008 to 36 billion

⁴GAO, *Renewable Fuel Standard: Program Unlikely to Meet Its Targets for Reducing Greenhouse Gas Emissions*, GAO-17-94 (Washington, D.C.: Nov. 28, 2016).

gallons in 2022. The EISA volumes can be thought of in terms of two broad categories: conventional and advanced biofuels.⁵

Conventional biofuel: Biofuels from new facilities must achieve at least a 20-percent reduction in greenhouse gas emissions, relative to 2005 baseline petroleum-based fuels. The dominant biofuel produced to date is conventional corn-starch ethanol, although recently some conventional biodiesel has entered the fuel supply.

Advanced biofuel: Biofuels, other than ethanol derived from corn starch must achieve at least a 50-percent reduction in life-cycle greenhouse gas emissions, as compared with 2005 baseline petroleum-based fuels. Advanced biofuel is a catch-all category that may include a number of fuels, including those made from any qualified renewable feedstock that achieves at least a 50-percent reduction in lifecycle greenhouse gas emissions, such as ethanol derived from cellulose, sugar, or waste material. This category also includes the following.

- **Biomass-based diesel:** Advanced biomass-based diesel must have life-cycle greenhouse gas emissions at least 50 percent lower than traditional petroleum-based diesel fuels.
- **Cellulosic biofuel:** Advanced biofuel derived from any cellulose, hemicellulose, or lignin that is derived from renewable biomass must have life-cycle greenhouse gas emissions at least 60 percent lower than traditional petroleum-based fuels.⁶ This category of fuel may include cellulosic ethanol, renewable gasoline, cellulosic diesel, and renewable natural gas from landfills that can be used to generate electricity for electric vehicles or used in vehicles designed to run on liquefied or compressed natural gas.

⁵The statutory categories are renewable fuel, advanced biofuel, cellulosic biofuel, and biomass-based diesel. Conventional biofuels are defined as renewable fuels that are ethanol derived from corn starch. A fuel may qualify for one or more categories for purposes of meeting the volume requirements. For example, cellulosic biofuel may be used to meet the cellulosic biofuel volume requirement, the advanced biofuel requirement, and the renewable fuel requirement. However, conventional biofuels such as corn-based ethanol count toward meeting only the renewable fuel volume requirement.

⁶Plant biomass is made up primarily of cellulose, hemicellulose, and lignin. Cellulose and hemicellulose are made up of potentially fermentable sugars. Lignin provides the structural integrity of plants by enclosing the tightly linked cellulose and hemicellulose molecules, which makes these molecules harder to reach.

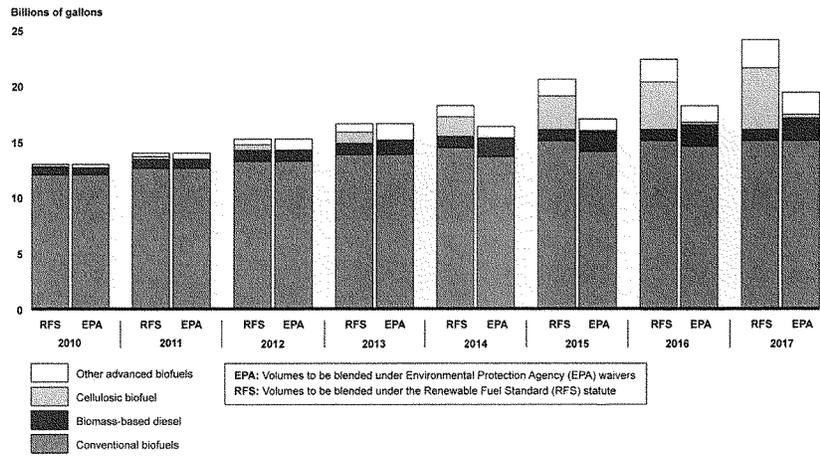
EPA administers the RFS in consultation with DOE and USDA. EPA's responsibilities for implementing the RFS include setting annual volume requirements. Each year, by November 30, EPA is required to establish via rulemaking the volumes of biofuel that must be blended into transportation fuels during the following calendar year (volume requirement).⁷ The statute provides EPA with waiver authority to set volumes below the targets specified in the statute under certain circumstances, such as when there is inadequate domestic supply.⁸ The structure of the volume targets emphasized conventional biofuels in the early years covered by the statute, while providing lead time for the development and commercialization of advanced, and especially cellulosic, biofuels. However, these fuels have not been produced in sufficient quantities to meet statutory targets through 2016. As a result, since 2010, EPA has used its waiver authority to deviate from the statutory target volumes and has reduced the volume requirement for cellulosic biofuel every year, citing inadequate domestic supply, among other things (see fig. 1).⁹

⁷42 U.S.C. § 7545(o)(3)(B).

⁸42 U.S.C. § 7545(o)(7).

⁹The law provides that for any calendar year for which the projected volume of cellulosic biofuel production is less than the statutory volume, the Administrator of EPA must reduce the applicable volume of cellulosic biofuel to the projected volume available during that calendar year. 42 U.S.C. § 7545(o)(7)(D)(i).

Figure 1: Volumes of All Biofuels to Be Blended into Domestic Transportation Fuel, As Set by the Renewable Fuel Standard Statute and by EPA, 2010 through 2017



Source: GAO analysis of legal requirements and EPA data. | GAO-17-264T

Note: Although the figure lists "conventional biofuels" as a separate category, the statute includes conventional biofuels as part of the broader category of "renewable fuel"; thus, other categories of fuels could be used to meet the requirement for this category.

Further, in December 2015—when EPA finalized the volume requirements for 2014, 2015, and 2016—the agency reduced the total renewable fuel requirement for those years.¹⁰ Effectively, this meant that EPA reduced the amount of conventional biofuels required under the program relative to statutory targets for those years. In this case, EPA cited constraints in the fuel market's ability to accommodate increasing volumes of ethanol. EPA's use of this waiver authority has been controversial among some RFS stakeholders, and EPA's 2015

¹⁰In December 2015, when EPA finalized its volume requirement for 2016, it retroactively established volumes for 2014 and 2015. *Renewable Fuel Standard Program: Standards for 2014, 2015, and 2016 and Biomass-Based Diesel Volume for 2017; Final Rule*, 80 Fed. Reg. 77420 (2015).

requirement currently faces legal challenges from multiple parties. However, in the volume requirement it finalized in November 2016, EPA effectively set the amount of conventional biofuels required under the program at 15 billion gallons, equal to the statutory target for 2017 (see fig.1).¹¹

Supported through Direct Research or Grants, Federal R&D Related to Advanced Biofuels Is Shifting toward Drop-In Fuels

In our November 2016 report, we found that the federal government has supported R&D related to advanced biofuels through direct research or grants, and the target of this R&D is shifting away from cellulosic ethanol and toward drop-in biofuels.¹² Unlike corn-starch-based or cellulosic ethanol, drop-in fuels, such as renewable gasoline, are fully compatible with existing infrastructure, such as vehicle engines and distribution pipelines. In fiscal years 2013 through 2015, the federal government obligated more than \$1.1 billion for advanced biofuels R&D. Of this amount, DOE obligated over \$890 million. For example, DOE's Office of Science funds three bioenergy research centers affiliated with universities and national laboratories that conduct basic research for all stages of biofuel production. In addition, USDA obligated over \$168 million in fiscal years 2013 through 2015 to support advanced biofuels. For example, USDA scientists developed a novel process to increase production of butanol, a drop-in fuel that lowered production costs by over 20 percent. The remaining federal obligations during these years were through EPA, DOD, and NSF, which obligated less for such R&D. According to agency officials, agencies are shifting their focus to drop-in fuels in part because these fuels are compatible with existing infrastructure. Officials from one federal funding agency said this compatibility makes drop-in fuels more desirable than cellulosic ethanol.

¹¹Renewable Fuel Standard Program: Standards for 2017 and Biomass-Based Diesel Volume for 2018; Proposed Rule, 81 Fed. Reg. 34778 (2016). The EPA Administrator signed the final rule on November 23, 2016.

¹²GAO-17-108

**Experts Agreed
Several Advanced
Biofuels Are
Technologically Well
Understood but Cited
Factors That Make It
Challenging to
Significantly Increase
Production**

As we reported in November 2016, experts told us that the technology to produce several advanced biofuels is well understood but noted that among those currently being produced there is limited potential for increased production in the near term.¹³ Experts further cited multiple factors making it challenging to significantly increase the speed and volume of production. In addition, current advanced biofuel production is far below overall RFS target volumes, and those volumes are increasing every year. Consequently, it does not appear possible to meet statutory target volumes for advanced biofuels in the RFS under current market and regulatory conditions.

Biofuels that the experts identified as being technologically well understood include biodiesel, renewable diesel, renewable natural gas, cellulosic ethanol, and some drop-in fuels. A few of these fuels are being produced in significant volumes, but the overall volume being produced falls short of the volume target in the RFS. For example, in 2015, about 3.1 billion ethanol equivalent gallons of advanced biofuels were produced, falling short of the statutory target of 5.5 billion gallons for that year. By 2022, the advanced biofuels target increases to 21 billion gallons, so production would have to rapidly increase to meet this target. Even though a few of these fuels, such as biodiesel and renewable diesel, are being produced in significant volumes, it is unlikely that production of these fuels can expand much in the next few years because of feedstock limitations. Current production of cellulosic biofuels is far below the statutory volume targets and, according to the experts, there is limited potential for expanded production to meet future higher targets, in part because production costs are currently too high. Experts told us that technologies to produce other fuels, such as some drop-in fuels, are well understood, but that those fuels are not being produced because production is too costly.

