MEMORANDUM

TO: EPA Air and Radiation Docket EPA-HQ-OAR-2015-0111
FROM: Dallas Burkholder, Office of Transportation and Air Quality, US EPA
DATE: April 15, 2015
SUBJECT: Cellulosic Biofuel Producer Company Descriptions

The following contains a brief description of each of the companies that EPA believes may produce commercial scale volumes of RIN generating cellulosic biofuel by the end of 2016. These descriptions are based on a review of the publicly available information and information provided to EPA in conversations with company representatives.

Abengoa

Abengoa, a large international biofuels company, has developed an enzymatic hydrolysis technology to convert corn stover and other agricultural waste feedstocks into ethanol. After successfully testing and refining their technology at a pilot-scale facility in York, Nebraska as well as in a demonstration-scale facility in Salamanca, Spain, Abengoa successfully constructed their first commercial-scale cellulosic ethanol facility in Hugoton, Kansas. This facility was partially funded by a $132 million Department of Energy (DOE) loan guarantee. Abengoa held a grand opening for this facility in October 2014[1], and conducted commissioning and start-up operations throughout the winter of 2014/2015. Abengoa currently has contracts in place for the majority of feedstocks necessary for the Hugoton facility for the next 10 years and successfully completed their first biomass harvest in the fall of 2011. The Hugoton plant is capable of processing up to 1,000 dry tons of corn stover per day, with an expected annual ethanol production capacity of approximately 25 million gallons. Abengoa plans to begin producing salable volumes of fuel at the facility in the spring of 2015.

Compressed Natural Gas (CNG) and Liquefied Natural Gas (LNG) Producers

In July 2014 EPA approved, as part of the "Pathways II" rule,[2] a new cellulosic biofuel pathway for CNG and LNG from biogas produced at landfills, separated MSW digesters, municipal wastewater treatment facilities, agricultural digesters, and biogas from the cellulosic components of biomass processed in other waste digesters. The production potential for this type of cellulosic biofuel is large and is expected to increase at a rapid pace due to the fact that many U.S.-based entities currently capture or produce biogas. This means that in many cases the construction of new facilities will not be required for facilities to begin generating cellulosic biofuel (D3) RINs. Instead, both new and existing facilities must register with the EPA under the RFS program and provide sufficient documentation to demonstrate that the CNG or LNG for which the RINs are being generated will be used exclusively as transportation fuel in the United States. This can be accomplished by fueling vehicles with CNG/LNG at the biogas production site or through the use of contractual mechanisms or appropriate affidavits, as prescribed in the

[1] Abengoa. *Abengoa Celebrates Grand Opening of Its First Commercial-Scale Next Generation Biofuels Plant.* N.p., 17 Oct. 2014. Web. 26 Mar. 2015.
[2] 79 FR 42128, July 18, 2014.

RFS regulations. Additionally, to generate RINs for the CNG or LNG derived from biogas companies must demonstrate that the biogas feedstock used was derived from a landfill, separated MSW digester, municipal wastewater treatment facility, agricultural digester or the cellulosic components of biomass processed in a waste digester..

The use of CNG and LNG as a transportation fuel in 2016 is expected to be approximately 500 million ethanol-equivalent gallons.[3] In projecting likely production volumes of RIN generating cellulosic biogas used in 2015 and 2016, EPA has reviewed the current rate of RIN generation for cellulosic biogas, the capacity and historic production rates of all facilities registered to produce cellulosic biogas[4], and company specific production projections provided to EPA by the industry.[5]

Cool Planet Energy Systems

Cool Planet Energy Systems has developed a process to convert a variety of forms of cellulosic biomass into gasoline, diesel, or jet fuel blendstock as well as a bio-carbon soil amendment co-product. Their proprietary process uses pressure and heat in a modified pyrolysis system to convert the cellulosic biomass to a hydrocarbon stream by passing the pyrolysis vapors across chemical catalysts. Cool Planet Energy Systems plans to deploy relatively small-scale production units capable of producing between 5 and 10 million gallons of fuel and 25,000-50,000 metric tons of bio-carbon per year that can be located near readily available sources of cellulosic biomass. Cool Planet Energy Systems' first commercial-scale facility will be built at the Port of Alexandria, Louisiana. The facility will be designed to produce at least 5 million gallons of cellulosic hydrocarbon blendstocks per year from wood residues. Cool Planet Energy Systems anticipates beginning construction on the first module of this facility in 2015 and producing a small volume of fuel at the facility in the second half of 2016.

DuPont

DuPont has developed an enzymatic process to convert corn stover into cellulosic ethanol. DuPont has invested hundreds of millions of dollars to develop this technology and since 2009 has operated a demonstration-scale facility in Vonore, Tennessee. In addition to developing technology for converting cellulosic biomass to ethanol, DuPont has been working with corn producers, equipment manufacturers, the U.S. Department of Agriculture, and Iowa State University to develop expertise in the collection, transportation, and storage of the biomass

[3] EIA Short Term Energy Outlook (STEO) April 2015. Natural Gas Vehicle Use from the Custom Table Builder (0.10 billion cubic feet/day in 2016). This projection includes all CNG/LNG used as transportation fuel from both renewable and non-renewable sources. EIA does not project the amount of CNG/LNG from biogas used as transportation fuel.

[4] For a list of all facilities registered to generate cellulosic biofuel RINs using biogas as a feedstock see "List of Registered Cellulosic Biofuel Producers in March 2015", memorandum from Dallas Burkholder to EPA Air Docket EPA-HQ-OAR-2015-0111.

[5] Further detail on our projection of cellulosic biogas in 2015 and 2016 can be found in "Assessment of Cellulosic Biofuel Production from Biogas (2015-2016)", memorandum from Dallas Burkholder to EPA Air Docket EPA-HQ-OAR-2015-0111.

feedstock for their cellulosic ethanol facility. On November 30, 2012, DuPont began the construction of their first commercial-scale cellulosic ethanol facility in Nevada, Iowa. This facility is designed with a production capacity of 30 million gallons of cellulosic ethanol per year. Mechanical completion of the facility is expected to be achieved in the spring of 2015, followed by a period of commissioning. Based on conversations with DuPont representatives, EPA expects commercial-scale production to commence sometime in the third quarter of 2015.

Edeniq

Edeniq has developed a proprietary process that would allow corn ethanol producers to generate cellulosic ethanol from corn kernel fiber at the corn ethanol producers' existing production facilities. Their process involves the addition of the Cellunator™, a proprietary milling technology designed to increase the uniformity of the feedstock particles, along with a combination of enzymes to convert the cellulosic material in the corn kernel into sugars and ultimately cellulosic ethanol. Several commercial plants are currently using the Cellunator technology to increase their yields of ethanol from starch. Edeniq has been testing their technology, including both the Cellunator and the additional enzymes, at a demonstration-scale facility in Visalia, California since June 2012 and announced in May 2013 that they had successfully completed a trial run at this facility with a continuous run time of greater than 1,000 hours. Edeniq has also run successful short term trials at commercial corn ethanol production facilities. In the July 2014 "Pathways II" rule EPA clarified that processes, such as the one developed by Edeniq, that convert corn kernel fiber into transportation fuel are approved to generate cellulosic RINs.[6] Edeniq anticipates their technology will be used to produce commercial scale volumes of cellulosic ethanol at existing corn ethanol facilities beginning in the second half of 2015 and an increasing number of facilities through the end of 2016.[7]

Ensyn

Ensyn owns and operates a technology known as Rapid Thermal Processing that involves the non-catalytic thermal conversion of carbon-based solid feedstocks to liquid products. Ensyn's technology has successfully operated commercially for over 25 years. It is currently deployed in five commercial facilities in Wisconsin for the production of specialty chemicals and heating fuels, and Ensyn recently expanded their production capacity with the opening of a new facility in Ontario, Canada. Ensyn's primary fuel product, renewable fuel oil (RFO), is sold commercially in the US as a replacement for heating oil. Ensyn registered its Ontario facility under the RFS program in 2014 and has generated cellulosic diesel (D7) RINs related to sales of RFO as a replacement for heating oil to clients in the United States. Ensyn is currently acquiring additional customers for RFO and plans to increase the volume of RFO exported to the United States. For the purposes of projecting a volume of cellulosic biofuel produced by Ensyn in 2015 and 2016 EPA is only considering the volume of RFO from Ensyn's Ontario facility that is

[6] 79 FR 42128, July 18, 2014

[7] More information on Edeniq's commercialization plans has been placed in the docket at "Email from Edeniq containing projected cellulosic biofuel production for 2015 and 2016 (CBI)", memorandum from Dallas Burkholder to EPA Air Docket EPA-HQ-OAR-2015-0111.

eligible to generate RINs, not the full expected production volume of Ensyn's facilities.

INEOS Bio

INEOS Bio has developed a process for producing cellulosic ethanol by first gasifying cellulosic feedstocks into a synthesis gas (syngas) and then using naturally occurring bacteria to ferment the syngas into ethanol. On February 9, 2011, INEOS Bio broke ground on their first commercial-scale facility in Vero Beach, Florida. The facility is designed to produce 8 million gallons of cellulosic ethanol per year. INEOS Bio announced that they had completed construction on this facility in June 2012 and began full commissioning of the facility. On July 31, 2013, INEOS Bio announced they had begun producing cellulosic ethanol at commercial scale from their Vero Beach facility. In September 2014 it was reported that INEOS Bio was producing very little ethanol at their facility and planned to undertake efforts to increase the quality of the syngas in order to increase the plant productivity.[8] INEOS Bio has completed construction on the required syngas clean-up modules and expects to begin producing commercial-scale volumes of ethanol in the second quarter of 2015.

POET-DSM Advanced Biofuels

POET-DSM Advanced Biofuels uses an enzymatic hydrolysis process to convert cellulosic biomass into ethanol. POET, one of the largest ethanol producers in the U.S., has invested in the development of cellulosic ethanol technology for more than a decade and began producing small volumes of cellulosic ethanol at pilot scale at their plant in Scotland, South Dakota in late 2008. In January 2012, a joint venture was formed between POET and the international biotech company Royal DSM of the Netherlands, called POET-DSM Advanced Biofuels, to commercialize and license their cellulosic ethanol technology. The joint venture's first commercial-scale facility, called Project LIBERTY, is located in Emmetsburg, Iowa. This facility is designed to process 770 dry tons of corn cobs, leaves, husks, and stalks per day into cellulosic ethanol. The facility is projected to have an annual production of approximately 20 million gallons per year, later ramping up to 25 million gallons per year.[9] Construction of the facility began in March 2012. On September 3, 2014, POET-DSM held a grand opening for Project Liberty to mark the commencement of the start-up of the facility. Based on conversations with representatives of POET-DSM, EPA expects production of commercial scale quantities of cellulosic ethanol from Project LIBERTY to begin in the third quarter of 2015.

Quad County Corn Processors

Quad County Corn Processors (QCCP) have developed a bolt-on technology called

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[8] INEOS Bio Making Little Cellulosic Ethanol at US Plant. ICIC News. September 5, 2014. Accessed online <http://www.icis.com/resources/news/2014/09/05/9818462/ineos-bio-making-little-cellulosic-ethanol-at-us-plant/>

[9] "Construction remains on schedule for Poet-DSM's first commercial cellulosic bio-ethanol plant." December 23, 2013. Article available online at http://www.poet.com/pr/construction-remains-on-schedule-for-project-liberty. Accessed May 1, 2014.

Adding Cellulosic Ethanol or ACE for existing dry grind corn ethanol plants to enable them to produce cellulosic ethanol from corn kernel fiber. QCCP claims that their technology can increase ethanol yields by 6% through the conversion of the cellulose, hemicellulose, and lignin present in the corn kernel fiber. They also expect that their process will result in significantly increased corn oil yields and increase the protein content of the distillers grains coproduct. The ACE technology uses a post-processing approach, first fermenting the starch present in the corn kernel, and then using their proprietary technology to process and ferment the remaining cellulosic portions. QCCP broke ground on the bolt-on ACE process in the summer of 2013. On July 2, 2014, QCCP announced that they had completed construction and begun producing cellulosic ethanol from their Galva, Iowa facility using the ACE technology.[10] The facility is designed to be capable of producing approximately 2 million gallons of cellulosic ethanol per year.[11]

[10] "Quad County begins cellulosic ethanol production" Ethanol Producer Magazine, July 2, 2014. Accessed online on August 5, 2014. Available at <http://www.ethanolproducer.com/articles/11212/quad-county-begins-cellulosic-ethanol-production>

[11] Ibid.

MEMORANDUM

Subject: Estimating E0 Volume Sold in the U.S. at marinas

From: Lester Wyborny, U.S. EPA, Office of Transportation and Air Quality

To: EPA Air Docket EPA-HQ-OAR-2015-0111

All recreational marine engines are currently produced and certified to operate on both E0 and E10. The number of older marine engines that were certified to operate only on E0 is in the extreme minority. Demand for E0 among owners of recreational marine engines is driven primarily by concerns about potential water contamination, the phase separation that occurs with ethanol blends, and the resulting engine damage. For smaller watercraft that are commonly trailered to launching sites, gasoline is generally purchased from retail stations that by and large only offer E10. Thus to the degree that there are sales of E0 to owners of recreational marine engines, it will occur primarily at marinas.

Stakeholders have communicated to the EPA that various entities make non-ethanol blended gasoline (E0) for sale at marinas. EPA has also heard from stakeholders that many marinas receive requests from boat owners for E0 gasoline, and in many cases, the local suppliers try to satisfy the boat owners' requests. Because EPA was unable to find a direct estimate, publicly available or otherwise, of the volume of E0 sold at marinas, we conducted an analysis to estimate E0 sold at marinas for purposes of determining the applicable standards under the RFS program.

A number of U.S. marinas are represented by the Association of Marina Industries (AMI). According to AMI's website (marinaassociation.org/), AMI represents several hundred marinas, boatyards, yacht clubs, public/private mooring basins, partner associations and marine industry vendors and suppliers across the U.S. and the world. The AMI webpage also states that 38 million gallons of fuel was sold from the marinas they represent in 2010.

In discussions with representatives from AMI, we were told that AMI represents 500 marinas in the U.S. and many of those marinas sell fuel, although some do not. The 38 million gallons of fuel sold at the marinas they represent includes both gasoline and diesel fuel, but the AMI did not know how much of each. Also, the 38 million gallon figure reported by AMI is the result of a survey, and AMI did not know what fraction of total fuels sales at their marinas the 38 million gallons represents, because some marinas don't respond to the survey even though they sell fuel. We asked AMI if there was a way for them to estimate the volume of gasoline sold at its marinas and AMI did not believe that there was any way to do that from the data that they had on hand. AMI referred us to ValvTect, a company which markets additives for marine fuel at the AMI member marinas.

ValvTect produces additives designed to be blended into marine gasoline and diesel fuel. Their additives help to prevent corrosion, stabilize the fuels, provide some detergent qualities, and help to control the effects of moisture, thus allowing the use of ethanol-blended gasoline by

boats if that is the fuel available. Their additives are blended into the E0 and ethanol-blended fuels used at 640 marinas across the US, out of the estimated 3000 marinas which sell fuels. At the marinas which use their additives, both gasoline and diesel fuels are marketed. Some sell only a small amount of fuel, while others sell a significant amount of fuel. ValvTect believes that the marinas at which their additives are used tend to be somewhat representative of the all marinas in the U.S. and ValvTect estimated the volume of gasoline sold at those marinas is 50 million gallons per year. ValvTect could not provide an estimate of the total volume of gasoline sold at all US marinas. We estimated the total gasoline sold at all marinas by applying a ratio of 3000 to 640 to the estimated 50 million gallons of gasoline sold at the marinas that ValvTect sells its marine gasoline additives. Based on this methodology, we estimate that the total volume of marine gasoline sold in the U.S. is on the order of 248 million gallons.

In response to our questions regarding the amount of marine gasoline sold as E0, ValvTect replied that not all gasoline sold at marinas is E0. Marine gasoline is likely to contain ethanol when only gasoline blendstocks (rather than finished fuels) are available in the area, such as renewable blendstocks for oxygenate blending (RBOB) or conventional blendstock for oxygenate blending (CBOB). Conversely, finished gasoline which receives a 1 psi waiver and is simply splash blended with ethanol could be sold as E0. Based on this information from ValvTect, we estimated the fraction of marine gasoline which is E0 versus E10.

Available data is not sufficient to indicate the volume of marine gasoline sold in RFG areas nor the volume of marine gasoline sold in the states with RFG areas. We estimated the volume of marine gasoline sold in each state based on the number of marinas in each state. Marinas.com provides the number of marinas in each state, which we summarized in the table below.

Estimated number of Marinas by State*			
State	# of Marinas	State	# of Marinas
Alabama	35	Montana	UC
Alaska	UC	Nebraska	UC
Arizona	1	Nevada	UC
Arkansas	2	New Hampshire	15
California	468	New Jersey	438
Colorado	1	New Mexico	UC
Connecticut	255	New York	900
Delaware	21	North Carolina	128
Dist. of Columbia	6	North Dakota	UC
Florida	970	Ohio	243
Georgia	33	Oklahoma	1
Hawaii	19	Oregon	57
Idaho	1	Pennsylvania	33
Illinois	74	Rhode Island	153
Indiana	12	South Carolina	65

Iowa	UC	South Dakota	UC
Kansas	UC	Tennessee	27
Kentucky	34	Texas	67
Louisiana	19	Utah	UC
Maine	277	Vermont	34
Maryland	428	Virginia	185
Massachusetts	394	Washington	303
Michigan	414	West Virginia	UC
Minnesota	11	Wisconsin	151
Mississippi	18	Wyoming	UC
Missouri	8		

*The term UC means "under construction" meaning that data collection is incomplete

For some states, information is not provided for the number of marinas and the website uses the term "under construction" (UC) to indicate this. It is likely that for most of these states, there are very few marinas in the entire state, or perhaps none, because they are states without a coastline and contain few lakes. The exception to this is Alaska which has a very long coastline, although a very small population. Counting only those states for which Marinas.com provides a value, there are a total of 6,301 marinas in the U.S.

To estimate the volume of marine gasoline which is E10 versus E0, we added up the number of marinas in predominantly Reformulated Gasoline (RFG) states, which includes California, Connecticut, Delaware, District of Columbia, Maryland, Massachusetts, New Jersey, New York, and Rhode Island. While a substantial volume of conventional gasoline is sold in New York, this is offset by the many other states which have RFG areas, including Arizona, Georgia, Illinois, Indiana, Kentucky, Louisiana, New Hampshire, Pennsylvania, Texas, and Wisconsin. However, the RFG volume is either small relative to the total gasoline sold in these states, or these states have a fewer number of marinas. Using this method, we estimate that the volume of marine gasoline in predominantly RFG states is about half of the total marine gasoline sold. Thus, the volume of E0 is estimated to be about half of the estimated 248 million gallons of marine gasoline sold in the U.S., which we calculated to be 124 million gallons. This volume of E0 is equivalent to about 128 million gallons of E10. Thus, the use of E0 rather than E10 at marinas reduces the nationwide total volume of ethanol consumed by about 13 million gallons.

MEMORANDUM

Subject: Projection of potential E15 consumption and its impacts on total ethanol consumption

From: David Korotney, U.S. EPA, Office of Transportation and Air Quality

To: EPA Air Docket EPA-HQ-OAR-2015-0111

In the context of estimating the total volume of ethanol that can be produced and consumed in 2014 for purposes of setting the applicable volume requirement for total renewable fuel under the RFS program, we have estimated the contribution that consumption of E15 can make to total ethanol.

According to the national E15 compliance survey there were 63 stations that operated blender pumps selling E15 as of February, 2014. This number is expected to grow throughout 2014. For instance, MAPCO has indicated that it intends to offer E15 at 100 of its stations, though it is unclear how many will be installed in 2014.[1] For the purposes of this analysis we have assumed that 100 stations will offer E15 in 2014. This number could, for instance, represent a rampup of about 10 new E15 stations per month between March and December 2014. While there would be a total of 163 E15 stations by December 2014, some stations would only be operational for part of the year. The average number of stations in operation for all of 2014 would be about 100 in this scenario.

The number of all retail stations selling fuel in the U.S. has been in steady decline over the last decade. Using station counts from the National Petroleum News, this trend can be projected into the future. On this basis, the projected number of service stations in 2014 will be 153,488.

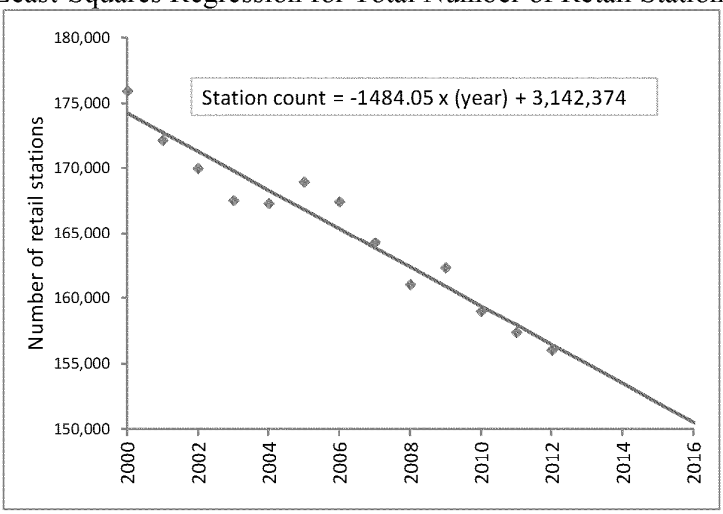
Table 1
Total Number of Retail Stations
(Source: National Petroleum News "2012 Market Facts")

2000	175,941
2001	172,169
2002	170,018
2003	167,571
2004	167,346
2005	168,987
2006	167,476
2007	164,292
2008	161,068
2009	162,350

[1] http://www.businesswire.com/news/home/20140115005879/en/MAPCO-offer-E15-Customers-2014#.UuKJJ_tOm00

2010	159,006
2011	157,393
2012	156,065

Figure 1
Least-Squares Regression for Total Number of Retail Stations



Therefore, the fraction of retail stations selling E15 in 2014 is projected to be 0.065%.

100 E15 stations / 153,488 retail stations = 0.065%

A simplified estimate of the volume of E15 that might be sold in 2014 would use the per-station sales rate for E10 as a substitute. Given that in 2014 about 134 bill gal of gasoline is expected to be sold through 153,488 stations, the average station is projected to sell about 870,000 gallons of E10 in 2014. If stations offering E15 sell it at this same rate, a total of 87 mill gal of E15 could be sold in 2014 (870,000 × 100 stations). However, an estimate of 87 mill gal of E15 for 2014 is likely to be an overprojection for the following reasons:

- Stations offering E15 are unlikely to do so to the exclusion of E10. That is, it would be unreasonable to expect that a retail station selling E15 would not also sell E10. The purpose of blender pumps is to provide customers with a choice, and even those whose vehicles can use E15 would not be expected to use E15 100% of the time. As a result, E15 sales at those stations offering E15 are likely to be less than 870,000 gal per year per station.

- While all 2001 and newer model year vehicles are legally permitted to use E15, most of them were not designed by manufacturers with the expectation that they might operate on E15. Manufacturers have only recently begun adding E15 to the list of fuels covered by their vehicle warranties. Absent the explicit inclusion of E15 to the

warranty, vehicle owners may be reluctant to use E15 even if legally permitted to do so.

Since only model years 2012 - 2014 have been explicitly warranted to use E15 (and in fact not all models within these model years), it may be that vehicles manufactured prior to 2012 do not use E15 at all. Model years 2012 - 2014 comprise about 22% of all the vehicles in the 2014 in-use fleet.

While we are not able at this time to quantitatively estimate the impact of these factors on E15 sales for 2014, it seems reasonable to assume that together they would likely result in more than a 50% reduction in the maximum of 87 mill gal that we estimated above. For the purposes of estimating potential E15 sales in 2014, then, a projection of 40 mill gal appears to be reasonable.

MEMORANDUM

Subject: Assessment of Statutory Factors for 2015-2017 biomass-based diesel (BBD) Applicable Volumes pursuant to CAA section 211(o)(2)(B)(ii)(I)-(VI)

From: U.S. EPA, Office of Transportation and Air Quality

To: EPA Air Docket EPA-HQ-OAR-2015-0111

EPA's primary assessment of the statutory factors for years 2015 through 2016 is that because the proposed advanced biofuel volume requirements for 2015-2016 reflect the maximum volumes of all advanced biofuels (including BBD) that can reasonably be expected to be produced and consumed, and because the BBD requirement is nested within the advanced biofuel volume requirement, we expect that the advanced biofuel volume requirement will determine the level of BBD production and import; the same volume of BBD will be produced and imported regardless of the BBD applicable volumes that we require for 2015-2016. Since our decision on the BBD applicable volumes for 2015-2016 is not expected to impact the volume of BBD produced and imported during this time period, we do not expect our decision to result in a difference in any of the factors we are required to evaluate pursuant to CAA section 211(o)(2)(B)(ii)(I)-(VI), with the exception, as described in the preamble, that in considering statutory factor 211(o)(2)(B)(ii)(III), we believe that our decision on the level of the nested BBD volume requirement can have an impact on the future development and marketing of non-BBD advanced biofuels and can also be seen as a supportive or non-supportive signal to potential investors in BBD. Similarly for 2017, even though we are proposing only the 2017 BBD requirement at this time and not the 2017 advanced biofuel requirement, we believe this same primary assessment is appropriate since, as in previous years, the 2017 advanced biofuel requirement will be set to reflect the maximum volumes of all advanced biofuels (including BBD) that can reasonably be expected to be produced and consumed for 2017, and it is the advanced standard that can be expected to drive BBD production and use.

As an additional supplementary assessment, we have considered the potential impacts of modifying the applicable volume of BBD from the proposed levels of 1.70 billion gallons in 2015, 1.80 billion gallons in 2016, and 1.90 billion gallons in 2017, based on the assumption that in guaranteeing BBD volumes at any given level there could be greater use of BBD and a corresponding decrease in the use of other types of advanced biofuels for years 2015-2017.[1]

[1] Section 211(o)((2)(B)(i)(IV) of the Clean Air Act provides the statutory applicable BBD volumes for years 2009 – 2012. For years after 2012 through 2022, section 211(o)(2)(B)(v) specifies that the applicable volume for BBD cannot be less than the requirement for 2012 which was 1.0 billion, and section 211(o)(2)(B) (ii) requires that EPA determine the annual BBD requirement taking into consideration a review of the implementation of the program and an analysis of various factors, in coordination with USDA and DOE. In setting this annual BBD volume, the statute does not establish any numeric criteria or other means of weighing the importance of the often competing factors, or how to balance the overarching RFS program goals. Based on these statutory requirements, EPA set the applicable volume for BBD at 1.28 billion gallons in 2013. As described in the preamble, a review of implementation of the BBD requirements to date and the expected annual rate of future commercial production of renewable fuels (in particular, BBD capacity, ability of the advanced biofuel and total renewable fuel standards to drive BBD

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However, setting a higher or lower BBD volume requirement than the levels proposed would only be expected to impact BBD volumes on the margin, protecting to varying degrees this advanced biofuel from being outcompeted by other advanced biofuels. At present, the other advanced biofuels that could be affected include the following: sugarcane ethanol; ethanol from grain sorghum, food waste, or cover crops; renewable diesel from food waste or cover crops; renewable naphtha from food waste or cover crops; CNG/LNG from non-cellulosic sources; and cellulosic biofuel. However, as part of this proposed rulemaking, as discussed in section IV of the preamble, we have carefully evaluated the production/import potential for cellulosic biofuels, and will continue to update this analysis prior to setting final cellulosic biofuel volume requirements and corresponding percentage standards that reflects this detailed analysis. We think it is unlikely that our decision regarding a BBD applicable volume will have any impact on the production or import of cellulosic biofuels given our separate action in establishing a cellulosic biofuel standard that is nested within the advanced biofuel standard. Accordingly, the more likely affected biofuels are non-cellulosic advanced biofuels, and our assessment below discusses the possibility that our decision regarding the BBD applicable volumes for 2015-2017 could impact the production and use of these non-cellulosic advanced biofuels.

Our supplementary assessment is described below, together with a discussion of the statutory factors the EPA must consider as part of its decision-making with regard to setting the applicable volume of BBD. Overall, the supplemental assessment and statutory factors analysis specified in CAA section 211(o)(2)(B)(ii)(I)-(VI) for the years 2015-2017, does not appear, based on available information, to provide a compelling reason for setting a higher or lower nested standard for BBD than 1.70 billion gallons in 2015, 1.80 billion gallons in 2016, and 1.90 billion gallons in 2017.

1. Impact on the Environment

a. Air Quality

Based on our emissions and air quality impact analyses from the 2010 RFS2 final rule, we can assess the likely impacts on non-GHG pollutants associated with setting the applicable volume of BBD at levels higher or lower than 1.70 billion gallons in 2015, 1.80 billion gallons in 2016, and 1.90 billion gallons in 2017.