Experts identified a number of factors that will affect the speed and volume of advanced biofuel production, including the following.

- **The low price of fossil fuels relative to that of advanced biofuels.** This disparity in price is a disincentive for consumers to adopt greater use of biofuels and also a deterrent for private investors entering the advanced biofuels market.

¹³GAO-17-108

- **Uncertainty about government policy, including whether the RFS and federal tax credits that support advanced biofuels will continue to be in effect.** While such policies should encourage investment, investors do not see them as reliable and thus discount their potential benefits when considering whether to invest.
- **High cost of converting cellulosic feedstocks.** These costs include transporting and handling feedstocks, processing them into a fuel, and disposing of wastes, among other things.
- **Time and cost to bring a new technology to commercial-scale production.** The timeline to bring a new technology from laboratory scale to commercial scale is 12 years if everything works well, and it can be considerably longer.
- **Time and cost to secure fuel certification and acceptance.** Before a fuel is brought to market, it must go through regulatory registration, certification by ASTM International, and other testing.¹⁴
- **Underdeveloped feedstock supply chain.** Lack of logistics for the entire feedstock supply chain—from securing a contract to delivering and storing a feedstock—is an economic barrier to the production of advanced biofuels.

The RFS Is Expected to Fail Short of Its Goals Because of Limited Production of Advanced Biofuels and Reliance on Conventional Corn-Starch Ethanol

As we found in our November 2016 report, it is unlikely that the goals of the RFS—reduce greenhouse gas emissions and expand the nation’s renewable fuels sector—will be met as envisioned because there is limited production of advanced biofuels and limited potential for expanded production by 2022.¹⁵ Advanced biofuels achieve greater greenhouse gas reductions than conventional biofuels, although the latter account for most of the biofuel blended into domestic transportation fuels under the RFS. As a result, the RFS is unlikely to achieve greenhouse gas emissions reductions as envisioned. For example, the cellulosic biofuel blended into the domestic transportation fuel supply in 2015 was less than 5 percent of the statutory target of 3 billion gallons. Partly as a result of low production of advanced biofuels, EPA has reduced the RFS targets for such fuels through waivers in each of the last 4 years. According to experts we interviewed, the shortfall of advanced biofuels is the result of high

¹⁴Regulatory registration takes place with EPA’s Office of Transportation and Air Quality, which requires submission of information about a fuel’s potential impact on public health and other information. ASTM International is an international organization that defines and sets standards for various industries and specifications for products, including biofuels.

¹⁵GAO-17-94.

production costs, and the investments in further R&D required to make these fuels more cost-competitive with petroleum-based fuels, even in the longer run, are unlikely in the current investment climate.

Given the relative scarcity of advanced biofuels, most of the biofuel blended under the RFS to date has been conventional corn-starch ethanol, which achieves smaller greenhouse gas emission reductions than advanced biofuels. The use of corn-starch ethanol has been effectively capped at 15 billion gallons. As a result, expanded use of biofuels will require increasing use of advanced biofuels, and experts told us the most likely advanced biofuel to be commercially produced in the near- to mid-term will be cellulosic ethanol. However, the ability to add ethanol to the transportation fuel market to meet expanding RFS requirements is limited by the incompatibility of ethanol blends above E10 (up to 10 percent ethanol) with the existing vehicle fleet and fueling infrastructure.¹⁶ Many experts and stakeholders refer to this infrastructure limitation as the "blend wall." If ethanol continues to be the primary biofuel produced to meet the RFS, these infrastructure limitations will have to be addressed.

Several experts raised concerns about the extent to which the RFS is achieving its goal for reducing greenhouse gas emissions, given that most biofuel blended under the RFS is corn-starch ethanol. More specifically, some experts were critical of the life-cycle analysis EPA used to determine the greenhouse gas emissions reductions for corn-starch ethanol. Further, corn-starch ethanol plants that were in operation or under construction before December 19, 2007, are not subject to the requirement to reduce greenhouse gas emissions by at least 20 percent. According to an August 2016 EPA Inspector General report, grandfathered production that is not subject to any greenhouse gas reduction requirements was estimated to be at least 15 billion gallons, or over 80 percent of today's RFS blending volume.¹⁷ Moreover, some experts told us that the RFS creates a perverse incentive to import Brazilian sugarcane ethanol. Specifically, because sugarcane ethanol qualifies as an advanced biofuel, it is more profitable to import this fuel than to domestically produce advanced biofuels. According to these

¹⁶Fuel retailers sell specific blends of gasoline and ethanol: E10 (up to 10 percent ethanol); E85 (51 to 85 percent ethanol); and, less typically, E15 (15 percent ethanol).

¹⁷Environmental Protection Agency, Office of Inspector General, *EPA Has Not Met Certain Statutory Requirements to Identify Environmental Impacts of Renewable Fuel Standard*, 16-P-0275 (Washington, D.C.: Aug. 18, 2016).

experts, the import of sugarcane ethanol, which occurs to meet RFS requirements, causes significant greenhouse gas emissions as a result of fuel burned during shipping.

Experts Suggested Multiple Federal Actions That Could Improve the RFS Framework by Incrementally Encouraging Investment in Advanced Biofuels

As we reported in November 2016, while advanced biofuels are not likely to be produced in sufficient quantities to meet the statutory targets, experts identified actions that they suggested could improve the existing RFS framework by incrementally increasing investment in advanced biofuels, which may lead to greater volumes of these fuels being produced and used in the longer term.¹⁸ For example, some experts stated that the Second Generation Biofuel Producer Tax Credit—an incentive to accelerate commercialization of fuels in the advanced and cellulosic biofuels categories—has expired and been reinstated (sometimes retroactively) about every 2 years, contributing to uncertainty among cellulosic fuel producers and investors. One expert told us that investment in cellulosic biofuels could be encouraged, in part, by maintaining the Second Generation Biofuel Producer Tax Credit consistently, rather than allowing it to periodically lapse and be reinstated.

In addition, experts identified actions to increase compatibility of infrastructure with higher ethanol blends. For example, several experts suggested that expanding grants to encourage infrastructure improvements, such as USDA's Biofuel Infrastructure Partnership, could increase both the availability and competitiveness of higher blends at retail stations nationwide. Through this partnership, USDA is investing \$100 million to install nearly 5,000 pumps offering high-ethanol blends in 21 states. However, some experts also said that blender pumps are not being installed with the density required to test demand. One expert suggested that, instead of installing blender pumps at all the transportation fuel stations of a certain brand in a region, blender pumps should be installed at all the stations at a specific road intersection. That way, these stations would be forced to compete with each other, which this expert told us would result in more competitive prices at the pump and increased incentives to improve fueling infrastructure.

¹⁸GAO-17-94.

Experts Suggested Policy Alternatives That Could More Efficiently Reduce Greenhouse Gas Emissions

As we reported in November 2016, several experts stated that the RFS is not the most efficient way to achieve the environmental goal of reducing greenhouse gas emissions, and they suggested policy alternatives—in particular, a carbon tax and a low carbon fuel standard (LCFS).¹⁹ Several experts suggested that these alternatives would be more efficient at reducing greenhouse gas emissions. Specifically, some experts said that, whereas the RFS creates disincentives for the production of cellulosic fuels that achieve the greatest reductions in greenhouse gas emissions, a carbon tax or LCFS would incentivize the technologies that achieve the greatest such reductions at the lowest cost. Under a carbon tax, each fossil fuel would be taxed in proportion to the amount of greenhouse gas (carbon dioxide) released in its combustion. In addition, one expert stated that a carbon tax is preferable to the RFS because it allows market effects to increase the price of emission-causing activities, which decreases demand for those activities. As a result, a carbon tax could sustain consumers' interest in fuel-saving vehicles and result in a wide range of fuel-saving responses from all consumers (rather than just those purchasing a new vehicle). However, some experts also noted that a carbon tax would force further electrification of the light-duty vehicle fleet because the electric power sector is the cheapest sector from which to obtain greenhouse gas reductions. According to one expert, this electrification of the light-duty fleet might further limit biofuels R&D, in effect undermining the RFS goal to expand that sector.

In light of these concerns, several experts said that an LCFS would be more flexible and efficient than the RFS or a carbon tax at developing biofuels that achieve the greatest greenhouse gas reductions.²⁰ Specifically, an LCFS accounts for carbon in a given fuel on a cost per unit of carbon intensity, thereby supporting incremental carbon reductions. An LCFS can be implemented in one of two ways. The first involves switching to direct fuel substitutes (e.g., drop-in fuels) or blending biofuels with lower greenhouse gas emissions directly into gasoline and diesel fuel. The second involves switching from petroleum-based fuels to other alternatives, such as natural gas, hydrogen, or electricity, because an LCFS would allow a wider array of fuel pathways than the RFS. Under

¹⁹GAO-17-94

²⁰For example, the California Low Carbon Fuel Standard requires a 10-percent reduction in the carbon intensity of fuels in the State of California by 2020. It requires fuel suppliers to reduce the expected lifecycle greenhouse gas emissions from motor fuels on the basis of the fuels' energy content. In this way, the greenhouse gas intensity of transportation fuels decreases, regardless of the growth in transportation or fuel demand.

the first scenario, an LCFS would promote biofuel usage, rather than incentivizing electrification of the light-duty vehicle fleet. As a result, according to some experts, an LCFS is preferable to a carbon tax because it more efficiently reduces greenhouse gas emissions and promotes the expansion of the biofuel sector. However, other experts we spoke with critiqued an LCFS as being uneconomical. Specifically, one expert stated that, while an LCFS such as the one in California could force technology and create greenhouse gas reductions in the fuel market, the costs of implementing an LCFS are much higher than its benefits.

Chairman Lankford, Ranking Member Heitkamp, and Members of the Subcommittee, this concludes my prepared statement. I would be pleased to answer any questions that you may have at this time.

**GAO Contact and
Staff
Acknowledgments**

If you or your staff members have any questions concerning this testimony, please contact Frank Rusco, Director, Natural Resources and Environment, at (202) 512-3841 or ruscof@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement. Other individuals who made key contributions to this testimony include Karla Springer, Assistant Director; Jesse Lamarre-Vincent; Marietta Revesz; and Jarrod West.

Janet McCabe
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

Committee on Homeland Security and Government Affairs
Subcommittee on Regulatory Affairs and Federal Management
U.S. Senate
December 1, 2016

Statement

Chairman Lankford, Ranking Member Heitkamp, and other members of the Subcommittee, 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 2017, and the biomass-based diesel volume requirement for 2018.

The RFS program began in 2006 under the Energy Policy Act of 2005, and was subsequently 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.

The Clean Air Act 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, and must be issued by November 30th of each year for the following year and 14 months in advance for the biomass-based diesel category.

The EPA is committed to successful implementation of the RFS program, and the past year has been an active and productive one for the program.

One of our chief priorities has been timely issuance of the annual volume rules, and we have stayed on schedule for the 2017 rule, which we finalized just last week. The final rule incorporates the most up-to-date data available to us, and is informed by written stakeholder comments, by input provided during a public hearing held this year in Kansas City, Missouri, and by our consultation with the Departments of Energy and Agriculture.

The 2017 volume final rule established requirements for cellulosic, advanced, and total renewable fuel for 2017 and also includes a biomass-based diesel volume requirement for 2018. The 2017 final rule once again establishes ambitious but achievable targets for the RFS program, and becomes part of what is now a multi-year track record of growth. As finalized, total renewable fuel volumes would grow by nearly 1.2 billion gallons between 2016 and 2017. Advanced renewable fuel – which requires a minimum fifty percent lifecycle greenhouse gas (GHG) emissions reduction – would grow by nearly 700 million gallons from 2016 to 2017. While Congress did not establish specific goals for non-advanced (or “conventional”) biofuels, the established targets for total and advanced mean that conventional biofuels would reach 15 billion gallons. The 2017 final rule achieves that level.

Biomass-based biodiesel – which must achieve at least 50 percent lifecycle emissions reductions – would grow by at least 100 million gallons from 2017 to 2018, and the final 2018 standard is more than double the Congressionally-mandated minimum level of one billion gallons. Finally, cellulosic biofuel – which requires 60 percent lifecycle carbon emissions reductions – would grow by 81 million gallons, or 35 percent, between 2016 and 2017.

Beyond the volume rule, the Agency remains active in multiple other areas of the program, and I'd like to briefly mention two of them. On November 16, we published the "Renewables Enhancement and Growth Support" proposed rule, a collection of proposed revisions to the fuel regulations that will support market growth of advanced and other biofuels in the U.S. That proposal, among other things, would establish an updated regulatory structure that would allow biofuel producers to partially process renewable feedstocks at one facility and further process them into renewable fuels at another facility under existing pathways. This would improve the economics and efficiency for the production of biofuels, particularly advanced and cellulosic fuels that have lower GHG footprints. This proposal strongly reflects input we've received from many stakeholders in recent years and we are looking forward to people's comments.

The second thing to mention is that over the past year, EPA has received several petitions from RFS stakeholders asking us to change the point of obligation under the program. Currently, refiners and importers of gasoline and diesel are the regulated parties under the RFS program, and certain stakeholders have asked us to initiate a rulemaking to change the point of regulation to a point further downstream, such as blenders. We have had a lot of input on this issue from a wide range of stakeholders, with widely divergent views. On November 10, 2016, we issued a proposed denial of these petitions that examines this issue in depth and provides an opportunity for the public to provide comment to the agency. We encourage all stakeholders to review our assessment of this issue and provide comments and data to the agency.

On November 28, 2016, the Government Accountability Office (GAO) released two reports relevant to the RFS program, one of which focused on federal biofuel R&D efforts and one that looked more generally at challenges in implementing the RFS program. EPA provided GAO with responses to drafts of both reports, and those responses are included in GAO's final reports, which were made available to the public on November 28. Broadly speaking, the GAO's reports examine the challenges associated with reaching greater levels of advanced biofuel production and achieving Congress's GHG reduction targets. As we

discuss in our response letters, EPA agrees with many of the identified challenges, including limited production of cellulosic biofuels currently and limited potential for expanded cellulosic fuel production by 2022.

EPA recognizes that both opportunities and challenges 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.

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

November 30, 2016

The Honorable Gina McCarthy
Administrator
Environmental Protection Agency
William Jefferson Clinton Federal Building
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

Dear Administrator McCarthy,

The undersigned associations represent a significant majority of participants across the United States' transportation fuels value chain. While each association has an individual, unique position – often conflicting – regarding the broader Renewable Fuel Standard (RFS) program, we write to express our unified position in opposition to efforts by petitioners to move the point of obligation for RFS compliance. It is unprecedented for all of these undersigned groups to unite in a single letter to express a uniformly held position.

Each of the undersigned associations strongly supports the Environmental Protection Agency's (EPA) proposed denial of petitions for a rulemaking to change the point of obligation under the RFS. There is no sound public policy rationale for moving the point of obligation and further, such a change would add complexity and uncertainty to the current RFS program.

We urge EPA to finalize its conclusion and deny the petitions to move the point of obligation.

Sincerely,





National Biodiesel Board 605 Clark Ave. PO Box 104898 Jefferson City, MO 65110-4898 (800) 841-5849 phone (573) 635-7913 fax	National Biodiesel Board 1331 Pennsylvania Ave., NW Suite 505 Washington, DC 20004 (202) 737-8901 phone nbb.org biodiesel.org
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Written Statement of Anne Steckel
Vice President of Federal Affairs, National Biodiesel Board

Senate Committee on Homeland Security & Governmental Affairs
Subcommittee on Regulatory Affairs and Federal Management
United States Senate
Examining Two GAO Reports Regarding the Renewable Fuel Standard
December 1, 2016

Chairman Lankford, Ranking Member Heitkamp, and other members of the Subcommittee, I appreciate the opportunity to provide a written statement regarding two recent reports issued by the Government Accountability Office (GAO) on the Renewable Fuel Standard (RFS) program.

Our comments will focus on our continued efforts to grow the Biomass-based Diesel and Advanced Biofuel categories of the RFS. Biomass-based Diesel – commonly referred to as “biodiesel” – includes both biodiesel and renewable diesel, and qualifies as an Advanced Biofuel under the program. The GAO reports appear to focus on cellulosic biofuels, but, as members of the Subcommittee noted, biodiesel has thrived under the RFS.

In creating and then expanding the RFS, Congress and the Administration of President George W. Bush sought to substantially increase domestic renewable fuel production to reduce our dependence on petroleum, to create jobs and economic activity in a new American energy industry, and to reduce harmful emissions. The law particularly sought to promote the development of Advanced Biofuels – those reducing greenhouse gas emissions by at least 50 percent.

Biodiesel is the first EPA-designated Advanced Biofuel under the program to reach commercial-scale production nationwide. Since the RFS was created, biodiesel has grown from a niche fuel to a commercial-scale industry with a record U.S. market of nearly 2.1 billion gallons last year, and is on pace to reach 2.5 billion gallons this year. U.S. biomass-based diesel is made from an increasingly diverse mix of resources including recycled cooking oil, soybean oil and animal fats. Biodiesel’s growth is proving that Advanced Biofuels are achieving the goals of the RFS.

Those goals are as compelling today as they were when Congress initially created the RFS with overwhelming bipartisan support in 2005. While most of us appreciate the low prices we are currently seeing at the fuel pump, we should not be lured into complacency. All of us know that oil prices rise and fall, often under the influence of nations and cartels that do not have our best interests at heart. We understand that fuel prices will rise again in the not too distant future, and Americans expect our elected officials to work on solutions. We must continue to develop and incentivize alternative fuels to protect American consumers from these price fluctuations, and to ensure that our economy is not overly dependent on a single, globally traded commodity. Doing so requires consistent, long-term policy.

www.nbb.org

www.biodiesel.org

We also must continue to develop new fuels that reduce harmful pollutants, including carbon emissions, which are creating costly public health problems along with tremendous burdens on public infrastructure. And we must incentivize new technologies that create the jobs of the future and keep the United States at the forefront of advances in the energy sector.

The RFS is working to do all of those things in a cost-effective way that helps consumers. The availability of renewable alternatives through the RFS program has resulted in reduces prices at the pump. This is particularly true for biomass-based diesel. Thanks to the market dynamics of the RFS, biodiesel blends are often available on the market at prices lower than petroleum diesel. Petroleum diesel has been cited as a health hazard, and it can have devastating impacts on the environment. Unlike biodiesel, which is non-toxic and biodegradable.