The 2010 RFS2 analysis estimated the upstream and downstream emission impacts associated with various types of renewable fuels, including BBD, ethanol, renewable diesel and cellulosic diesel at full implementation of the RFS2 program in 2022. The BBD and advanced

production, the benefits of providing additional support to the BBD industry through a higher nested standard, and the impact of our decision on the likely future commercial production of non-BBD, non-cellulosic advanced biofuels) led us to consider proposing applicable BBD volumes of 1.70 billion gallons in 2015, 1.80 billion gallons in 2016, and 1.90 billion gallons in 2017. In the analysis presented in this memorandum, we have considered whether any of the other factors listed in the statute should lead us to propose higher or lower BBD volume requirements. The volumes could be set as low as the statutory minimum 1.0 billion gallons or, for 2015-2016 as high as the proposed advanced volume requirement minus the proposed cellulosic biofuel requirement

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biofuels volumes assumed in the RFS2 analysis led to increases in some criteria pollutant and air toxics emissions and decreases in others.[2] This indicates that some emissions increases or decreases might be associated with any change in the volume of BBD and other advanced biofuels. Depending on which of the competing advanced biofuels is compared to BBD, the emissions impacts of devoting a larger portion of the advanced biofuel standard to BBD will vary (assuming the advanced standard stays constant). However, given that other advanced biofuels also result in air quality impacts, and that the volumes at issue are relatively small when considered in the context of transportation fuel use throughout the geographic area in which the RFS program applies (the continental United States and Hawaii), the overall impacts of marginal shifts between BBD and other advanced biofuels is expected to be small, and this factor does not appear to provide a compelling reason for setting a higher or lower nested BBD volume requirement.

b. Climate Change

Pathways for advanced biofuels approved by EPA, including BBD produced from virgin vegetable oils such as soy, meet the definitional requirement that advanced biofuels provide at least a 50% improvement in GHG performance compared to 2005 baseline petroleum fuels. We believe the trend to increasing the use of waste fats, oils, and greases as feedstock for the production of BBD is likely driven by the lower cost of these feedstocks compared to virgin vegetable oils such as soy oil. Since BBD produced from waste fats, oils, and greases receives the same RFS compliance credit as BBD produced form virgin vegetable oils, the growth in use of waste fats, oils, and greases is indicative of their cost advantage as a feedstock. The cheaper waste fats, oils, and greases will tend to be used preferentially toward meeting the BBD and advanced biofuel standards prior to the use of virgin vegetable oils such as soy oil. Similarly, the volume of non-food grade corn oil extracted from distillers grains and solubles produced during corn ethanol production has continued to grow as a source for BBD feedstock, again reflecting its lower cost compared to virgin vegetable oils like soy oil.

The available supplies of waste fats, oils, and greases feedstock and non-food grade corn oil feedstock are insufficient to produce even the statutory minimum volume for BBD of 1.0 billion gallons. For any volume above the 1.0 billion gallon minimum, it is appropriate, therefore, to consider the impact of producing BBD from soy oil, the feedstock that will most likely be used at the margin to increase production over levels that can be attained using waste materials. Our analysis of soy-derived biodiesel as part of the 2010 RFS rulemaking indicated that it provides a 57% reduction in lifecycle GHG emissions as compared to the 2005 petroleum baseline. Other non-cellulosic advanced biofuels which could compete with soy BBD within the advanced standard include: sugarcane ethanol (primarily from Brazil); ethanol from grain sorghum, non-cellulosic portions of food waste and cover crops; renewable diesel from food waste or cover crops, naphtha from camelina oil, food waste or cover crops; and CNG/LNG from

[2] A complete discussion of the RFS2 air quality analysis and its limitations can be found in Chapter 3 of the RFS2 Regulatory Impact Analysis (RIA). U.S. EPA 2010, Renewable Fuel Standard Program (RFS2) Regulatory Impact Analysis. EPA-420-R-10-006. February 2010. Docket EPA-HQ-OAR-2009-0472-11332.

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non-cellulosic sources. These alternative advanced biofuels range in GHG reduction performance, with the waste-derived fuels providing the greatest reduction due to lack of any land use impact while biofuels made from crops having GHG reductions that are roughly comparable to soy biodiesel (e.g., sugarcane ethanol which has a 61% GHG reduction compared to gasoline; sorghum ethanol with estimated emission reductions of just over 50%;). Since for the years in question sugarcane and sorghum ethanol are the most likely marginal replacements for soy biodiesel, as suggested by feedstock availability and fuel production capacity, we believe based on these lifecycle GHG reduction calculations that if we set a marginally lower or higher BBD nested volume requirement and assumed this made a difference in how much BBD is ultimately used, that there would be no significant GHG impact. Therefore, this factor does not appear to provide a compelling reason for setting a higher or lower nested BBD volume requirement.

We note, however, that certain advanced biofuels (e.g. ethanol from food waste or CNG/LNG from non-cellulosic feedstock) have significantly superior lifecycle GHG performance than soy biodiesel. Setting the nested BBD volume requirement sufficiently below the advanced biofuel requirement, as reflected in the proposed volumes, should provide a continuing incentive for the further development and marketing of such fuels, and may result in potentially increased GHG reductions through RFS implementation over the long term.

c. Wetlands, Ecosystems, and Wildlife Habitats

As in the rulemaking establishing the BBD volume requirement for 2013, EPA has completed a largely qualitative assessment of impacts on wetlands, ecosystems, and wildlife habitats, consistent with available information.

The comparison of impacts on wetlands, ecosystems, and wildlife habitats will depend on which alternative advanced biofuel would be displaced by BBD from virgin oils such as soy oil. As noted above, soy oil is the most likely feedstock for biodiesel production after the less-expensive waste fats, oils and greases and thus is the likely feedstock for producing marginal increases in BBD. Other non-cellulosic advanced biofuels which could compete with BBD within the advanced standard include: sugarcane ethanol (primarily from Brazil); ethanol from grain sorghum, non-cellulosic portions of food waste and cover crops; renewable diesel from food waste or cover crops, naphtha from camelina oil, food waste or cover crops; and CNG/LNG from non-cellulosic sources. The advanced biofuels that are most likely to be impacted by the level at which the BBD applicable volume is established include grain sorghum ethanol and sugarcane ethanol. Such biofuels, like soy biodiesel, are made from planted crops and therefore are likely to have impacts on wetlands, ecosystems and wildlife habitats which are roughly comparable to, yet still may differ from, those of soy-based BBD. Depending on which of these alternative advanced fuels might replace soy-based BBD, the impacts of devoting a larger or smaller portion of the advanced biofuel standard to BBD will vary somewhat but, particularly given the relatively small volumes at issue, we do not believe that this factor provides a compelling reason for setting a higher or lower nested volume requirement for BBD.

We note, however, that certain advanced biofuels (e.g. ethanol from food waste,

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CNG/LNG from non-cellulosic feedstock, etc.) are not made directly from crops, and would therefore likely have significantly lower impacts on wetlands, ecosystems, and wildlife habitats than soy biodiesel. Setting the nested BBD volume requirement sufficiently below the advanced biofuel requirement, as reflected in the proposed volumes, should provide a continuing incentive for the further development and marketing of such fuels; to the extent such fuels become increasingly significant players in the advanced biofuel market, there could be long-term reductions in impacts on wetlands, ecosystems, and wildlife habitats as compared to a scenario where the BBD volume requirement is set at a level that did not incentivize production of such fuels.

d. Water Quality and Water Supply

As is the case when considering the impacts on wetlands, ecosystems, and wildlife habitats, the impact on water quality and water supply will depend on which alternative advanced biofuel is displaced by soy-based BBD. The advanced biofuels that are most likely to be impacted by the level at which the BBD applicable volume is established for these years in question include grain sorghum ethanol, sugarcane ethanol and naptha from camelina oil. Such biofuels, like soy biodiesel, are made from planted crops and therefore are likely to have impacts on water quality and water supply that are comparable to, yet still may differ from, those of soy-based BBD. Depending on which of these alternative advanced fuels might replace soy-based BBD, the impacts of devoting a larger or smaller portion of the advanced biofuel standard to BBD will vary somewhat but, particularly given the relatively small volumes at issue, we do not believe that this factor provides a compelling reason for setting a higher or lower nested volume requirement for BBD.

Some advanced biofuels s (e.g., CNG/LNG or ethanol made from food waste) will have little or no impact on water quality and water supply. While production of such fuels is likely to be limited in the short term, setting the nested BBD volume requirement significantly below the advanced biofuel requirement, as reflected in the proposed volumes, should provide a continuing incentive for the further development and marketing of such fuels; to the extent such fuels become increasingly significant players in the advanced biofuel market, there could be long-term reductions in impacts on water quality and water supply as compared to a scenario where the BBD volume requirement is set at a level that did not incentivize production of such fuels.

2. Impact on Energy Security

The wider use of any advanced biofuels, including BBD and sugar cane or sorghum ethanol, diversify the U.S. liquid fuel mix and provide energy security benefits. This is true for both domestically produced and imported biofuels. Advanced biofuels, whether produced domestically or imported, will contribute, on the basis of energy displaced, to enhanced energy security. Based on these considerations, the supplemental analysis does not appear to suggest a distinct energy security advantage associated with selecting any particular BBD applicable volume for 2015, 2016 and 2017.

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3. The Expected Annual Rate of Future Commercial Production of Renewable Fuels, including Advanced Biofuels in each Category

The preamble, section II.C, provides an overview and discussion of the expected annual rate of future commercial production and import of total renewable fuels for 2015 and 2016, including advanced biofuels and BBD.

In order to meet the advanced biofuel standards being proposed for 2015 through 2017, we anticipate at least 1.70 billion gallons in 2015, 1.80 billion gallons in 2016, and 1.90 billion gallons in 2017 of BBD will be produced, distributed, and consumed. The industry already has sufficient production capacity to meet the full 1.90 billion gallons being proposed for 2017 and there does not appear to be any limitations in supplying this volume to the market. We believe that an increase in the BBD volume to 1.70 billion gallons in 2015, 1.80 billion gallons in 2016, and 1.90 billion gallons in 2017 would strike the appropriate balance between providing a market environment where other types of advanced biofuels are incentivized and providing support and a degree of certainty for the BBD industry and the RFS program that are associated with increasing the BBD volume requirement to proposed levels. This approach does not limit additional BBD production.

4. Impact of Renewable Fuels on Infrastructure

a. Deliverability of Materials, Goods, and Products Other than Renewable Fuels

We do not anticipate any significant impacts on deliverability of materials other than renewable fuels that might result from devoting a larger or smaller portion of the advanced biofuel standard to BBD for years 2015-2017. The EPA evaluated in the RFS2 final rule the impacts on the U.S. Transportation network from the distribution of the total additional volume of biofuels that would be used to meet the RFS standards. Oakridge National Laboratory (ORNL) conducted an analysis of biofuel transportation activity from production plants to petroleum terminals by rail, barge, and tank truck to identify potential distribution constraints to help support the assessment in the RFS2 final rule.[3] The ORNL analysis concluded that the increase in biofuel shipments due to the RFS2 standards would have a minimal impact on U.S. transportation infrastructure. The majority of biofuel transportation is projected to be accomplished by rail. It was estimated that biofuels transport would constitute only 0.4% of the total freight tonnage for all commodities transported by the rail system through 2022.[4] Given the small contribution of biofuel transport as a whole to total US freight tonnage, we do not believe that any particular BBD mandate would have a significant impact on the deliverability of

[3] "Analysis of Fuel Ethanol Transportation Activity and Potential Distribution Constraints", Oakridge National Laboratory, March 9, 2009. To simplify the ORNL analysis, BBD volumes were assumed to originate at the same points of production and to be shipped to the same petroleum terminals as the ethanol projected to be used to meet the RFS standards.

[4] See sections 1.6.4 and 1.6.5 of the RFS2 RIA.

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materials other than renewable fuels. In addition, to the extent there were an impact, it would likely be comparable to impacts associated with the use of other advanced biofuels that it might displace. As a result, we do not believe that this factor provides a basis for selecting any particular BBD applicable volume for 2015, 2016 and 2017

b. Sufficiency of Infrastructure to Deliver and Use Renewable Fuels

The rapid growth of biodiesel use has been driven by the RFS program and tax subsidies. The blending and distribution infrastructure has demonstrated the ability to respond to these incentives. For 2015-2017 volumes we anticipate that this will still be the case. The market has room to absorb more BBD. The proposed 2017 BBD level would represent about 3% of the diesel fuel supply. Most engines/vehicles in-use have been warranted by the manufacturer for the 5% level, and most manufacturers now have at least some product offerings warranted for up to 20% biodiesel. Cold temperature concerns may limit blend concentrations in northern cities during winter conditions, but this cold weather limit can be offset with greater use during the summer months. Furthermore, a portion is likely to be renewable diesel, for which there is no blending limit or winter use concerns. Finally, the National Biodiesel Board (NBB) has extensive efforts underway working with the vehicle and engine manufacturers to continue to expand product offerings capable of operating on B20, working with their membership to improve fuel quality, and working with dealers and technicians to clear away obstacles standing in the way of expanding biodiesel acceptance in the marketplace. These should continue to bear fruit.

As described in the preamble, there are a series of factors associated with the E10 blendwall that pose constraints on the deliverability and use of ethanol. While these constraints apply to both conventional and advanced ethanol, we note that the advanced standard is nested within the total standard, such that any advanced biofuel RIN generated for advanced sugarcane ethanol or sorghum ethanol can be used to satisfy both the advanced and total volume requirements. For this reason, we would expect that surgarcane and sorghum ethanol are alternatives to BBD for satisfying advanced biofuel volume requirements above the level guaranteed for BBD through the nested BBD standard.

In sum, we would not expect sufficiency of infrastructure to deliver and use renewable fuels to be a constraint for the proposed, or for a marginally higher or lower nested BBD applicable volume requirement.

5. Impact of the Use of Renewable Fuels on the Cost to Consumers of Transportation Fuel and on the Cost to Transport Goods

In, the preamble, we provide illustrative cost estimates for hypothetical examples in which either soybean oil BBD or sugarcane ethanol fills the entire change in the proposed advanced biofuel mandates from 2014 through 2016. We estimate the difference in the price per energy-equivalent gallon of BBD or sugarcane ethanol on the one hand, and the petroleum-based fuel they would replace on the other. We then multiply this difference by the year-on-year

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change in the proposed advanced biofuel volume requirement. More detail on this analysis can be found in the Memo to the Docket titled "Illustrative Costs Impact of the Proposed Annual RFS2 Standards, 2014-2017." This memo, for example, estimates the cost of using biodiesel to replace petroleum diesel that ranges from $218 million to $229 million in 2015 and from $483 million to $679 million in 2016, while the cost for sugarcane ethanol to replace gasoline to satisfy the proposed year to year changes in the advanced biofuel volume mandate ranges from $228 million to $615 million for 2015, and $424 to $1,303 million for 2016. These cost estimates however, are based on current market conditions, and it is likely that market conditions will vary over time. The market will determine which advanced biofuels are used to meet the portion of the advanced standard based that is not dedicated to BBD. To the extent that cost considerations favor BBD, the cost benefit can be accomplished either through setting a higher BBD nested standard, or allowing the market to choose BBD over competing products in meeting the advanced and total RFS standards. Thus, this factor does not appear to clearly favor setting either a higher or lower BBD nested standard than the levels proposed.

Setting a higher BBD volume requirement would only be expected, under the assumptions associated with this supplementary assessment, to impact biodiesel volumes on the margin, protecting them from being outcompeted by other advanced biofuels. Thus, the extra BBD volume requirement would merely replace other advanced renewable fuels that could be used to meet the advanced biofuel standard. As noted in the preamble, leaving room within the advanced standard for non-BBD advanced biofuels can incentivize the development and production of non-BBD advanced biofuels which may eventually provide a cost benefit as compared to BBD. In addition, this approach may temper to some extent BBD prices, by providing competition between the marginal BBD production volumes and other types of advanced biofuels. Therefore we believe that this factor supports maintaining the BBD volume requirement at a level sufficiently lower than the advanced biofuel volume requirement, consistent with today's proposal.

6 Impact of Renewable Fuels on Other Factors

a. Job Creation and Rural Economic Development

Executive Order 13563 directs federal agencies to consider regulatory impacts on job creation and employment. According to the Executive Order, "our regulatory system must protect public health, welfare, safety, and our environment while promoting economic growth, innovation, competitiveness, and job creation. It must be based on the best available science" (Executive Order 13563, 2011). Regulatory employment impacts are difficult to disentangle from other economic changes affecting employment decisions, over time and across regions and industries. Labor market responses to regulation are complex. They depend on labor demand and supply elasticities and possible labor market imperfections (e.g., wage stickiness, long-term unemployment, etc.). The unit of measurement (e.g., number of jobs, types of job hours worked,

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and earnings), may affect observability of that response. Net employment impacts are composed of a mix of potential declines and gains in different areas of the economy (e.g., the directly regulated sector, upstream and downstream sectors, etc.) over time.

If the U.S. economy is at full employment, even a large-scale environmental regulation is unlikely to have a noticeable impact on aggregate net employment. Instead, labor would primarily be reallocated from one productive use to another and net national employment effects from environmental regulation would be small and transitory (e.g., as workers move from one job to another). If the economy is operating at less than full employment, economic theory does not clearly indicate the direction or magnitude of the net impact of environmental regulation on employment; it could cause either a short-run net increase or short-run net decrease (Schmalansee and Stavins, 2011).

To the extent that the guaranteed volumes cause more BBD to be used to fulfill the advanced biofuel volume, there will be more employment and wage income earned producing BBD, but less employment and wage income in the production of other advanced biofuels that could be used to satisfy the advanced biofuel mandate. Given the small changes in job and wage income across the advanced biofuel sector that would likely result from changes in BBD volume, we do not believe that this factor provides a compelling reason for setting a higher or lower nested standard for BBD.

b. Price and Supply of Agricultural Commodities

In Sec II.F. of the preamble, we provide illustrative cost estimates for a hypothetical scenario in which soybean oil BBD fills the entire year-to-year increase in the proposed advanced biofuel standard. As part of this scenario analysis, we estimate price impacts on soybean oil from the higher demand for soybean oil BBD. We similarly analyzed a cost impact assuming Brazillian sugarcane ethanol satisfied the entire increase in the advanced standard. More detail on this analysis can be found in the Memo to the Docket.

To the extent that the guaranteed volumes cause more BBD to be used to fulfill the advanced biofuel volume, there may be small increases in the price of soybeans and soybean oil, but this should then result in offsetting price and supply impacts on feedstocks used to make other advanced biofuels such as grain sorghum and sugarcane. As a result, we do not believe that this factor provides a compelling basis for either raising or lowering the nested standard for BBD.

c. Food Prices

As mentioned previously, in Sec II.F. of the preamble we estimate price impacts on

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soybean oil for a hypothetical example in which the entire change in the year-to year proposed advanced biofuel volume mandates is met with soybean oil BBD. We have assessed these impacts for soybean oil at the wholesale level and the expected impact on food price. More detail on this analysis can be found in the Memo to the Docket titled "Illustrative Costs Impact of the Proposed Annual RFS2 Standards, 2014-2017".

To the extent that the guaranteed volumes cause more BBD to be used to fulfill the advanced biofuel volume, there may be small increases in the price of soybeans, but this should then lead to offsetting price and supply impacts on crop feedstocks used to make other advanced biofuels such as grain sorghum and sugarcane. Given the offsetting impacts and given that feedstock price is only one component in determining food prices, we would not expect any significant impact on food prices to result from setting the BBD nested volume requirement; therefore we do not believe that this factor provides a compelling basis for either raising or lowering the nested standard for BBD.

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MEMORANDUM

Subject: Illustrative Costs Impact of the Proposed Annual RFS2 Standards, 2014-2017

From: Michael Shelby, U.S. EPA, Office of Transportation and Air Quality

To: EPA Air Docket EPA-HQ-OAR-2015-0111

In this memo we provide further description of our assessment of the illustrative costs of the proposed advanced biofuel and total renewable fuel standards for 2015 and 2016. We start with an overview of considerations of a baseline from which to assess the impacts, followed by descriptions of the specific costs assessed. We provide cost estimates for three illustrative scenarios – one, if the entire change in the proposed advanced standards is met with soybean oil biodiesel; two, if the entire change in the proposed advanced standards is met with Brazilian sugarcane ethanol; and three, if the entire change in the volume of the non-advanced renewable fuel required by the proposed standards is met with corn ethanol. While a variety of biofuels could help fulfill the advanced standard beyond soybean oil BBD and sugarcane ethanol from Brazil, these two biofuels have been most widely used in the past. We believe these scenarios provide a range of possible costs of meeting the proposed standards.

For this analysis, we estimate the per gallon costs of producing biodiesel, sugarcane ethanol and corn ethanol relative to the petroleum fuel they replace at the wholesale level, then multiply these per gallon costs by the applicable volumes established in this rule for the advanced and total renewable fuel categories. Because we are focusing on the wholesale level in each of the three scenarios, these comparisons do not consider taxes, retail margins, and any other costs or transfers that occur at or after the point of blending (i.e., transfers are payments within society and not additional costs). In addition, because more ethanol gallons must be consumed to go the same distance as gasoline and more biomass-based diesel must be consumed to go the same distance as petroleum diesel due to each of the biofuels' lesser energy content, we consider the costs of ethanol and biomass-based diesel on an energy equivalent basis to their petroleum replacements (i.e., per energy equivalent gallon (EEG)).

1. Baseline Consideration

A number of different scenarios could be considered the "baseline" for the assessment of the costs of this rule. For the purposes of showing illustrative overall costs of this rulemaking, we are proposing to use the preceding year's standard as the baseline (e.g., the baseline for the 2016 advanced standard is the proposed applicable 2015 advanced standard, etc), an approach consistent with past practices. Arguments could be made for using a variety of alternative baselines such as the statutory renewable fuel volumes (e.g., the required volumes in the Clean Air Act for 2013, 2014, and 2015) or the volumes of renewable fuels that would be produced in the complete absence of the RFS program (e.g., "no RFS"). However, we believe the difference

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between each year's standards provides information that is illustrative of the magnitude of the potential overall costs of the standards being proposed today without adding the complexity of trying to project a hypothetical future baseline that would only call into question the meaningfulness of the cost comparison.

Use of alternative baselines from the 2013, 2014 and 2015 standards is problematic from a practical standpoint. For example, using the 2013, 2014, and 2015 statutory volumes would require estimating a hypothetical set of cellulosic fuel costs as part of the baseline. Since the cellulosic fuels are not currently being produced in significant quantities, estimating their average costs of production would be highly speculative on EPA's part. Furthermore, trying to estimate the hypothetical mix of fuels that could meet the annual EISA volumes would introduce a level of complexity that would not necessarily provide a more robust estimate of costs.

There are similar complexities with trying to project what volumes of renewable fuels would be consumed in the U.S. in the absence of any RFS program, a hypothetical "no RFS" baseline. One option would be to try to estimate the amount and types of biofuels that would have penetrated the market without the RFS program from its inception in the relevant years of consideration 2013, 2014 and 2015. Estimating the quantities of renewable fuels that would have been used by market participants absent any RFS requirements from the inception of the program would be an uncertain exercise. A combination of economic and policy factors, such as the value of ethanol as an octane enhancer and individual state renewable fuel mandates, would have to be assessed to determine this baseline. Thus, we believe that estimating the quantities of renewable fuels that would be used in the absence of the RFS program, as well as their associated costs, would be highly speculative.

The choice of a baseline will have a directional implication for the costs assessed. For example, reducing the standards from a high renewable fuel volume baseline (e.g., the CAA 2013, 2014, or 2015 volumes) would show cost savings (assuming a gallon of renewable fuel is more costly than its petroleum-based fuel equivalent). Conversely, increasing the volumes from a low renewable fuel volume baseline (e.g., the "no RFS" volumes) would show cost increases as a result of the 2014, 2015, and 2016 standards (assuming a gallon of renewable fuel is more costly than its petroleum-based fuel equivalent). For the purpose of providing illustrative costs, we have opted for a more straightforward and real world baseline assumption of the applicable standard for the previous year as a baseline to assess the costs. In evaluating the costs for 2014, we would use the actual applicable standards for 2013 as the baseline. In evaluating the costs for 2015 and 2016, we would use the proposed applicable standards for 2014 and 2015, respectively, as the baseline.

The 2014 standards were not finalized in 2014 so it is difficult to estimate what their costs may have been. Market participants may have anticipated a final 2014 standard would require higher levels of biofuels than the market would provide in the absence of the standard, which would contribute to the positive RIN prices witnessed in 2014. In contrast, the 2014 standards being proposed in this rulemaking represent reductions in both the advanced and conventional volumes compared to the 2013 standards, suggesting cost savings for this proposed 2014 rule. Finally, the 2014 standards being proposed in this rulemaking are based on actual

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production levels in 2014, suggesting that the 2014 standards we are proposing have no costs. Given the complexity of this issue, we have not attempted to estimate the costs of the 2014 standards. Therefore, we only evaluate costs for the 2015 and 2016 advanced standards and total (i.e., non-advanced) standards.

2. *Cost of Displacing Petroleum-Based Diesel with Soybean-Based Biodiesel*

Consistent with our previous work in this area, EPA's estimate is a "bottom-up" engineering cost analysis that quantifies the costs of producing a gallon of soybean-based biodiesel and then compares that cost to the energy-equivalent gallon of petroleum-based diesel.[1]

Similar to the analysis EPA undertook for the 2013 annual standard, we have made the simplifying assumption that the marginal biodiesel feedstock used to meet the higher total advanced biofuel standard will come from soybean oil. EPA recognizes that a variety of different feedstocks in addition to soybean oil could be used to make biodiesel. These include other oils (e.g., canola oil) as well as waste oils, fats, and greases. However, projecting the proportions of different feedstocks that may be used to make extra biodiesel as a result of the standard and the different feedstocks' costs would be speculative. Based on historical data, 43 percent of the biodiesel that generated RINs in 2014 was from soybean oil, the largest source of feedstock used to make biodiesel.[2] Other feedstocks such as oils derived from wastes are generally less costly so they will be preferentially used regardless of the volume set. However, there are not enough oils derived from wastes to fully supply the advanced standards we are proposing. Thus, we believe it is appropriate to make the simplifying assumption that the marginal feedstock used to produce biodiesel to meet the total advanced biofuel standard will be from soybean oil.

We base our estimates of soybean oil feedstock costs in 2015 and 2016 on the latest United States Department of Agriculture/World Agricultural Supply and Demand Estimate (USDA-WASDE) forecasts.[3] Soybean oil feedstock costs represent the majority of the overall costs of biodiesel, usually somewhere between 70 and 90 percent of overall costs. In addition to soybean oil feedstock cost, we assume variable production costs to estimate the total per gallon cost. We use two sources to represent a range of potential variable costs. For the higher cost estimate, we used per gallon cost estimates from the University of Missouri, Food and Agricultural Policy Research Institute (FAPRI-Missouri) March 2015 U.S. Baseline Briefing Book. They estimate variable biomass-based biodiesel production costs of $0.47/gallon, net of the coproduct (i.e., glycerin) value for both 2015 and 2016.[4] FAPRI-Missouri also include an

[1] Notice Department of Energy, Alternative Fuels Data Center. *Fuel Properties Comparison.* *http://www.afdc.energy.gov/fuels/fuel_comparison_chart.pdf*

[2] By way of comparison, the next largest source of feedstock for biodiesel was biogenic waste oils/fats/greases (30 percent), followed by canola oil (17 percent) and non-food grade corn oil (10 percent). EPA, EPA Moderated Transaction System (EMTS). Accessed, March 27, 2015

[3] 2014/2015: 32.0 cents/lb, 2015/2015: 29.5-32.5 cents/lb USDA, World Agricultural Supply and Demand Estimates (May 2015). We use WASDE's 2014/2015 estimates as a base for 2015, and the 2015/2016 estimates as a base for 2016. http://www.usda.gov/oce/commodity/wasde/latest.pdf

[4] University of Missouri, Food and Agricultural Policy Research Institute. *U.S. Baseline Briefing Book (March*

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average net operating return to produce biodiesel of $0.10 per gallon in 2015 and $0.39 per gallon in 2016.[5] For our lower cost estimate, we used a forecast of 2014 average biodiesel variable cost projections of $0.50/gallon from the National Biodiesel Board.[6] We then compare these ranges to estimates of the average price of wholesale petroleum-based diesel in 2015 and 2016. We assume that the wholesale price of petroleum-based diesel represents its costs. EPA obtained the projected average wholesale petroleum-based diesel 2015, and 2016 cost estimates from Energy Information Administration (EIA's) Short Term Energy Outlook (STEO) Report.[7] The STEO price is $1.90 in 2015 and $2.17 in 2016.

The proposed 2014 standard is being set at the actual level of advanced biofuels produced in 2014, 2.68 billion gallons. The total advanced biofuel volumes are being proposed for 2015 at 2.90 billion gallons and 3.40 billion gallons in 2016.

Consistent with the approach we used for the 2013 BBD standard, EPA estimates that increasing volumes of soybean oil for biodiesel will create upward pressure on the price of soybean oil. Based on work from Iowa State University, we assume each additional 200 million gallons of soybean oil used to produce extra biodiesel results in an increase in soybean oil costs of 3.2 cents per pound.[8] Applying this cost increase to the projected range of USDA-WASDE soybean oil prices results in an estimate of the cost of soybean oil 34.3 cents per pound for 2015, and 37.2 to 40.2 cents per pound for 2016. Considering non-feedstock variable production cost estimates from FAPRI-Missouri and the National Biodiesel Board, and low and high WASDE soybean oil estimates, the resulting biodiesel costs range from $3.39 to $3.46 per gallon in 2015 and $3.62 to $4.26 per gallon in 2016 (on a diesel gallon equivalent basis).