In response to the RFS, the U.S. biomass-based diesel industry has made substantial investments, increasing capacity and diversifying its feedstocks. While existing capacity continues to be underutilized, new investments in expansion and distribution continue to be made. But, certainty is needed to ensure these continued investments. The advanced biofuel industry was setback by the delay in issuing the standards for 2014, 2015 and 2016, and we appreciate the EPA's hard work to get the annual process of establishing volume standards back on track from a timing perspective. While we believe EPA continues to underestimate the availability of advanced biofuels, particularly biomass-based diesel, their program has now shown annual increases from 2.75 billion in 2013 to 4.28 billion in 2017.

The evidence clearly shows that stable, growing biomass-based diesel volumes will help achieve the goals of Congress and the EPA. We believe biodiesel is the cleanest fuel available on a commercial-scale today. According to EPA calculations, which were recently corroborated by similar findings from the California Air Resources Board, biodiesel reduces greenhouse gas emissions by 57 percent to 86 percent when compared to petroleum diesel. Based on the feedstocks used by U.S. producers today, the average reduction is about 81 percent, well above the 60 percent required for cellulosic biofuel. It is important to note that the feedstocks used by biomass-based diesel producers are co-products or waste products, which are obtained from production of other sought after products. It is without question the most successful Advanced Biofuel to date under the RFS, and it has delivered the vast majority of Advanced Biofuel under the program.

We can do more, particularly in a 60-billion-gallon diesel market that continues to grow. The National Biodiesel Board has done a careful review of industry production capacity, feedstock availability and other factors, while GAO appears to have interviewed only one company that produces biodiesel. Dr. John Kruse, the principal and director of quantitative analysis of World Agricultural Economic and Environmental Services, told Biodiesel Magazine, that an abundant and expanding supply of vegetable oils exists.¹ For example, U.S. soybean yields have been at record levels the past four years, further increasing the supply of soybean meal and oil. As Dr. Kruse noted, "[s]ometimes it is forgotten that

¹ Ron Kotrba, *GAO RFS reports paint an incomplete picture of advanced biofuels*, Biodiesel Magazine, Nov. 29, 2016, <http://www.biodieselmagazine.com/articles/1899085/gao-rfs-reports-paint-incomplete-picture-of-advanced-biofuels>.

soybean oil is primarily a byproduct of soybean crush and that the soybean market has and will continue to be driven by the demand for soybean meal.”²

It is important to recognize, however, that the U.S. biodiesel industry has demonstrated the ability to diversify its feedstocks significantly over the past few years. Distillers corn oil (DCO) is a prime example of a new and growing source. Dr. Kruse sees “corn oil extraction yields growing nearly 45 percent over the next five years.”³ Animal fats, waste oils and greases make up a growing part of the feedstocks used for U.S. biomass-based diesel production. New feedstocks continue to be researched, but, again, certainty is needed to ensure this continued investment in moving toward cleaner, low-carbon feedstocks.

The RFS is working. We can and must move forward with growth of Advanced Biofuels and specifically the Biomass-based Diesel program in a meaningful way that drives investment and production. We also must provide long-term assurances through the government policy, and not waver at the first sign of trouble.

About NBB: NBB is the national trade association representing the biodiesel and renewable diesel industry as the coordinating body for research and development in the United States. It was founded in 1992, and represents fuel producers, feedstock organizations, fuel marketers and distributors, technology providers and other related businesses.

Biodiesel/Renewable Diesel Background: Biodiesel, renewable diesel, and renewable aviation fuels are renewable, low-carbon diesel and jet fuel replacements. The EPA has determined, based on the lifecycle and greenhouse gas emissions requirements established under the Energy Independence and Security Act (EISA) (P.L. 110-140), that these fuels qualify as Advanced Biofuels under the RFS – in that when compared to petroleum diesel, they reduce greenhouse gas emissions by at least 50 percent. There are over 200 biodiesel and renewable diesel plants registered with the EPA, representing a combined production capacity in excess of 3 billion gallons.

I appreciate the opportunity to submit comments. If you have any questions or comments, please do not hesitate to contact me at 202.737.8801.

Sincerely,



Anne Steckel
Vice President of Federal Affairs
National Biodiesel Board

² *Id.*

³ *Id.*



The Myth of High RIN Prices As Proof of the Blend Wall

- **Data recently released by EPA challenges conventional wisdom that the blend wall caused RIN prices to rise in 2013.**
- **Refiners and importers blended ethanol into obligated gasoline volumes beyond the 10 percent limit as early as 2010.**
- **Refiners' and importers' use of compliance flexibility reveals they did not experience RIN shortages at any point.**
- **EPA's rulemaking delays and unwarranted changes to the RFS based on blend wall assumptions harmed biofuel producers while providing obligated parties relief from a problem that didn't exist.**
- **EPA should reconsider its 2017 RFS proposed rule in light of this newly available data.**

In 2007, Congress updated the Renewable Fuel Standard (RFS) and set a statutory schedule for annual increases in production and use of biofuels to reach 36 billion gallons in 2022. Under the RFS, petroleum refiners and importers are assigned an annual Renewable Volume Obligation (RVO), indicating the percentage of refined or imported fuel that must be renewable in order to meet the congressionally set schedule for production and use of biofuels. Entities incurring an RVO are referred to as obligated parties. Renewable Identification Numbers (RINs) are credits generated under the RFS program that obligated parties use to demonstrate compliance with their annual RVOs.

The blend wall is a theoretical 10 percent limit on the amount of ethanol that can be blended into gasoline in the United States, due to infrastructure and market constraints. The 36 billion gallon volume set by Congress was projected to be 20 percent of transportation fuel use by 2022, indicating that the blend wall would have to be passed at some point. It has become widely accepted that U.S. fuel

refiners and importers reached the 10 percent blend wall in 2013 and that this event was signaled by a dramatic spike in spot market prices for RINs.^{1,2}

A seminal 2012 paper from researchers at the Food and Agricultural Policy Research Institute (FAPRI) at the University of Missouri advanced the theory that a sharp increase in RIN prices would signal when the RFS forced fuel refiners over the blend wall.³ The authors sought to understand why RIN prices did not rise during 2012, given estimated constraints on biofuel supplies in comparison to RFS requirements. The researchers tested a hypothesis that obligated parties could accumulate sufficient RINs in the early years of the updated RFS to delay arrival of the blend wall (though not prevent it), possibly until 2015. The paper presented a straightforward accounting model comparing the congressionally established fuel volumes to the number of available RINs, estimating an existing bank of 3 billion RINs at the start of 2012.

Data recently released by the U.S. Environmental Protection Agency (EPA) in response to a Freedom of Information Act (FOIA) request enables a true accounting of how obligated parties met annual RVOs from 2010 through 2013, using current year generated RINs, banked carryover RINs, and other compliance options.^{4,5} A true accounting – comparable to the FAPRI model – directly challenges the conventional wisdom that difficulty in meeting the RFS obligations due to the blend wall caused RIN prices to rise in 2013. RFS obligated parties' reported fuel use and

¹ Stock, J.H. (2015) "The Renewable Fuel Standard: A Path Forward." New York: Columbia University School of International and Public Affairs and Center on Global Energy Policy.

² Knittel, C.R. et al. (2015) "The Pass-Through of RIN Prices to Wholesale and Retail Fuels under the Renewable Fuel Standard." Cambridge, MA: Center for Energy and Environmental Policy Research, Massachusetts Institute of Technology.

³ Thompson, W. et al. (2012) "A Question Worth Billions: Why Isn't the Conventional RIN Price Higher?" Columbia, MO: Food and Agricultural Policy Research Institute. FAPRI-MU Report #12-12.

⁴ EPA. (2016) "Annual Compliance Data for Obligated Parties and Renewable Fuel Exporters under the Renewable Fuel Standard (RFS) Program." <https://www.epa.gov/fuels-registration-reporting-and-compliance-help/annual-compliance-data-obligated-parties-and>.

⁵ Letter from Byron J. Bunker, Director, Compliance Division, Office of Transportation and Air Quality, USEPA to Paul Winters, BIO. "RE: Freedom of Information Act request EPA-HQ-2015-004861." Aug. 8, 2016. <https://foiaonline.regulations.gov/foia/action/public/view/request?objectId=090004d2805fef3f>.

use of ethanol RINs indicates that the blend wall was reached as early as 2010 and was definitely breached by 2012. Nonetheless, during those years conventional RIN prices remained low and obligated parties continued to accumulate excess RINs to carry over for future compliance years.

The 2013 price spikes in spot market RIN trading cannot be explained as a consequence of the blend wall, since they are not connected to a demonstrable increase in difficulty for obligated parties to meet annual RFS obligations. The finding has implications for current policy in EPA's administration of the RFS. Further research into the causes of RIN price spikes will require data on the volumes of RINs traded and actual prices paid during transfers of RINs.

Compliance Options

Obligated parties are assigned four distinct but nested RVOs each year – for cellulosic biofuel, biomass-based diesel (BBD), advanced biofuel and conventional biofuel – and they must retire sufficient eligible and valid RINs to satisfy each. RVOs are nested; e.g., RINs retired to meet the cellulosic or the BBD RVO also concurrently satisfy the advanced and overall RVO. EPA established different RIN codes to distinguish the various categories of biofuels eligible to meet the nested RVOs. With the exception of D4 RINs, though, the RIN codes do not distinguish the type of biofuel, such as ethanol or biomass-based diesel; EPA publishes separate data on RINs generated by type of fuel produced.