Comparing the petroleum-based diesel price estimate and multiplying by the volume of fuel displaced on an energy equivalent basis, results in an overall annual cost of $218 to $229 million in 2015 and $483 to $697 million in 2016. Table 1 below shows estimates of per gallon increases on an energy equivalent basis as well as total annual costs for 2015 and 2016 of using greater amounts of biodiesel to meet the total advanced biofuel standard.

These cost estimates assume that the increase in the total advanced biofuel standard is met with soybean-based biodiesel, which is a simplifying assumption used for illustrative purposes. In all likelihood a variety of different sources of feedstocks and renewable fuels (e.g., biodiesel from other feedstocks, sugarcane ethanol, sorghum ethanol, CNG/LNG from biogas) are expected to be produced to meet the 2015 and 2016 total advanced biofuel standard. It

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2015). http://www.fapri.missouri.edu/wp-content/uploads/2015/03/FAPRI-MU-Report-01-15.pdf

[5] We are comparing the cost of producing a gallon of soybean oil biodiesel to a projected petroleum diesel cost (i.e., price) at the wholesale level which would include upstream operating returns. Therefore, we think it is appropriate to include operating returns into our soybean cost estimates.

[6] Presentation to EPA: *Analysis of Cost of Carbon Reduction January 27, 2014.* Although processing costs for soybean biodiesel may be lower than industry average costs (which include a heterogeneous mix of feedstocks that may have higher processing costs), we do not have sufficient data to incorporate potentially lower soybean oil processing costs at this time.

[7] Energy Information Administration (EIA), *Short Term Energy Outlook (STEO)*. May 2015 http://www.eia.gov/forecasts/steo/pdf/steo_full.pdf

[8] Babcock, Bruce, et. al. *Biofuel Taxes, Subsidies, and Mandates: Impacts on US and Brazilian Markets* (May 2013) http://www.card.iastate.edu/publications/dbs/pdffiles/13sr108.pdf

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should be noted that soybean oil costs and petroleum-based diesel costs could vary depending upon evolving supply and demand factors in their respective markets that are not reflected in current USDA/EIA price estimates.

Table 1
Illustrative Per Energy Equivalent Gallon Cost Difference and Total Cost Estimates of Meeting the Advanced Standard in 2015 and 2016 Using Biomass-Based Diesel to Displace Diesel

	2015		2016	
	Low	High	Low	High
Per Gallon Differences in Cost ($/gallon)	1.48	1.56	1.45	2.09
Total Annual Costs (millions of dollars)	218	229	483	697

3. Cost of Displacing Petroleum-Based Gasoline with Sugarcane Ethanol

While BBD can be used to meet the total advanced biofuel standard, other advanced renewable fuels can also be used to comply. One possible option is the use of sugarcane ethanol, the majority of which is imported to the U.S., principally from Brazil. In this section, we provide illustrative estimates of what the potential costs might be for a scenario in which we assume that all additional volumes used to meet the 2015 and 2016 total advanced biofuel standards above the previous year's total advanced biofuel standard are met with imported Brazilian sugarcane ethanol. We compare the cost of sugarcane ethanol and gasoline at the wholesale stage, since that is when the two are blended together and represents the approximate costs to society absent transfer payments. On this basis, EPA estimates the costs of producing and transporting a gallon of sugarcane ethanol to the blender in the U.S.

We use the sugarcane ethanol free on board (FOB) price at Santos, the port of San Paulo, Brazil, from which sugarcane ethanol is typically shipped to the U.S. Using daily price data from the Oil Price Information Service (OPIS) from January 1, 2014 to present, we estimate a range of prices for Brazilian ethanol exported to the U.S. Since OPIS does not project future sugarcane ethanol prices from Brazil, and a bottom-up approach to estimate sugarcane ethanol prices from sugar futures prices is uncertain, we make the simplifying assumption that the observed high and low estimates from January 1, 2014 to the present are reasonable high and low price estimates for 2015 and 2016 as well. We assume that the reported price of sugarcane ethanol represents both the production and transportation costs of delivering sugarcane ethanol to the port at Santos. Using data collected by the International Trade Commission (ITC), we assume that it costs an additional $0.14/gallon to transport the sugarcane ethanol from Santos to the U.S. where the ethanol can be blended with gasoline.[9] Based on the range of OPIS prices,

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the delivered price of sugarcane ethanol to the U.S. ranges from $1.85 to $3.02 per gallon. For comparison purposes, we used the average wholesale price of gasoline for 2015 and 2016 from the STEO, which is $1.73 per gallon and $1.92 per gallon, respectively.[10]

Taking the difference between the sugarcane ethanol and the wholesale gasoline price estimates, and multiplying that by the volume of petroleum displaced on an energy equivalent basis, results in an overall estimated annual cost of $228 to $615 million for 2015 and $424 to $1,303 million for 2016. Table II.G.3-12 below shows estimates of per gallon increases on an energy equivalent basis as well as total annual costs for 2015 and 2016 of using greater amounts of sugarcane ethanol to meet the total advanced biofuel standard. These cost estimates assume that the increase in the advanced biofuel standard is met with sugarcane ethanol, which is a simplifying assumption used for illustrative purposes. In all likelihood a variety of different sources of feedstocks and renewable fuels (e.g., biodiesel, sorghum ethanol, CNG/LNG from biogas) are expected to be produced to meet the increase in the 2014, 2015, and 2016 advanced biofuel standards. It should be noted that sugarcane ethanol costs and wholesale gasoline costs could vary depending upon evolving supply and demand factors in their respective markets that are not reflected in current OPIS/EIA price estimates.

Table II.G.3-12
Illustrative Per Energy Equivalent Gallon Cost Difference and Total Cost Estimates of Meeting the Advanced Standard in 2015 and 2016 Using Sugarcane Ethanol to Displace Gasoline

	2015		2016	
	Low	High	Low	High
Per Gallon Difference in Cost ($/gallon)	1.04	2.80	0.85	2.61
Total Annual Costs (millions of dollars)	228	615	424	1,303

4. Cost of Displacing Petroleum-Based Gasoline with Corn Ethanol

In this section, we assess the difference in cost associated with a change in the implied volumes available for conventional (i.e., non-advanced) biofuels for 2015 and 2016. We provide illustrative estimates of what the potential costs might be in a scenario where corn ethanol is

[9] U.S. International Trade Commission, Interactive Tariff and Trade DataWeb. http://dataweb.usitc.gov/

[10] Energy Information Administration (EIA), *Short Term Energy Outlook (STEO)*. May 2015 http://www.eia.gov/forecasts/steo/pdf/steo_full.pdf

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used to meet the entire conventional renewable fuel volumes.

The implied 2014 volume allowance for conventional renewable fuel is 13.25 billion gallons, 13.40 billion gallons in 2015, and 14.00 billion gallons in 2016. If corn ethanol is used to meet the difference between the implied 2014 to 2015 and 2015 to 2016 conventional renewable fuel volumes, an increase in 150 million gallons of corn ethanol would be required in 2015 and 600 million gallons in 2016. In Table 3, we show estimates of differences in costs on a per gallon energy equivalent basis between corn ethanol and wholesale gasoline as well as total annual costs of the conventional biofuel standard for 2015 and 2016.

To calculate the cost of corn ethanol, we use a bottom-up engineering cost framework starting with USDA-WASDE estimated corn prices for 2015 and 2016.[11] We then estimate the 2015 and 2016 marginal production costs of corn ethanol using data from the University of Missouri, FAPRI March 2015 U.S. Baseline Briefing Book.[12] There are many factors that influence the price of corn ethanol besides the RFS program. The price of corn is one of the primary drivers of the corn ethanol price, and corn is a commodity demanded for other end uses in addition to ethanol including food and livestock feed. Changes in demand for these other end uses will impact corn prices which will in turn affect corn ethanol prices. Also, corn ethanol is demanded internationally so changes in international demand will have impacts on domestic prices independent of the RFS program.

Using historical relationships developed by Iowa State, we assume each increase of one billion gallons of corn ethanol results in an increase in corn costs of $0.21/bushel.[13] Using this relationship, we estimate that corn prices will increase by roughly $0.03 bushel in 2015 and $0.13 per bushel in 2016 (approximately $0.01 and $0.05 per gallon of corn ethanol for 2015 and 2016, respectively). Based upon this methodology, EPA estimates that a gallon of corn ethanol will cost between $1.70 and $1.77 per gallon ($2.55 and $2.65 per gallon on a gasoline gallon equivalent basis (GGE)) in 2015 and $1.67 and $1.88 per gallon ($2.50 and $2.82 per GGE) in 2016. To estimate the premium per gallon against wholesale gasoline, we estimated the price of a gallon of wholesale gasoline using the latest EIA STEO estimates. As mentioned previously, STEO estimates an average wholesale gasoline price of $1.73 per gallon for 2015 and $1.92 per gallon for 2016. We assume that the wholesale price of gasoline represents the costs of producing gasoline. It is worth noting that corn ethanol costs and wholesale gasoline costs could vary depending on evolving supply and demand factors not reflected in current USDA/EIA price estimates.[14]

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[11] 2014/2015: 3.55-3.75 $/bu, 2015/2015: 3.20-3.80 $/bu USDA, World Agricultural Supply and Demand Estimates (May 2015). We use WASDE's 2014/2015 estimates as a base for 2015, and the 2015/2016 estimates as a base for 2016. http://www.usda.gov/oce/commodity/wasde/latest.pdf

[12] University of Missouri, Food and Agricultural Policy Research Institute. *U.S. Baseline Briefing Book.* (March 2015) http://www.fapri.missouri.edu/wp-content/uploads/2015/03/FAPRI-MU-Report-01-15.pdf

[13] Babcock, Bruce, et. al., *Impact on Corn Prices from Reduce Biofuel Mandates*, November, 2013 http://www.card.iastate.edu/publications/dbs/pdffiles/13wp543.pdf

[14] For example, in the winter of 2013/2014 a combination of rail car shortages and harsh winter weather in the Midwest contributed to an increase in the crush spread. Alternatively, due to dampened global demand prospects and sustained levels of crude oil supply, current gasoline and diesel prices are lower than they were projected to be.

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Table 3
Illustrative Per Energy Equivalent Gallon Cost Difference and Total Cost Estimates of Meeting the Change in the Total Standard for 2015 and 2016 Using Corn Ethanol to Displace Gasoline

	2015		2016	
	Low	High	Low	High
Per Gallon Difference in Cost ($/gallon)	0.81	0.92	0.58	0.90
Total Annual Costs (millions of dollars)	122	138	348	541

The short time frame provided for the annual renewable fuel rule process does not allow sufficient time for EPA to conduct a comprehensive analysis of the benefits of the 2015 and 2016 standards and the statute does not require it. Moreover, as discussed in the proposed rule establishing the 1.28 billion gallon requirement for BBD in 2013, the costs and benefits of the RFS program as a whole are best assessed when the program is fully mature in 2022.[15] We continue to believe that this is the case, as the annual standard-setting process encourages consideration of the program on a piecemeal (i.e., year to year) basis, which may not reflect the long-term economic and environmental effects of the program. Therefore, for the purpose of this annual rulemaking, we have not quantified benefits for the 2015 and 2016 proposed standards. We do not have a quantified estimate of the GHG impacts for the single year (e.g., 2015, 2016). When the RFS is fully phased in, the program will result in considerable volumes of advanced and cellulosic biofuels that will reduce GHG emissions in comparison to the fossil fuels which they will replace. EPA estimated greenhouse gas, energy security and air quality impacts and benefits for the 2010 Proposed RFS Rule for 2022.

[15] 77 FR 59477, September 27, 2012.

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MEMORANDUM

Subject: Statutory basis of the RFS program and development of the regulatory program

From: Madison Le, U.S. EPA, Office of Transportation and Air Quality

To: EPA Air Docket EPA-HQ-OAR-2015-0111

Congress established the RFS program in the Energy Policy Act (EPAct) of 2005 and significantly expanded it in 2007 with passage of the Energy Independence and Security Act (EISA). Congress' primary objectives for the expanded program were to increase U.S. energy security and decrease GHG emissions from transportation fuel by (1) increasing the volumes of renewable fuel used in transportation fuel and (2) requiring an increasing percentage of those renewable fuels to result in significantly lower lifecycle GHG emissions than 2005 baseline petroleum fuels.[1]

Congress prescribed many aspects of the RFS program in EPAct. Specifically, Congress established a program requiring increasing use of renewable fuel[2] as transportation fuel in the contiguous 48 states. Congress established a schedule for adding more renewable fuel each year until a total of 7.5 billion gallons was achieved in 2012. It also required EPA to set standards for future years based on factors including the impact of the use of renewable fuels on the environment, air quality, energy security, job creation, rural economic development and the expected annual rate of future production of renewable fuels, including cellulosic ethanol, and allowed EPA to waive the statutory volume requirements in specified circumstances.

For meeting the volume requirement specified in that statute, Congress directed EPA to establish a regulatory system that holds refiners, importers and blenders, "as appropriate," responsible for adding the requisite amount of renewable fuel to the transportation fuel supply. Congress also required that EPA each year issue the renewable fuel requirements for the following year and express those requirements as a percentage calculated by dividing the renewable fuel volume requirement for the year by the amount of gasoline that the Energy Information Agency (EIA) projects will be sold that year.

Congress prescribed that EPA's regulations include several mechanisms for providing compliance flexibility to obligated parties (as EPA's implementing regulations refer to the parties responsible for meeting volume requirements). Among them is a credit program that allows any party to earn credits for exceeding their renewable volume obligations. Those credits can be used for compliance in a subsequent year or traded or sold to others who may need them for compliance purposes. EPA has implemented the statutory credit program through a system of renewable identification numbers (or RINs) that are assigned to every gallon of produced or imported renewable fuel, and which are used by obligated parties to show compliance with the RFS percentage standards. RINs may be traded and an obligated party may carry over an

[1]See EISA, Pub. L. No. 110-140, 121 Stat. 1492 (20067).
[2] Renewable fuel is defined as fuel produced from renewable biomass and used to replace or reduce the amount of fossil fuel in transportation fuel. CAA section 211(o)(1)(F).

amount equal to 20% of the next year's volume requirements for use in the next compliance year. As a general matter, the RIN system allows obligated parties to find the lowest cost means of compliance. More specifically, it allows obligated parties who do not have the ability to blend renewable fuels into their product, and do not wish to develop that ability, to comply with RFS requirements through the acquisition of RINs to the extent RINs are made available by other obligated parties or market participants. The RIN system is compatible with the biofuel production and distribution system as it existed prior to the RFS program (and exists today), with the renewable fuel industry producing and distributing renewable fuel, and refiners, importers or independent blenders adding the renewable fuel to petroleum products. The RINs that initially accompany the renewable fuel ultimately are used by obligated parties to demonstrate compliance with their RFS obligations.[3]

Congress provided further compliance flexibility by allowing an obligated party to carry forward a compliance deficit for one year as long as it pays back the balance the following year and meets the applicable standards for that year. Congress also addressed the possibility that more systemic issues may warrant reducing the statutory volume requirements themselves. For that purpose, Congress authorized EPA to waive volume requirements in whole or in part in response to petitions by one or more States if EPA found, after public notice and opportunity for comment, that implementation of the requirement would "severely harm the economy or environment of a State, a region, or the United States" or "there is an inadequate domestic supply."