In establishing regulations for the RFS program, EPA provided obligated parties flexibility in complying with annual RVOs. EPA established the RIN system under the RFS to provide credits, as directed by Congress, for refiners and importers who use more renewable fuel than required. Like other compliance systems under the Clean Air Act fuel regulations, RFS RINs also equalize the compliance burden among obligated parties. Equalization of the compliance burden enables obligated parties who exceed their individual requirement to transfer (or sell) credits to those who fall short of the obligation.



Per the statute, RINs are valid to meet annual RVOs for one year from the date they are generated. EPA's regulations enable individual obligated parties to meet up to 20 percent of an annual RVO using RINs generated in the preceding year. Such RINs are referred to as "carryover RINs." RINs that are not used to satisfy an RVO in the year they are generated or the subsequent year expire unused.

EPA regulations, as directed by Congress, also allow individual obligated parties to carry forward a deficit in an annual RVO, essentially deferring all or part of that RVO to the following year. This is referred to as the "deficit carryforward" provision. The statute and regulations specify, though, that the individual obligated party must satisfy the full deficit in the subsequent year along with the annual RVO. An individual obligated party may not have a deficit carryforward in the same RVO two years in a row.

The FAPRI paper was published in December 2012, prior to the compliance deadline for the 2012 RFS RVOs (which occurred February 28, 2013). Consequently, the authors make use of data provided by EPA on the number of RINs generated in prior years – excluding the 2010 compliance year – to estimate the availability of 2011 RINs to be used for the current year and carried over for 2012. Lacking data on the use of carryforward deficits or RINs expired unused, the authors do not include these data points in the calculation. The authors also use the volumes specified by Congress for the RFS as proxies for the annual RVOs; they then estimate the obligation to use ethanol by calculating the "conventional gap" and the "advanced gap" – the difference between the RFS statutory volumes for these categories and the BBD category. Lastly, the authors use fuel use data from the Energy Information Administration (EIA) to estimate whether the annual RVOs approach the blend wall.

Actual data from the program now provides a clearer picture of the relative difficulty or ease for obligated parties to meet annual RVOs between 2010 and 2013. The data includes numbers of RINs used for compliance, carried over, and expired unused as well as actual RVOs (which differ from the statutory volumes). Data on the use of carryforward deficits – which decrease the current year and increase the subsequent year RVOs – can be included in a true accounting.



The Devil's in the Data

The volumes of U.S. fuel subject to the RFS (as reported by obligated parties) are substantially smaller than fuel use reported by EIA. Small refiners and small refineries (even those owned by large refiners) were exempted from the RFS program through 2012. In setting the 2010 RVOs, EPA reduced EIA's estimate of U.S. fuel production by 13.5 percent, while providing small refineries (processing less than 75,000 barrels of crude per day) and small refiners (employing 1,500 or fewer people) exemption from the obligations.^{6,7} In 2011, EPA ended the exemption for small refiners, but granted hardship exemptions to three small refineries that petitioned the agency.⁸ Then in 2012, in response to a Department of Energy study ordered by Congress, EPA reinstated the exemption for 21 small U.S. refineries and retroactively applied it to the 2011 RVOs, prior to compliance deadlines. EPA adjusted the EIA estimates of fuel use for those years by approximately 3.6 percent of the gasoline pool and 4.5 percent of the diesel pool, estimating the reduction to be approximately 4.87 billion gallons of gasoline and 2.28 billion gallons of diesel in 2012.⁹ EPA granted a single exemption to a small refinery in 2013.¹⁰

The actual fuel volumes reported by obligated parties are shown below in Table 1. Both gasoline and diesel are obligated fuels under the RFS, but ethanol is not blended into diesel fuel. The volume of obligated gasoline use is approximately 70 percent of the reported volumes each year. EIA reports minor variations in the balance of gasoline and diesel volume used each year from 2010 to 2013, so these relative annual percentages are applied to the reported obligated volumes to estimate obligated gasoline volume. The blend wall is estimated as 10 percent of annual obligated gasoline volumes.

⁶ Fed. Reg. 72 (23911), Tuesday, May 1, 2007.

⁷ 75 Fed. Reg. (14735-14737), Friday, March 26, 2010.

⁸ 75 Fed. Reg. (76805), Thursday, December 9, 2010.

⁹ 77 Fed. Reg. (1223, 1340), Monday, January 9, 2012. Cf. "Small Refinery Exemption Study: An Investigation into Disproportionate Economic Hardship," U.S. Department of Energy, March 2011.

¹⁰ 78 Fed. Reg. (49825), Thursday, August 15, 2013.



Table 1: Blend Wall for RFS Renewable Volume Obligations, 2010-2013

	2010	2011	2012	2013
Obligated fuel volume	153,191,431,635	169,401,578,093	166,585,474,309	172,975,631,165
Gasoline percentage of obligated fuel	0.71	0.69	0.7	0.7
Estimated obligated gasoline volume	108,168,815,169	117,707,460,175	116,507,319,837	121,546,237,671
Estimated blend wall	10,816,881,517	11,770,746,017	11,650,731,984	12,154,623,767

Annual RVOs are calculated as both a percentage of the current year's obligated volumes plus any deficit carryforward from prior years. Obligated parties used the deficit carryforward provision most heavily in 2010. They carried forward approximately 13.5 percent of the 2010 BBD RVO and 24.6 percent of the advanced RVO as a deficit and added these volumes to the 2011 RVO. By comparison, they carried forward less than 1.3 percent of the 2010 overall RVO as a deficit. Obligated parties have used the deficit carryforward provision less and less each year since, indicating relative ease in meeting the annual RVOs. In 2011, they carried forward only about 3.4 percent of the BBD RVO and added that volume to the 2012 RVO. They carried forward less than 2.7 percent of the advanced RVO and less than 0.5 percent of the overall RVO. Since 2011, obligated parties have carried forward less than 1 percent of each annual RVO as a deficit.

The total annual RVOs are shown below in Table 2. The final RVOs below are calculated by subtracting the deficit from the current year and adding it to the following year. Note that the statute adopted by Congress included 2009 obligations for biomass-based diesel and advanced volumes; however, EPA did not finalize regulations until 2010. EPA therefore set a BBD RVO in 2010 that included the 2009 obligation. Cellulosic RVOs for 2011 and 2012 were vacated, so the cellulosic RVO for 2011 remains zero, despite the deficit carryforward.

The FAPRI paper calculates the obligation to use ethanol as the "gap" between the overall RVO and the BBD RVO. Absent the data recently released by EPA, this was a



reasonable approximation. Nearly all D6 RINs and a large majority of D5 RINs represent ethanol production, which must be incorporated in the gasoline supply. A more accurate approximation can be obtained by looking at EPA data on the annual generation of RINs by type of biofuel produced.¹¹ This data shows that not all D6 RINs represent ethanol; in 2013, nearly 2 percent of D6 RINs were assigned to biomass-based diesel or other fuels. And not all D5 RINs represent ethanol; in 2010, nearly 86 percent of D5 RINs generated were for biomass-based diesel.

Table 2: Calculation of Annual RVOs Considering Deficit Carryforwards

	2010	2011	2012	2013
Annual overall RVO	12,638,293,110	13,569,066,405	15,375,839,279	16,848,743,020
Annual advanced RVO	934,467,733	1,321,332,309	2,015,684,239	2,802,157,305
Annual BBD RVO	1,685,124,090	1,168,882,005	1,515,927,816	1,954,598,102
Annual cellulosic RVO	6,182,591			864,865
Overall deficit carryforward	163,353,609	66,194,174	72,956,555	57,634,008
Advanced deficit carryforward	229,693,190	35,104,504	18,582,711	17,290,622
BBD deficit carryforward	227,120,812	39,731,828	13,336,991	6,617,884
Cellulosic deficit carryforward	31,453			26
Final overall RVO	12,474,939,501	13,666,225,840	15,369,076,898	16,864,065,567
Final advanced RVO	704,774,543	1,515,920,995	2,032,206,032	2,803,449,394
Final BBD RVO	1,458,003,278	1,356,270,989	1,542,322,653	1,961,317,209
Final cellulosic RVO	6,151,138			864,839
Percent ethanol in advanced RVO	14.1	85.3	96.7	86.7
"Ethanol gap"	11,106,281,004	12,041,123,331	13,757,942,313	14,212,739,835
Percent of obligated gasoline	10.3	10.2	11.8	11.7

¹¹ U.S. EPA. (2016) Renewable Identification Number (RIN) Data for Renewable Fuel Standard Program. <https://www.epa.gov/renewable-fuel-standard-program/renewable-identification-number-rin-data-renewable-fuel-standard>.



The amount of the annual RVOs that had to be met with ethanol – the “ethanol gap” – is estimated in Table 2 above by subtracting the BBD RVO plus the portion of the advanced RVO met by available biomass-based diesel from the overall RVO.

The amount of ethanol that obligated parties were therefore required to blend into the gasoline they produced was already at 10 percent (or slightly above) as of 2010. Comparing the “ethanol gap” in Table 2 above to the estimated blend wall in Table 1 above illustrates the fact that annual RVOs were above the blend wall by 2010. By 2012, the requirement was at 11.8 percent. Further, the “ethanol gap” was no more difficult for obligated parties to meet in 2013 than in 2012 – the relative percentages are nearly identical. The data undermine the theory that the blend wall was the cause of RIN price spikes in 2013.

Did Obligated Parties “Delay” the Blend Wall?

The FAPRI researchers test the hypothesis that obligated parties could use carryover RINs to limit blending of ethanol in any current year and thereby delay the arrival of the blend wall. Under this hypothesis, obligated parties would use as many carryover RINs as possible to meet each annual RVO, up to the allowable 20 percent.