Two years after EPAct's enactment, Congress passed EISA, which expanded the RFS program by significantly increasing the amounts and types of renewable fuels to be added not only to gasoline but to other types of transportation fuel, including on-road diesel and non-road gasoline and diesel fuels. It also allowed renewable fuel added to or used as heating oil and jet fuel to count towards RFS compliance.

EISA established four categories of renewable fuels, each with a specified required reduction in lifecycle GHG emissions as compared with a 2005 baseline from petroleum-based fuels. Those categories are (1) cellulosic biofuel with at least 60% lower GHG emissions, (2) biomass-based diesel with at least 50% lower GHG emissions, (3) other advanced biofuel with at least 50% lower GHG emissions, and (4) a general category of renewable fuel (referred to as "total renewable fuel" in EPA's regulations) that has a minimum 20% lower GHG emissions unless exempted under the grandfathering provision of the statute. The four categories are nested so that meeting volume requirements for fuels with larger specified GHG reduction requirements count toward meeting volume requirements for fuels with lower specified lifecycle GHG reduction requirements. For example, a gallon of cellulosic biofuel counts toward meeting the requirements for cellulosic biofuel, advanced biofuel and total renewable fuel. Other than the biomass-based diesel category, the categories for renewable fuels are fuel-neutral in that they can be met by any renewable fuel so long as the fuel meets the applicable GHG reduction requirement. Even within the biomass-based diesel category, a variety of fuels may be used for compliance.

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[3]Further explanation of the RIN system can be found in the preamble of the RFS1 proposed rule (72 FR 23904, May 1, 2007).

While in EPAct Congress called for 7.5 billion gallons of renewable fuel by 2012, in EISA it specified that the total volume of renewable fuel reach 36 billion gallons by 2022 and that the advanced biofuel category (which includes renewable fuels providing at least 50% lifecycle GHG reduction) grow as a share of the total from about 13% in 2006 to close to 21% in 2014 and nearly 60% by 2022. In particular, Congress sought a rapid and significant expansion of cellulosic biofuel from 0.1 billion gallons in 2010 to 16.0 billion gallons in 2022. It also specified a ramp-up of biomass-based diesel to 1.0 billion gallons in 2012. As in EPAct, Congress called on EPA to establish standards for years in which volumes were not specified in the statute. For that purpose, Congress expanded on the list of factors in EPAct (noted above) to also include a review of the program's implementation to date; more specific environmental impacts; and other impacts, including on the infrastructure of the U.S., the cost to consumers of transportation fuel, the cost to transport goods, the price and supply of agricultural commodities, and food prices.

With the addition of new, more ambitious volume requirements, Congress provided EPA with additional authority for waiving the statutory volume requirements. Perhaps in recognition that significant advances were still needed in the development and production of cellulosic biofuels at commercial scale, Congress added a specific cellulosic biofuel waiver provision that requires EPA to project cellulosic biofuel production for the coming year and, if that projection is lower than the applicable volume in the statute, to use the projected volume as the cellulosic biofuel requirement for that year. For any year that EPA reduces the cellulosic biofuel volume requirement, the provision also authorizes EPA to reduce the applicable volume of total renewable fuel and advanced biofuels by the same or a lesser volume and grants EPA broad discretion in deciding whether to make an adjustment.[4] Moreover, when EPA reduces the cellulosic biofuel requirement below the volume specified in the statute, the Act requires EPA to make available for sale cellulosic biofuel waiver credits at a price specified by the statute that may be used by obligated parties in lieu of acquiring cellulosic biofuel RINs.[5]

Congress also provided specific waiver authority for the statutory biomass-based diesel volume requirements if EPA determines that there is a significant renewable feedstock disruption or other market circumstances that would significantly increase the price of that fuel. Like its cellulosic biofuel counterpart, the biomass-based diesel waiver provision allows EPA, in the event it reduces the statutory volume requirement for that fuel, to reduce the applicable volume of total renewable fuel and advanced biofuels by the same or a lesser amount. For all categories of renewable fuel, Congress amended the "general" waiver authority established by EPAct for addressing "severe economic or environmental harm" or "inadequate domestic supply" to allow waivers to be sought by obligated parties or EPA on its own motion, in addition to States.

All told, with EPAct and then EISA, Congress created an ambitious but flexible program calling for substantial use of conventional biofuels (generally satisfied by corn starch-based ethanol to date), significant use of biomass-based diesel, and rapid development and deployment

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[4] See *Monroe Energy v. EPA*, No. 13-1265, 2014 U.S. App. LEXIS 8454 (D.C. Cir. May 6, 2014).

[5] Whenever the Administrator reduces the minimum cellulosic biofuel volume under this subparagraph, the Administrator shall make available for sale cellulosic biofuel credits at the higher of $0.25 per gallon or the amount by which $3.00 per gallon exceeds the average wholesale price of a gallon of gasoline in the United States. Such amounts shall be adjusted for inflation by the Administrator for years after 2008. CAA section 211(o)(7)(D)(ii).

of a new generation of biofuels having much lower lifecycle GHG emissions than 2005 petroleum-based fuel. The program is designed to help improve the nation's energy security by reducing the amount of oil it imports. Moreover, since the transportation sector has historically contributed about one-third of the total U.S. inventory of GHGs, the program has the potential to make a significant contribution to reducing that inventory in tandem with the GHG and fuel economy standards issued by EPA and NHTSA for on-road vehicles.

At the same time, the statutory design of the RFS program also reflects two important realities - that the transportation fuel market has many different participants that contribute to and control different aspects of supply, and that the statutory volumes, particularly for cellulosic biofuel, necessitate scientific, technological, and infrastructure developments to bring renewable fuels that consumers can use to the market. Congress required a credit program that, as implemented through the RIN provisions, allows other participants in the fuel market to continue to play a vital role in bringing renewable fuels to consumers. Congress also prescribed other means of facilitating compliance (e.g., deficit carryover) to help obligated parties address challenges, including those beyond their direct control. While Congress set very ambitious volume requirements for obligated parties to meet, it provided mechanisms in the form of waiver authorities in case EPA reduced volume requirements for cellulosic biofuel, in instances where compliance with the statutory volumes would severely harm the economy or environment or there is an inadequate domestic supply, or, in the case of biomass-based diesel, where a feedstock or other market disruption causes a significant increase in fuel price.

A Preliminary Assessment of RIN Market Dynamics, RIN Prices, and Their Effects

Dallas Burkholder, Office of Transportation and Air Quality, US EPA
May 14, 2015

Executive Summary

In 2013 the price of renewable identification numbers (RINs) for renewable fuels generated under the Renewable Fuel Standard (RFS) program increased significantly. This memo examines available data in an attempt to describe and explain the factors that caused this increase in the price of one variety of renewable fuel (D6) RINs, and the impact this increase in RIN prices may have had on retail fuel prices. We also examine the impact of high RIN prices on merchant refiners (i.e. refiners who do not blend the majority of the petroleum products they produce with renewable fuels), some of whom argue that they are disadvantaged relative to integrated refiners by high RIN prices. For the purposes of this memo we have primarily considered available data from 2013, and have assumed constant renewable volume obligations (RVOs) and prices for renewable fuels with attached RINs. This memo does not quantify the total cost of the RFS program to consumers or other parties. We acknowledge, however, that the program is likely to have a cost if the cost of renewable fuels is greater than the petroleum based fuels they replace on an energy equivalent basis and if this cost outweighs the overall decrease in the cost of transportation fuel that results from increased fuel supply.[1]

In examining the available data we found that the rise in D6 RIN prices can largely be explained by the increasing total renewable fuel requirement of the RFS program. For the first time in 2013 this standard was established at a level beyond what could be achieved by the blending of ethanol as E10. This meant that the D6 RIN price was largely driven by the marginal cost of blending ethanol as E85,[2] or the cost of blending other non-ethanol renewable fuels where available, since nearly all gasoline sold in the United States already contained 10 percent ethanol. The demand price for ethanol sold in an E85 blend is significantly less than the demand price for ethanol sold as an E10 blend, as the lower energy density of the fuel, and therefore lower fuel economy of a vehicle operating on E85, are more noticeable in higher level ethanol blends. Alternative fuel choices to E85, such as E10, are also widely available, giving consumers the opportunity to purchase the lowest cost fuel. With the exception of two brief spikes in the price of D6 RINs, which may be the result of the market adjusting to new supply and demand realities,[3] the D6 RIN prices in 2013 generally reflect what would be expected as the demand price for ethanol shifts from

[1] Several parties have credited the increased availability of renewable fuels with a decrease in the market price of petroleum derived fuels (relative to a scenario with no renewable fuels) as renewable fuels increase to the global supply of transportation fuel. While we acknowledge that increasing available volumes of renewable fuels may have had some effect on global petroleum prices, there is much uncertainty surrounding the magnitude of this impact and quantifying it is beyond the scope of this memo.
[2] Additional RINs can also be generated by blending non-ethanol fuels
[3] These price spikes, reported by Oil Price Information Service (OPIS), may overstate the average RIN price as many RINs are purchased through long term contracts or acquired attached to renewable fuels. The prices reported by OPIS are more reflective of the price for separated RINs in the spot market.

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a volumetric relationship with gasoline, as was the case for E10, to an energy equivalent relationship with gasoline, as is expected to be the case for E85. We do not find evidence that the price of D6 RINs was driven by scarcity pricing,[4] as some have suggested.

While RIN prices were significantly higher in 2013 than in previous years, we did not see, nor would we expect to see, a corresponding increase in the overall retail price of transportation fuels. This is because the RIN price, rather than acting as an additional cost, generally acts as a transfer payment between parties that blend renewable fuels and obligated parties who produce or import petroleum-based fuels and are required to obtain RINs for compliance purposes.[5] RINs are generated by renewable fuel producers and sold attached to volumes of renewable fuels to fuel blenders or obligated parties. When the RINs are separated from the renewable fuel and sold independently, the RIN seller may use the revenue received for the RIN to discount the effective cost of the renewable fuel. In order to recover the cost of purchasing RINs, however, obligated parties are expected to increase the selling price of the petroleum products they produce. If fuel prices are fully flexible and markets are perfectly competitive, these two price impacts, the discounting of renewable fuels enabled by the sale of the RINs and the higher petroleum prices that result from the cost of purchasing RINs, are thus expected to offset each other resulting in the RIN price having no net impact across the entire fuel pool.

We note, however, that higher RIN prices are expected to have an impact on particular types of transportation fuels such as E85, E10, and diesel fuel. In some cases high RIN prices are expected to decrease the retail price of the fuel, while in others they are expected to result in an increase in the retail price of the fuel. High RIN prices are expected to reduce the price of fuel blends that contain a higher percentage of renewable fuels, such as E85 or B20, while increasing the price of fuels that contain little or no renewable fuels.[6] An increase in D6 RIN prices, as seen in 2013, is expected to result in a significant decrease in the price of E85, a marginal decrease in the price of E10, and an increase in the price of diesel fuel. This is because the RIN costs of a gallon of fuel (the price increase of the petroleum blendstock due to the RIN obligations) is proportional to the amount of petroleum blendstock contained in a fuel blend, while the RIN value (the effective price reduction of the renewable fuel content enabled by the sale of the RIN) is proportional to the renewable content of the blend. These price impacts are one of the primary ways the RFS program can incentivize the increased blending and consumption of renewable fuels in the United States. In blends such as E10 RIN prices are expected to have little overall impact as the RIN cost is approximately equal to the RIN value.

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[4] Scarcity pricing occurs when the price of a good increases significantly due to concerns over a limited supply. In this context we use the term scarcity pricing to refer to a situation where the price of D6 RINs rises significantly beyond what would be expected when considering the price of ethanol and the consumer demand price for ethanol when sold as E85.

[5] In some cases the fuel blender and obligated party may be the same company.

[6] This is expected to be true in a competitive market, however, as discussed in Section IV.C.1.b of the preamble many of these expected price reductions may not be realized for fuels such as E85 that at the current time generally face little competition at the wholesale and retail level. As the availability of these fuels increases we anticipate that a higher proportion of the expected price decrease will be realized by consumers.

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Finally, we examined available data to determine if the expected impacts of high RIN prices could be observed. We were able to observe these impacts in several areas, notably in price differences between petroleum-based fuels with and without RIN obligations and in lower wholesale and retail prices for fuel blends containing higher percentages of renewable fuels. The higher market prices for petroleum fuels with RIN obligations relative to those without RIN obligations suggest that obligated parties are generally recovering their RIN costs in the price of the petroleum fuels they produce. Merchant refiners, who largely purchase separated RINs to meet their RFS obligations, should not therefore be disadvantaged by higher RIN prices, as they are recovering these costs in the sale price of their products. We also note several other strategies available to merchant refiners, such as contractual arrangements and investing in fuel blending and distribution infrastructure, which are available to merchant refiners looking for alternative methods for meeting their RIN obligations.

Each of these conclusions, and the available data that EPA examined to arrive at these conclusions, is presented in further detail below. While the focus of this memo is explaining the rise in RIN prices and resulting fuels marketplace impacts in 2013, we expect a similar set of issues and market forces will be at work in future years.

We note that this memo examines available data through June 2014. EPA intends to continue to monitor available data and update the assessments contained in this memo as time allows and data becomes available. EPA also welcomes comment and input on our methodology and conclusions.

Background

On March 26, 2010 EPA published changes to the RFS program regulations, as required by the Energy Independence and Security Act of 2007 (EISA), to ensure that transportation fuel sold in the United States contains volumes of renewable fuel that are either specified in the statute or set by EPA pursuant to specified waiver authorities. The EISA amendments increased the volume of renewable fuel required to be blended into transportation fuel to 36 billion gallons by 2022. As a part of the RFS regulations, EPA implemented a system for tracking the production and use of qualifying renewable fuel using Renewable Identification Numbers or RINs. These RINs are generated by renewable fuel producers or importers and are bought and sold "attached" to the renewable fuel until the fuel is purchased by an "obligated party" (a refiner or importer of gasoline or diesel fuel) or blended with a petroleum-based transportation fuel. At that point the RIN is "separated" from the fuel and may thereafter be independently bought or sold until it is retired to meet an obligated party's renewable volume obligation or for some other reason.