The data recently released by EPA demonstrate that obligated refiners and importers did not use the maximum allowable number of carryover RINs in any year for any RVO, with the singular exception of the overall RVO in 2012. In fact, the number of RINs obligated parties allowed to expire unused in 2010 and 2011 is considerable in comparison to the numbers carried over. Moreover, use of carryover RINs declined as a percentage of the annual RVOs from 2012 to 2013.

Table 3 below presents the numbers of 2010, 2011, and 2012 RINs carried over and retired to meet the 2011, 2012 and 2013 RVOs. The percentage of the annual RVOs that obligated refiners and importers met with carryover RINs and the numbers of prior year RINs that expired unused, after the annual RVO was met, are also presented.

Because the reported 2010 BBD RVO also included 2009 volumes, obligated parties had a limited number of 2010 D4 and D5 RINs available to carry over for the 2011 BBD and advanced RVOs. Obligated parties met less than 5 percent of the 2011 BBD and advanced RVOs with carryover 2010 RINs. Comparatively, they met 17 percent of the overall 2011 RVO with carryover 2010 RINs. Obligated refiners and importers apparently met a small portion of the 2011 RVOs with 2010 RFS1 RINs that are not reported by EPA.

In 2012, obligated parties met 18 percent of the BBD RVO and 16.1 percent of the advanced RVO with carryover RINs. In 2013, obligated parties met less than 15 percent of their annual RVOs with carryover RINs.

Nearly a half billion available 2010 vintage RINs expired unused, even as the deficit carryforward provision was used. And nearly half a billion 2011 vintage RINs also expired unused. Most of the expired unused RINs were D6 RINs from ethanol – more than 6 percent of D6 RINs generated in 2010 and nearly 3.5 percent of D6 RINs generated in 2011 expired unused.

Table 3: Carryover RINs Retired by Obligated Refiners and Importers, 2011-2013

	2011	2012	2013
D6 RINs carried over	2,241,455,041	3,169,954,134	2,087,485,067
D5 RINs carried over	3,580,101	50,801,949	165,030,837
D4 RINs carried over	57,368,904	277,937,240	248,305,050
Percent of overall RVO met with carryover RINs.	16.9	22.8	14.8
Percent of advanced RVO met with carryover RINs	4	16.2	14.7
Percent of BBD RVO met with carryover RINs	4.2	18	12.7
Prior year D6 RINs expired unused	426,649,448	469,306,771	11,935,021
Prior year D5 RINs expired unused	56,433	2,688,287	1,407,742
Prior year D4 RINs expired unused	2,755,307	23,115,151	2,514,278

Obligated parties did not use carryover RINs to the maximum possible, except in one instance. Interestingly, the data reveals that obligated parties met 22.8 percent of the 2012 overall RVO with rollover RINs, as shown in Table 3 above. While there is a 20 percent cap on use of rollover RINs, the cap applies to individual obligated parties. The data here represents an aggregate use of RINs. There is no indication from EPA that any individual refiner violated the cap.

The aggregate use of carryover RINs beyond the 20 percent cap is clearly indicated in the data posted by EPA for obligated refiners, recreated in Table 4 below. Obligated refiners used more than 3.378 billion 2011 vintage RINs out of a total 15.139 billion RINs retired to meet their overall 2012 RVO, equal to 22.3 percent. The final column in the table presents a sum of all carryover RINs retired by obligated refiners to meet the annual RVO above a sum of all RINs (both current year and carryover) retired.

Table 4: RINs Used for Compliance by Obligated Refiners, Including Carryover RINs, 2010-2013

	RIN Year	D4 RINs	D5 RINs	D6 RINs	Total Carryover and RINs retired to meet overall RVO
2010 Compliance Year¹		N/A	N/A	N/A	
	2010	166,232,179	23,720,991	3,441,123,591	3,631,076,761
2011 Compliance Year¹	2010	49,966,029	2,669,842	1,920,351,778	1,972,987,649
	2011	1,027,143,577	152,386,595	7,769,788,969	10,922,306,790
2012 Compliance Year	2011	268,961,057	49,103,786	3,060,020,326	3,378,085,169
	2012	1,254,882,608	415,495,440	10,090,718,261	15,139,181,478
2013 Compliance Year	2012	244,478,487	156,284,147	2,040,007,535	2,440,770,169
	2013	1,939,160,352	485,169,551	11,476,873,108	16,341,973,180

Did Obligated Parties Have Difficulty With the Blend Wall?

The FAPRI authors theorize that RIN prices would rise in response to market shortages of RINs, once refiners and importers are unable to blend ethanol into



obligated gasoline volumes beyond the 10 percent limit. EPA's newly released data reveals that the amount of ethanol blended into the U.S. transportation fuel supply exceeded 10 percent by 2011.

RINs separated in any given year (whether retired, expired or carried over to the following year) represent biofuel blended into transportation fuel. Table 5 below presents a calculation of all D6 and D5 RINs separated from ethanol each year that were eventually retired, carried over, or expired unused. The ratio of RINs generated and assigned to ethanol gallons is applied to those retired, carried over and expired unused. It could be the case that all D5 and D6 RINs that expired unused were separated from ethanol (and conversely, those RINs retired were from biomass-based diesel). That would directly counter the theory that obligated parties were "banking" ethanol RINs to forestall the blend wall. Regardless, the RINs that expired unused still represent ethanol blended into the transportation fuel supply. Further, eliminating expired unused RINs from the calculation would lower the rate of ethanol blended by only a few tenths of a percent.

	2010	2011	2012	2013
D6 RINs retired	3,838,694,623	9,184,154,593	10,555,225,166	11,923,667,579
D6 RINs carried over	2,241,455,041	3,169,954,134	2,087,485,067	
D6 RINs expired unused	426,649,448	469,306,771	11,935,021	
D5 RINs retired	24,808,442	170,668,757	430,685,359	507,813,089
D5 RINs carried over	3,580,101	50,801,949	165,030,837	
D5 RINs expired unused	56,433	2,688,287	1,407,742	
Percent ethanol in D5 RINs	14.1	85.3	96.7	86.7
Total ethanol RINs used	6,492,838,486	13,008,731,909	13,230,849,241	12,139,401,347
Percent ethanol in obligated gasoline volumes	6	11	11.4	10

The number of ethanol RINs retired, carried over or expired unused in 2010 and 2013 appear to be below the blend wall because the data is incomplete. EPA does not provide RIN data from the RFS1 program, which was in effect through June 2010. But only gasoline volumes were obligated under RFS1; it is likely that the RINs carried over from RFS1 to meet 2010 RVOs primarily represented ethanol. And therefore the proportion of ethanol used to satisfy fuel obligations likely exceeded 10 percent as early as 2010.

For 2013 EPA has yet to provide the numbers of RINs carried over to 2014 or expired unused. However, EPA has reported (as of September 2016) that more than 13.2 billion 2013 D6 RINs have been retired – exceeding the 11.9 billion reported in June. Including the 1.3 billion D6 RINs retired between June and September would increase ethanol use to 11 percent of the obligated volumes. Similarly, 551 million D5 RINs have been retired as of September, exceeding the 508 million reported in June. The additional 43 million RINs likely included 37 million from ethanol.

Obligated volumes of fuel increased in 2013 as the small refiner exemption expired. The additional volumes provided obligated parties a larger pool of gasoline in which to blend ethanol, compared to 2011 and 2012, potentially easing any difficulty with the blend wall. The rise in RIN prices in 2013 therefore cannot be explained by the blend wall, since it was demonstrably easier for obligated parties to blend ethanol in 2013 than in 2011 or 2012, when RIN prices remained low.

Caveats

As made clear in the newly provided data from EPA, fuel exporters incur a separate RVO if they export RIN-bearing biofuels. The current year and carryover RINs retired by exporters are excluded from the current analysis. The deficit carryforward numbers reported by EPA include deficits for export RVOs. However, the overall ratio of RIN deficits to the annual RVOs is so small after 2011 that it has no appreciable impact on final RVOs.

It is possible that some of the ethanol used during 2010, 2011 and 2012 was blended into gasoline produced by small refiners and small refineries exempted from RFS2 obligations. Splash blending ethanol into the unobligated volumes of gasoline therefore could have provided obligated refiners and importers potential relief from the blend wall. However, exempt small refiners and small refineries could not separate RINs from renewable fuels during 2011 and 2012; to do so, they would have had to register for the program and become obligated parties. Though the exemption originally expired in 2011, many small refiners did not register for the program as they sought congressional aid in extending their exemption.

Further, obligated parties could not take possession of the additional gasoline without increasing their own obligation. They would have had to purchase the separated RINs from other parties, if they faced a shortage in their obligations. This path of relief from the blend wall would therefore have presented a potential difficulty for obligated parties in meeting obligations; and under the theory, a shortage of RINs should have raised prices.

Implications for Policy

Newly released data refutes the theory that price spikes in spot trading of RINs in 2013 signaled arrival of the blend wall. Aside from the post hoc nature of such an argument, the evidence indicates that the blend wall arrived as early as 2010 and was definitively surpassed by 2012, even potentially easing slightly in 2013. The blend wall cannot serve as an explanation of the 2013 RIN price spikes, since its arrival should have caused RIN price spikes well before then.

Recently, a group of merchant refiners petitioned EPA to once again exempt them from the RFS program.¹² The petition rests on the demonstrably incorrect assumption that the 2013 RIN price spike was caused by arrival of the blend wall.