By providing an opportunity for obligated parties to fulfill their obligations under the RFS program by purchasing RINs, the RIN market allows obligated parties the flexibility to choose whether or not to be directly involved in the blending of renewable fuels. Obligated parties may choose to acquire RINs by directly blending renewable fuels, by purchasing renewable fuel, separating the RINs, and selling the renewable fuel without RINs, or by

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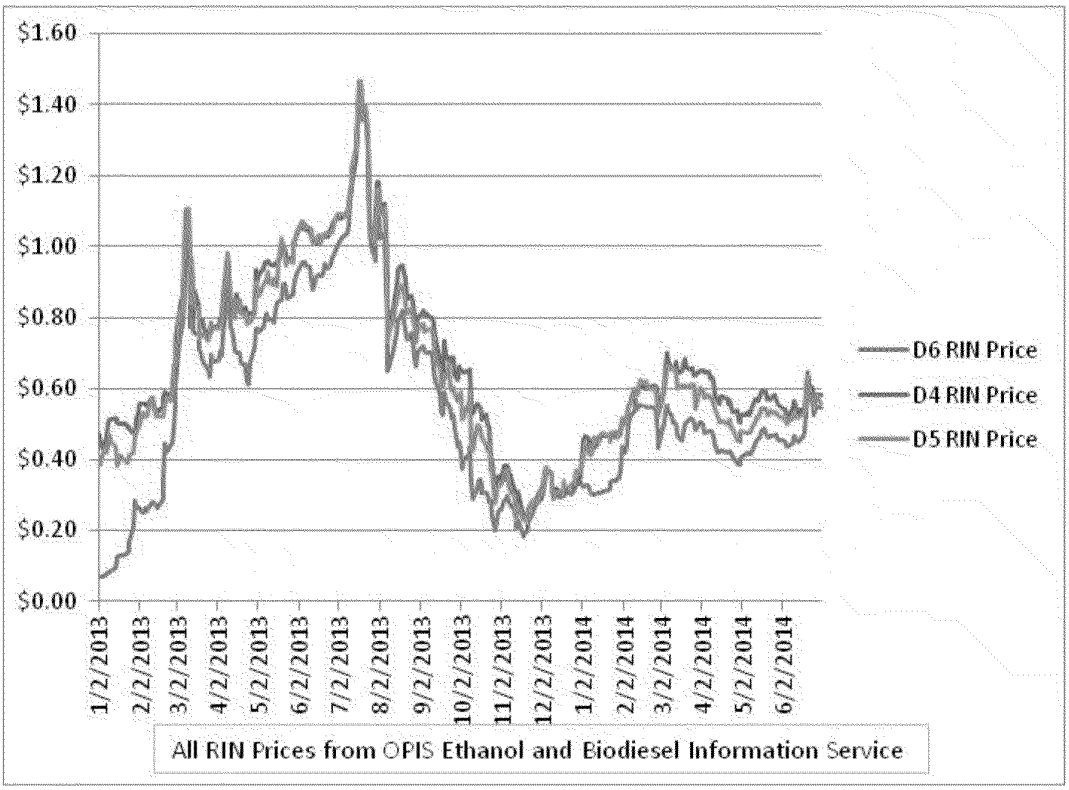
purchasing separated RINs on the spot market or through other contract arrangements. While most RINs are used for compliance in the year they are generated, up to 20% of an obligated party's renewable volume obligation (RVO) may be satisfied with RINs generated in the previous year. This allows excess RINs to function as an inventory in the RIN trading market and provides compliance flexibility to the obligated parties as excess (or "carry over") RINs can act as a buffer for obligated parties to protect themselves against unforeseen changes in the RIN market. Obligated parties may also defer their RFS obligation, in whole or in part, to the following year, provided that the RIN obligation is satisfied together with the party's next year's RVO.

In 2013 the price for Renewable Fuel RINs (D6) increased substantially, from an average of a few cents per RIN in previous years to over $1.00 per RIN in the summer of 2013 (see Figure 1 below). The swift run up in the RIN price led a variety of stakeholders to conduct analyses looking into the causes and impacts of the increase. This memo presents EPA's assessment of the cause of the high RIN prices, the expected impacts on retail fuel prices of high RIN payments, and the impact of high RIN prices on obligated parties. Throughout, this memo focuses on D6 RINs; references to RIN prices are to D6 RINs unless otherwise noted.

Figure 1
RIN Prices



RIN Market Overview

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In attempting to describe and explain the many factors that affect RIN prices or the effect of RIN prices on fuel prices and market participants, it is helpful to begin with a look at the roles different RIN market participants play. RINs are generated by renewable fuel producers.[7] RINs may be generated any time after the fuel is produced but before the fuel leaves the custody of the renewable fuel producer. Each RIN is "attached" to a gallon of renewable fuel and must be sold with that gallon of renewable fuel for which it was generated.

After a gallon of renewable fuel is sold, it is generally blended with a petroleum based fuel to produce a transportation fuel such as E10, E85, or B5. When a gallon of renewable fuel with an attached RIN is purchased by an obligated party[8] or blended to create a transportation fuel the owner of the fuel may separate the RIN from the renewable fuel. The RIN can then be used by the obligated party to demonstrate compliance with their RFS obligation, or it can be sold to another obligated party seeking RINs to fulfill their renewable volume obligation. Figure 2 presents a basic schematic of the RIN/renewable fuel market.

Figure 2
Product Transfers in the Renewable Fuel and RIN Market[9]

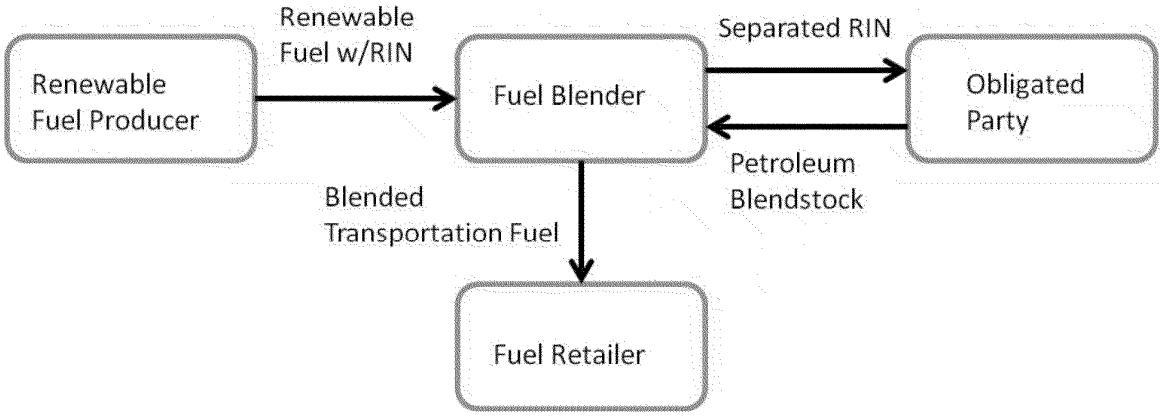

Figure 2 greatly simplifies the reality of a complex marketplace. For example, many obligated parties also own fuel blending operations, and others may purchase renewable fuel with an attached RIN, retain the RIN, and then sell the renewable fuel without the RIN.

[7] Renewable fuel must be made from "renewable biomass" in accordance with a "pathway" determined by EPA to satisfy lifecycle greenhouse gas reduction requirements (or be grandfathered from such requirements) and be produced for use as transportation fuel, jet fuel or home heating oil. Pathways are a combination of feedstock, finished fuel type, and production process. For a list of currently approved pathways see CFR 40.1426

[8] In the RFS program an obligated party is defined as any refiner that produces gasoline or diesel fuel in the 48 contiguous states or Hawaii, or any importer that imports gasoline or diesel fuel, into the 48 contiguous states or Hawaii

[9] In the graphics in this memo we have depicted the renewable fuel producer, fuel blender, obligated party, and fuel retailer as independent entities. In reality two or more of these functions may be conducted by the same company. Traditionally many obligated parties have also functioned as fuel blenders, and increasingly renewable fuel producers are also producing and marketing renewable fuel blends.

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In practice several parties may take ownership of a renewable fuel before it is blended with a petroleum blendstock to produce a transportation fuel. Similarly separated RINs may be sold to brokers or aggregators before being sold to obligated parties. Where there are additional parties participating in the marketplace not shown in the graphic above, the commodity price received by one of the depicted parties will not be equal to the purchase price paid by the party who ultimately receives the commodity as the intermediate parties will require a fee for their services. We do not expect these fees to be significant, as the RIN and transportation fuel marketplaces are generally competitive.

There are also cases where a single company may be active in multiple areas of the transportation fuel market place. Examples include an ethanol production facility that blends finished transportation fuel, or a refiner who owns fuel blending terminals. In these cases certain transactions may take place within a single company rather than between two companies. The same fundamental transactions, however, still take place, whether they are internal to one company or external and involve different entities.

Factors Affecting the RIN Price

EPA designed the RIN program with the intention of providing a market-based compliance mechanism that would cause minimal disruption in the transportation fuel marketplace, while also providing EPA with the necessary assurance that the mandated volumes of renewable fuel would be used in the transportation sector. EPA sought to provide flexibility to refiners, importers, and other producers of petroleum-based transportation fuel by allowing obligated parties to purchase RINs and rely on the existing renewable fuel production, distribution, and blending marketplace rather than requiring each obligated party to directly blend a quantity of renewable fuel equal to their renewable volume obligation. If the RIN market is functioning efficiently the RIN price should be approximately equal to the difference between a renewable fuel's supply price and its demand price (the price the market is willing to pay for the renewable fuel as a transportation fuel). The RIN price provides the incentive the renewable fuel producer needs to continue to produce renewable fuel up to the mandated volume even if the demand price for the fuel would not otherwise cover the cost of production of the renewable fuel.

With this in mind, EPA examined available price data to determine if changes in the supply and demand price for renewable fuels explained the rising and variable D6 RIN prices observed in 2013. Determining a supply price was straightforward: EPA used ethanol[10] price data reported weekly by USDA.[11]

Determining the demand price for ethanol, however, is more complicated. Ethanol, in its unblended form, cannot be used as a transportation fuel by vehicles in the United States. It

[10] Throughout this memo all references to ethanol are to denatured ethanol
[11] Data recorded by Agricultural Marketing Resource Center. These prices are for ethanol with attached RINs. Accessed online April 10, 2014 <http://www.agmrc.org/renewable_energy/ethanol/midwest-ethanol-cash-prices-basis-data-and-charts-for-selected-states/>

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must be blended with gasoline to produce transportation fuels such as E10 (containing 10% ethanol) or higher level blends such as E85 (containing between 51% and 83% ethanol with a national average ethanol content of 74% as reported by the Energy Information Administration (EIA)).

We posit that the demand price for ethanol in a blended transportation fuel varies significantly depending on the ethanol blend level. The vast majority of ethanol sold as transportation fuel in the United States is sold as E10. When ethanol is sold in an E10 blend we argue that the demand price is equal to the price of the gasoline fuel into which it is blended on a volumetric basis, despite the fact that ethanol contains approximately 33% less energy per gallon than gasoline.

There are several reasons we believe this to be the case. Due to the relatively low level of ethanol in E10 the fuel economy reduction of E10 as compared to E0 (gasoline without ethanol) is fairly small (approximately 3%) and not noticeable by most consumers. Customers therefore generally do not seek price discounts for E10 v. E0. Furthermore, for the relatively few consumers who are aware of the slightly lower energy content (and therefore lower fuel economy) of E10 as compared to E0, options to purchase E0 are very limited as virtually all gasoline sold in the United States now contains 10% ethanol. Where E0 is available, it is generally priced at a significant premium relative to E10, thus negating any potential value it may have offered due to its higher energy content. For a further discussion of the pricing of ethanol as E10 see the 2012 Notice of Decision Regarding Requests for a Waiver of the Renewable Fuel Standard.[12]

If the demand price for ethanol as transportation fuel when blended as E10 is approximately equal to the price of gasoline on a volumetric basis, rather than an energy-equivalent basis, we would expect D6 RIN prices to be very low whenever the ethanol price is below the gasoline price. This is because fuel blenders can generate profit by purchasing ethanol for a lower price than gasoline and sell the blended E10 at a price approximately equal to that of the gasoline blendstock on a per gallon basis despite the lower energy content of the fuel. No RIN value is necessary for the blending of ethanol to be profitable under these conditions. This was the case throughout the history of the RFS program until the early months of 2013. As shown in the graph below, from July 2010, the effective date of the updated RFS regulations, through the end of 2012 ethanol was generally priced below gasoline *on a volumetric basis*, and D6 RIN prices were only a few cents, likely attributable to RIN transaction costs. In 2013 the price of ethanol generally remained below the price of gasoline on a volumetric basis, yet the price of D6 RINs increased substantially. We argue a significant factor in this change in RIN price was a saturation of the E10 pool requiring that any additional volumes of ethanol be blended as E85.

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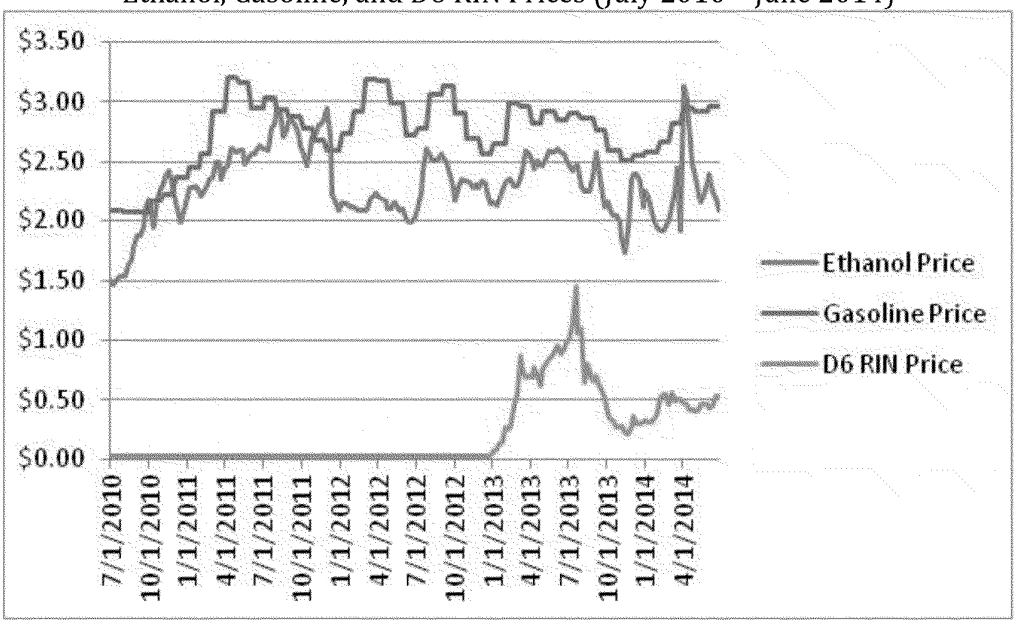
Figure 3
Ethanol, Gasoline, and D6 RIN Prices (July 2010 – June 2014)



Note: The ethanol blenders tax credit expired in December 31, 2011, likely resulting in the decline in ethanol price in January 2012. The price spike in March/April 2014 was primarily the result of extremely cold winter temperatures leading to rail congestion[13]

When ethanol is sold as an E85 blend we argue that the ethanol has a significantly different consumer demand price. E85 blends contain significantly less energy per gallon than E10 (approximately 22% less energy per gallon assuming E85 contains 74% ethanol). This lower energy content results in a decrease in fuel economy of approximately 22% when owners of flexible fuel vehicles (FFVs) operate their vehicles on E85 rather than E10. Not only is the decrease in fuel economy more noticeable to fuel customers, but the fuel customers also have the ability to choose between purchasing E85 or E10, as E10 is available everywhere that E85 is. For E85 to appeal to most customers, therefore, it would need to be priced in a manner that accounts for the fuel economy penalty, as well as any "inconvenience factor" associated with its lack of availability relative to E10 and the need to refuel more frequently.