¹² *Oversight of the Renewable Fuel Standard, Hearing before the Sen. Comm. On Env't and Public Works*, 114th Cong. 10 (Feb. 24, 2016). Written Testimony of Ronald E. Minsk. http://www.epw.senate.gov/public/_cache/files/a4545f2f-52df-4f3f-8a08-e5802950d8e5/rem-rfs-written-testimony.pdf. Also, Minsk, R.E., Letter to Janet McCabe, Acting Assistant Administrator for Air and Radiation, EPA, July 24, 2015.

The original expiration of the small refiner exemption in 2011 appeared to have no effect on RIN prices or availability; therefore, reinstatement of an exemption is unlikely to have an impact in the future. In fact it could shrink the obligated volume of gasoline still further, increasing difficulty for the remaining obligated parties to meet RVOs.

EPA delayed issuing the 2013 RVOs until August of that year as it considered the assumed arrival of the blend wall and the potential difficulty for refiners to meet annual RVOs that year. The agency eventually stuck with the statutory volume; nevertheless, it delayed the compliance deadline for the 2013 RVOs and subsequently extended the delay until March 2016.¹³ The relative ease or difficulty for obligated parties to meet RVOs in 2012 and 2013 was thereby obscured until this year.

EPA also delayed issuing the 2014 and 2015 RVOs as it addressed controversy “about how the volumes should be set in light of lower gasoline consumption than had been forecast” in 2007 when Congress initially set the statutory volumes of biofuel – referring to the blend wall.¹⁴ The agency eventually established RVOs for 2014, 2015 and 2016 in a single rule made public in November 2015, while at the same time denying petitions from refiners for a waiver of the 2014 RVOs. The refiners’ petition argued that a shortage of available RINs – due to their inability to blend ethanol above 10 percent of gasoline volumes – would severely harm the economy through an increase in fuel prices.¹⁵ Despite rejecting the petition, EPA waived significant volumes from the congressionally set schedule of biofuel production and use for 2014, 2015 and 2016. It further refused to set higher RVOs in those years, arguing that doing so would force obligated parties to draw down the “bank” of carryover RINs.

EPA’s delays in setting the 2013, 2014, and 2015 RVOs combined with the unwarranted changes to the RFS program finalized for 2014-2016 caused direct

¹³ 79 Fed. Reg. (34242). Monday June 16, 2014; 79 Fed. Reg. (46353). Friday, Aug. 8, 2014.

¹⁴ 79 Fed. Reg. (73007). Tuesday, Dec. 9, 2014.

¹⁵ 80 Fed. Reg. (77428-29). Monday, Dec. 14, 2015.



harm to biofuel producers and increased greenhouse gas emissions from the transportation sector. BIO estimates that EPA's new methodology for setting annual RVOs has caused a \$22.4 billion shortfall in necessary investment in advanced biofuels. Investment patterns clearly demonstrate that EPA is sending a sustained market signal that disincentivizes advanced biofuels.¹⁶ Further, EPA's rule changes cut short the effectiveness of the RFS program for greenhouse gas emission reduction by limiting market space for renewable fuels and guaranteeing more market space for petroleum fuels. BIO estimates that transportation-related greenhouse gas emissions (measured in CO₂e) increased by 72 million metric tons in 2014 and again by 22.9 million metric tons in 2015, from year to year. Further, based on EIA projections, BIO estimates that greenhouse gas emissions will increase in 2016 by 6.9 million metric tons, compared to 2015. And in 2017, emissions will increase by 16.8 million metric tons, if EPA finalizes the volumes it proposes.¹⁷

The 2013 price spikes in spot market RIN trading remain unexplained. Further research into the true causes of RIN price spikes is hampered by lack of data on the volumes of RINs traded and actual prices paid for RIN transfers in 2013.

EPA has again proposed to provide unwarranted relief from the blend wall to obligated parties in the 2017 RVOs.¹⁸ EPA should reconsider this course of action in light of data disproving the relationship between high RIN prices and the blend wall.

¹⁶ Biotechnology Innovation Organization. (2016) "Estimating Another Year of Chilled Investment in Advanced Biofuels Due to RFS Uncertainty." Washington, DC. https://www.bio.org/sites/default/files/Estimating_Another_Year_of_Chilled_Investment.pdf

¹⁷ Biotechnology Innovation Organization. (2016). "BIO Comments on Renewable Fuel Standards for 2017." <https://www.bio.org/letters-testimony-comments/bio-comments-renewable-fuel-standards-2017>.

¹⁸ 81 Fed. Reg. (34778). Tuesday, May 31, 2016.

Appendix: Calculation of Ethanol RINs from RINs Generated

EPA reports annual RIN generation and biofuel production by fuel type in its public data for the Renewable Fuel Standard. The ratio of RINs generated for ethanol to those generated for biomass-based diesel during the 2010- 2013 time period is presented below in Appendix Table 1. Other types of fuel that generate RINs available to satisfy the RFS – such as naphtha, compressed and liquefied natural gas, or heating oil – are not counted since they are not blended into the obligated volumes of gasoline and diesel.

	2010	2011	2012	2013
D6 biomass-based diesel RINs	18,779,478	6,258,577	1,118,519	251,525,451
D6 ethanol RINs	6,777,308,371	13,609,057,120	12,986,723,082	13,098,970,936
Ratio of ethanol	99.7	100	100	98.1
D5 biomass-based diesel RINs	24,568,615	33,385,319	20,728,997	70,172,481
D5 ethanol RINs	4,043,017	193,748,805	603,461,683	458,250,657
Ratio of ethanol	14.1	85.3	96.7	86.7

ANALYSIS & PROJECTIONS

SHORT-TERM ENERGY OUTLOOK

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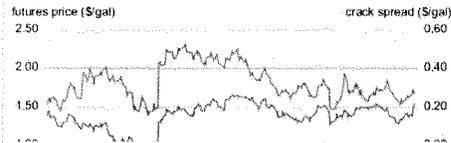
FAQS

Petroleum Products

Gasoline prices: The front-month futures price of reformulated blendstock for oxygenate blending (RBOB, the petroleum component of gasoline used in many parts of the country) increased in November and settled at \$1.55 per gallon (gal) on December 1 (Figure 5). The RBOB-Brent crack spread (the difference between the price of RBOB and the price of Brent crude oil) declined slightly in November.

Although gasoline crack spreads declined during November, the average crack spread was still a record high for the month. Strong domestic and international demand for gasoline likely supported gasoline crack spreads. Preliminary export data indicate that monthly gasoline exports set a record high in November. EIA also estimates U.S. gasoline consumption will reach a record high of 9.31 million bbl in 2016; the previous record was 9.29 million bbl set in 2007.

Figure 5. Historical RBOB futures prices and crack spread



U.S. Petroleum and Other Liquids

	2014	2015	2016	2017
Crude Oil prices (dollars per barrel)				
WTI Spot Average	93.17	48.67	43.07	50.66
Brent Spot Average	98.89	52.32	43.46	51.66
Imported Average	89.63	46.34	38.86	47.20
Refiner Average Acquisition Cost	92.05	48.40	40.82	49.70
Retail prices including taxes (dollars per gallon)				
Regular Gasoline	3.36	2.43	2.14	2.30
Diesel Fuel	3.83	2.71	2.31	2.70
Heating Oil	3.71	2.65	2.12	2.62
Production (million barrels per day)				
Crude Oil	8.76	9.42	8.86	8.78
Natural Gas Plant Liquids	3.01	3.34	3.48	3.78
Fuel Ethanol	0.93	0.97	0.99	1.00
Biodiesel	0.083	0.082	0.099	0.104

(IV) Biomass-based diesel

For the purpose of subparagraph (A), of the volume of advanced biofuel required under subclause (II), the applicable volume of biomass-based diesel for the calendar years 2009 through 2012 shall be determined in accordance with the following table:

Calendar year:	Applicable volume of biomass-based diesel (in billions of gallons):
2009	0.5
2010	0.65
2011	0.80
2012	1.0

(ii) Other calendar years For the purposes of subparagraph (A), the applicable volumes of each fuel specified in the tables in clause (i) for calendar years after the calendar years specified in the tables shall be determined by the Administrator, in coordination with the Secretary of Energy and the Secretary of Agriculture, based on a review of the implementation of the program during calendar years specified in the tables, and an analysis of—

- (I)** the impact of the production and use of renewable fuels on the environment, including on air quality, climate change, conversion of wetlands, ecosystems, wildlife habitat, water quality, and water supply;
- (II)** the impact of renewable fuels on the energy security of the United States;
- (III)** the expected annual rate of future commercial production of renewable fuels, including advanced biofuels in each category (cellulosic biofuel and biomass-based diesel);
- (IV)** the impact of renewable fuels on the infrastructure of the United States, including deliverability of materials, goods, and products other than renewable fuel, and the sufficiency of infrastructure to deliver and use renewable fuel;
- (V)** the impact of the use of renewable fuels on the cost to consumers of transportation fuel and on the cost to transport goods; and
- (VI)** the impact of the use of renewable fuels on other factors, including job creation, the price and supply of agricultural commodities, rural economic development, and food prices.

(II) Advanced biofuel

For the purpose of subparagraph (A), of the volume of renewable fuel required under subclause (I), the applicable volume of advanced biofuel for the calendar years 2009 through 2022 shall be determined in accordance with the following table:

Calendar year:	Applicable volume of advanced biofuel (in billions of gallons):
2009	0.6
2010	0.95
2011	1.35
2012	2.0
2013	2.75
2014	3.75
2015	5.5
2016	7.25
2017	9.0
2018	11.0
2019	13.0
2020	15.0
2021	18.0
2022	21.0

(III) Cellulosic biofuel

For the purpose of subparagraph (A), of the volume of advanced biofuel required under subclause (II), the applicable volume of cellulosic biofuel for the calendar years 2010 through 2022 shall be determined in accordance with the following table:

Calendar year:	Applicable volume of cellulosic biofuel (in billions of gallons):
2010	0.1
2011	0.25
2012	0.5
2013	1.0
2014	1.75
2015	3.0
2016	4.25
2017	5.5
2018	7.0
2019	8.5
2020	10.5
2021	13.5
2022	16.0

(B) Applicable volumes**(i) Calendar years after 2005****(I) Renewable fuel**

For the purpose of subparagraph (A), the applicable volume of renewable fuel for the calendar years 2006 through 2022 shall be determined in accordance with the following table:

Calendar year:	Applicable volume of renewable fuel (In billions of gallons):
2006	4.0
2007	4.7
2008	9.0
2009	11.1
2010	12.95
2011	13.95
2012	15.2
2013	16.55
2014	18.15
2015	20.5
2016	22.25
2017	24.0
2018	26.0
2019	28.0
2020	30.0
2021	33.0
2022	36.0

Post-Hearing Questions for the Record
Submitted to Mr. Frank Rusco
From Senator Heidi Heitkamp

"Examining Two GAO Reports Regarding the Renewable Fuel Standard"
December 1, 2016

1. As you were putting this report together, did you take any steps to validate the input you were receiving from your panelists or did you accept every statement at face value? For example, the report states, "...reliance on adding more ethanol to the transportation fuel market to meet expanding RFS requirements is limited by the incompatibility of ethanol blends above E10 with the existing vehicle fleet and fueling infrastructure." This is of course completely false and not reflective of the facts.

I am curious as to whether GAO did any independent verification or research into what your panelists recited to you from their talking points to determine their validity, and I would like to flag the following facts which do not appear in your report and directly refute this and other inaccurate statements:

- a. E15 is approved for use in current vehicles and has been since 2011. It is the most extensively tested fuel in use today. Any car or light truck model year 2001 or later can use E15, as can as any flex-fuel vehicle. THIS REPRESENTS 87% OF THE CURRENT VEHICLE FLEET.
- b. Today, more than 70% of the top-selling cars are approved by the automaker for E15 usage in their 2016 models. Auto manufacturers couldn't provide a warranty for vehicles to use E15 before 2011 because the fuel wasn't yet approved.
- c. As of December 2016, E15 is offered by independent retailers like Sheetz, Kum and Go, and Racetrac at 415 locations in 28 states including AL, AR, CO, FL, GA, IA, IL, IN, KS, MI, MN, MO, NC, ND, NE, OH, SD, TX, WI, VA, OK, TN, KY, PA, MS, WY, WV, and KY. North Carolina has the most E15 stations anywhere in the country. There isn't a single report of engine damage.
- d. We're already blending more than 10% renewable fuel. The EPA's 2017 final rule will bring us to a 10.7% blend rate – the country is already blending above 10%. BIO released a study (attached) in October 2016 based on EPA data obtained through FOIA which found that RINs were never in short supply in 2013, and refiners blended more than 10% ethanol as early as 2010.
- e. Gilbarco and Wayne are the dominant gas pump manufactures with a combined market share exceeding 90%. All Wayne gas pumps currently in service have a warranty for dispensing E15. All Gilbarco gas pumps manufactured starting in 2008 also are warrantied for use with E15. Older Gilbarco gas pumps can be updated to carry a warranty for E15.
- f. All steel storage tanks in use in the United States are compatible with E15.

To conduct our work on both reports on which our testimony is based,¹ we contracted with the National Academy of Sciences to identify two separate groups of experts. In GAO-17-94 we interviewed the experts and analyzed their responses. In GAO-17-108 we convened a 2-day expert meeting in conjunction with the National Academy of Sciences. Members of these groups, who were identified and recommended by the National Academy of Sciences and approved by us, included experts in the current structure of the RFS; blending, distribution, and marketing infrastructure of biofuels; automobile manufacture; petroleum consumption and prices; advanced biofuels feedstocks; conversion technologies; and the use of biofuels. These experts came from industry, academia, and research organizations.

We conducted our work in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Regarding infrastructure for higher ethanol blends, our report (GAO-17-94) points out challenges raised by experts to accommodating higher ethanol blends. Specifically, we noted challenges related to compatibility, cost, and liability and that there are few incentives for fuel distributors and retailers to make the changes that would be needed to accommodate higher blends. We stated that if ethanol continues to be the primary biofuel produced to meet the RFS these infrastructure limitations will have to be addressed. These findings were supported by a broad range of experts described above, and also by studies vetted by our methodologist.

2. During your testimony, you responded to a question regarding the relationship between the quantity of ethanol used and the price of gas, citing GAO work from “years ago” that was never published. Please provide a copy of all documents, research products, draft findings, and other materials that formed the basis of your testimony related to GAO work from “years ago” during the hearing.

My statement during the hearing was based on background academic research with which I am familiar through many years of working on energy issues. The main point I was trying to make was that there is a body of academic work related to ethanol use and the price of gas and that the relative prices of ethanol and gasoline influence the extent to which fuel sellers will voluntarily blend ethanol into fuel. However, my response was not sourced from any specific GAO work.

We would be happy to discuss these, or any further, questions with your staff at any time.

¹GAO-17-94 and GAO-17-108.

**Post-Hearing Questions for the Record
Submitted to Mr. Frank Rusco
From Senator Jon Tester**

"Examining Two GAO Reports Regarding the Renewable Fuel Standard"
December 1, 2016

1. I understand that biofuel producers you interviewed were concerned about the regulatory future of biofuels. Chief among their concerns were the stability of the Biodiesel Income Tax Credit, the Second Generation Biofuel Producer Tax Credit, and the Renewable Fuel Standard.

a. What were the primary concerns biofuel producers had about the future of the RFS?

As stated in GAO-17-94, many experts told us that uncertainty about the future of the RFS is limiting investment in advanced biofuels. In particular, some experts stated that the possibility of a repeal of the RFS has caused potential investors to question whether the RFS will continue to exist until 2022 and beyond. Further, in GAO-17-108, we reported that there is uncertainty about whether the RFS will remain in place, and uncertainty about where EPA will set annual volume requirements. This uncertainty affects all stages of biofuel production. For example, one expert stated that producers of farm equipment will not invest in new harvesting technology to maximize biomass feedstock yields if they see too much uncertainty in the market for advanced biofuels over the next 10 years, while other experts noted the difficulty in obtaining capital to build commercial-scale plants. Every advanced biofuels producer we interviewed also cited uncertainty about government policy as a major barrier to commercial-scale production.

b. Did your investigation discover any opportunities to help stabilize the investment market?

Addressing uncertainty about the future of the RFS. According to experts we interviewed for GAO-17-94, EPA may be able to improve the investment climate for advanced biofuels by clarifying its plans for managing the program in upcoming years. Specifically, statutory volume targets have been set through 2022. After that, EPA will be responsible for setting these volumes. One expert said that if EPA provided more insight into its plans for setting post-2022 volume targets, it could reduce some of this investment uncertainty. Further, the annual requirement that EPA finalized in 2015 triggered what is commonly referred to as the "reset provision" of the RFS for the advanced biofuel and cellulosic biofuel categories. The reset provision requires EPA to modify the statutory volume targets for future years if certain conditions are met. Although the statute provides factors for EPA to consider when modifying these volumes, EPA has not specified how it will approach setting volumes under this reset provision. As a result, several experts thought that uncertainty about the volumes of advanced and cellulosic biofuels affected by the reset may be limiting investments in these fuels. Some experts thought that EPA should clarify how it will implement the reset to reduce negative impacts on investments in advanced biofuels. EPA officials told us that recent annual volume requirements make EPA's intent clear in the near term.

Providing more consistent subsidies to advanced biofuel producers. Some experts stated that the Second Generation Biofuel Producer Tax Credit—an incentive to accelerate commercialization of fuels in the advanced and cellulosic biofuels categories—has expired and been reinstated (sometimes retroactively) about every 2 years, contributing to uncertainty among cellulosic fuel producers and investors. These experts told us that investment in cellulosic biofuels could be encouraged, in part, by maintaining the Second Generation Biofuel Producer Tax Credit consistently, rather than allowing it to periodically lapse and be reinstated.

Expanding the types of fuel that qualify for the RFS. The current RFS framework specifies that qualifying biofuels must be derived from biomass-based feedstocks. According to some experts, this excludes some types of low carbon fuels (e.g., those derived from industrial sources) from qualifying under the RFS. According to these experts, expanding the RFS to include fuel types such as this would better incentivize investment in innovative technologies.

Reducing RIN fraud and price volatility. Some experts said that a lack of transparency in the RIN trading market has led to an increased risk of fraud and increased volatility of RIN prices. This has caused uncertainty among potential investors. Some experts told us that EPA should make RIN market trading more open and transparent like other commodity markets, which could reduce the potential for fraudulent RIN activities and reduce RIN price volatility. EPA officials told us that EPA has recently begun to publish aggregated data on RIN transactions and biofuel volume production on its website in an effort to make the RIN market more transparent. However, it is too early to know how effective this will be in addressing fraud and price volatility.

We would be happy to discuss these, or any further, questions with your staff at any time.