We argue that the more noticeable decrease in fuel economy and the greater availability of alternative fuel choices has a significant impact on consumer decisions regarding purchases of E85. While some FFV owners, primarily motivated by factors other than minimizing fuel costs[14], may purchase E85 at prices above energy parity, the majority of

[13] For further information on this issue see "Rail congestion, cold weather raise ethanol spot prices." *Today in Energy*. U.S. Energy Information Administration, April 3, 2014. Web. September 25, 2014 <http://www.eia.gov/todayinenergy/detail.cfm?id=15691>.

[14] Consumers may purchase E85 when priced above energy parity for reasons such as supporting the rural economy, a desire to buy a domestically sourced fuel, E85's environmental attributes, or government fleet mandates. Alternatively some customers may avoid purchasing E85 even when it is available and priced below energy parity due to concerns about fuel quality, a desire to avoid more frequent refueling, or a lack of

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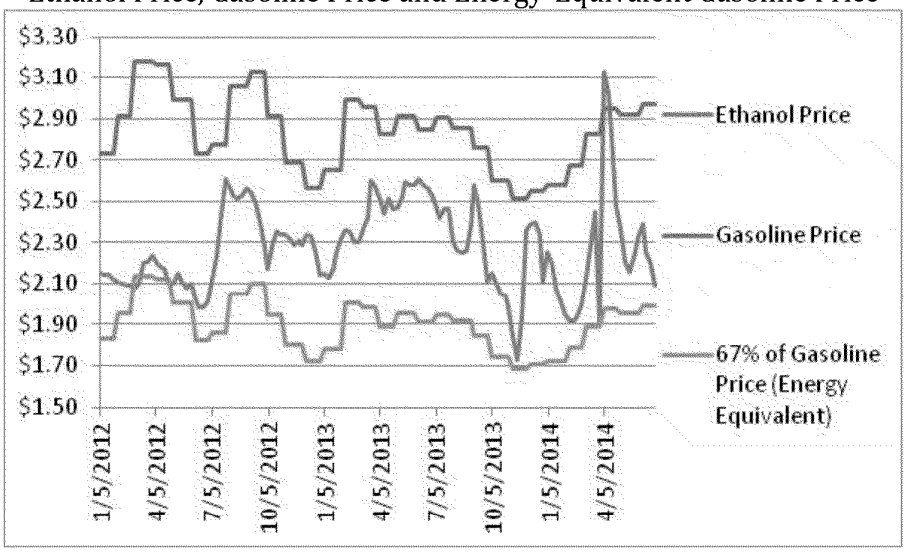
potential E85 customers will likely only purchase E85 if it is priced at a per gallon discount equal to or greater than the difference in energy content between E85 and E10.[15] If this is the case, the demand price for ethanol as a transportation fuel in an E85 blend is proportional to gasoline on an energy-equivalent, rather than a volumetric basis. This means that we would expect the true demand price for ethanol blended as E85 to be approximately 67% of the price of gasoline.[16] We would further expect that in a competitive market the D6 RIN price would be approximately equal to the difference between the price of ethanol relative to the price of gasoline on a volumetric basis (or near zero if ethanol were cheaper) when ethanol was primarily sold as E10, as it was until the end of 2012, and approximately equal to the difference on an energy-equivalent basis (67% of the price of gasoline) when the E10 market is effectively saturated and additional ethanol must be blended as E85, as in 2013. The prices of ethanol, gasoline, and an ethanol-equivalent gallon of gasoline (67% of a gallon) for 2012 and 2013 are shown below (Figure 4), followed by a graph that compares the difference between these prices and the observed D6 RIN price in 2012 and 2013 (Figure 5).

Figure 4
Ethanol Price, Gasoline Price and Energy-Equivalent Gasoline Price



knowledge that the fuel is compatible with their vehicle.

[15] Informed customer decisions are often complicated by a lack of information on the precise ethanol content of E85. E85 may contain anywhere from 51% to 83% ethanol. Uncertainty regarding the ethanol content of E85 may hinder a customers ability to effectively choose the lower cost fuel on an energy-equivalent basis.

[16] The energy content of ethanol (77,000 BTU/gallon) is approximately 67% of the energy content of gasoline or E0 (115,000 BTU/gallon).

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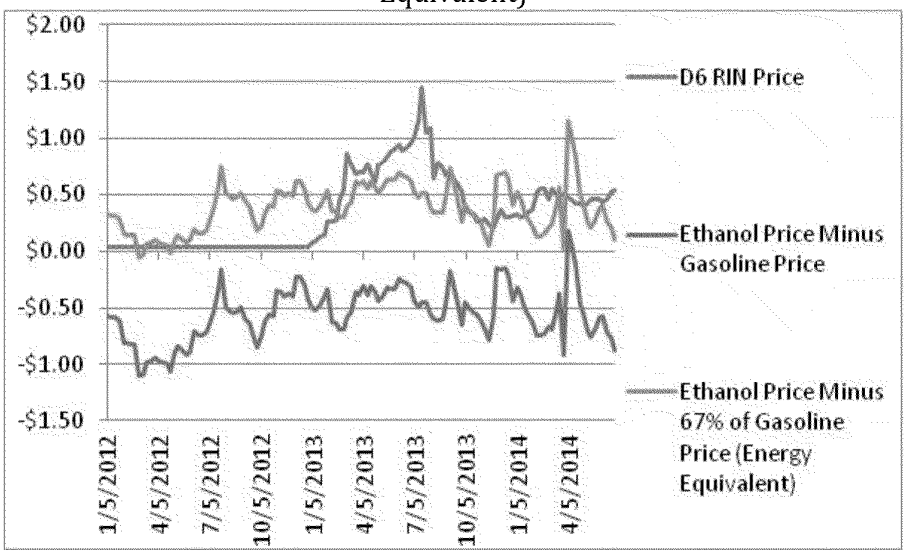
Figure 5
D6 RIN Price and Difference Between Ethanol and Gasoline Price (Volumetric and Energy-Equivalent)



For the first time in 2013, the portion of obligated parties' total renewable volume obligations that could be satisfied with D6 RINs (the total volume obligation for non-advanced biofuels) exceeded the quantity of RINs that could be obtained by blending ethanol with gasoline to create E10. Because the amount of ethanol that could be blended as E10 was effectively capped, obligated parties looked to alternative sources of RINs, such as increased blending of ethanol as E85, the blending of additional non-ethanol biofuels, or the use of carry over RINs (RINs generated in 2012 available to satisfy 2013 obligations). In the ethanol market, we argue that the customer demand price shifted from a price based in part on gasoline on a volumetric basis (as it had been when increased blending of ethanol as E10 had represented the marginal gallon of ethanol), to one based in part on gasoline on an energy-equivalent basis, as increased ethanol blending of ethanol as E85 now represented the marginal gallon of ethanol. This higher D6 RIN value also provided an increased opportunity for the increased blending of non-ethanol fuels, which may not have been profitable to blend into transportation fuel with low D6 RIN prices. In each of these cases, increased blending of ethanol as E85, increased use of non-ethanol biofuels, and the use of carry over RINs, the supply price exceeded the demand price for these renewable fuels when used as a transportation fuel. As a result, RIN prices increased in 2013 as shown in Figure 1. The increasing D6 RIN price provided an incentive not only for increased blending of ethanol as E85, but also for the increased production and import of non-ethanol fuels such as biodiesel and for a draw-down in the bank of carry over RINs.

During the period of high RIN prices in the middle of 2013 some parts of the United States saw growth in E85 sales. This growth was most notable in states, such as Minnesota and Iowa, where the RIN value was most likely to be passed on to the consumer due to competition at both the wholesale and retail level in the E85 market.[17] However,

[17] According to data from DOE's Alternative Fuels Data Center approximately 20% of all E85 stations in the

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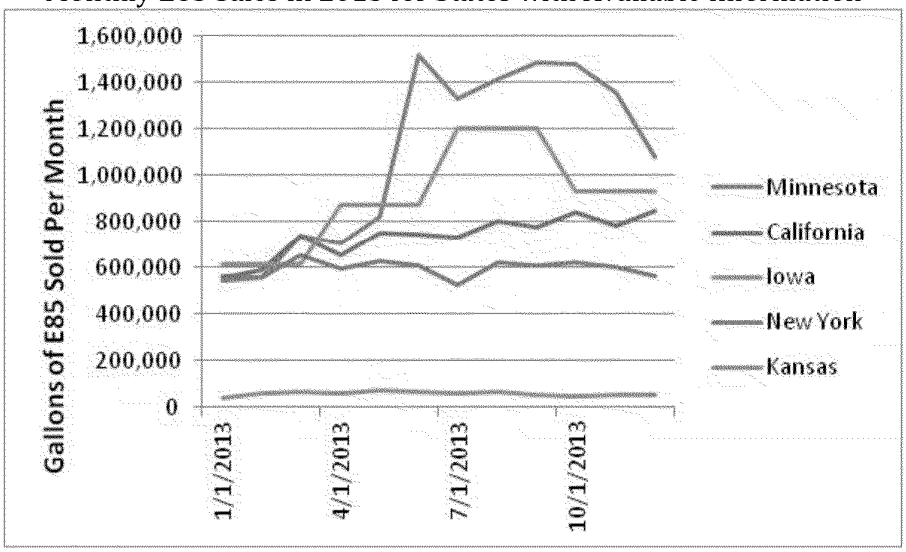
consumption of E85 remained limited despite the high RIN prices due to a variety of factors including a lack of infrastructure for the blending, sale, and consumption of E85, and the lack of competitive markets leading to RIN value pass through to consumers in many markets.

Figure 6
Monthly E85 Sales in 2013 for States with Available Information



High D6 RIN prices had an even more significant impact on the production and consumption of non-ethanol biofuels such as biodiesel and renewable diesel, which did not face the same infrastructure challenges as ethanol blended as E85. Generation of D6 RINs for biodiesel and renewable diesel increased from approximately 6 million and 1 million in 2011 and 2012 respectively to over 250 million in 2013.[18] Generation of D4 (biomass-based diesel) RINs were also at the highest levels achieved under the RFS program. The increased availability of these fuels, combined with the availability of carry over RINs from excess production in 2012 helped to moderate the price of D6 RINs in 2013 despite the limited ability of RIN prices or volume mandates to increase the consumption of ethanol as E85.

On the basis of the data available to EPA, we believe much of the increase in 2013 D6 RIN can be explained by the arrival of the E10 blendwall in 2013 and the resulting change in demand price for ethanol. These factors alone, however, do not provide a complete explanation of the observed D6 RIN prices. From May 2013 through August 2013, spot D6 RIN prices were substantially higher than would have been expected based solely on the prices of ethanol and gasoline. This may have been due to a variety of factors, including: limited blending and retail infrastructure for E85, limited ability for RIN prices to affect the retail price of E85, the RIN price needed to incentivize increasing the production or import of non-ethanol fuels, and uncertainty about the final RFS standards for 2013 and 2014. It

United States in 2013 were located in Minnesota or Iowa
[18] All RIN production numbers from EMTS

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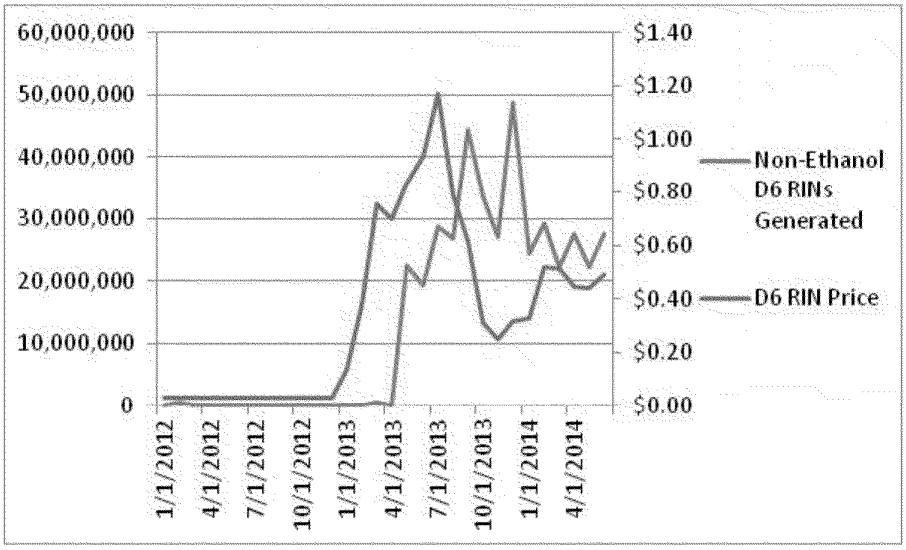
may also be the case that the reported prices for D6 RINs reflect the price of a relatively small number of RINs traded on the spot market rather than the D6 RINs purchased through long term contracts and are therefore more volatile and not necessarily reflective of the average D6 RIN price. Regardless, these elevated D6 RIN prices increased the incentive for the production, import, and consumption of non-ethanol fuels, notably biodiesel produced from grandfathered facilities,[19] which was eligible to generate D6 RINs and could now compete in the domestic fuels market as a result of its significantly increased RIN value. In other words, renewable fuels that were uneconomic to produce or import to satisfy the D6 RIN obligations when RIN prices were only a few cents became economic to produce or import with substantially increased D6 RIN prices.

It is highly speculative and difficult to predict the future price of D6 RINs, as they are influenced by multiple factors, including the supply and demand prices for ethanol, the price of petroleum, the cost of production of non-ethanol renewable fuels, consumer behavior in the E85 market, and availability of alternative compliance mechanisms. However, given the fact that the required total renewable fuel volume will likely exceed the volume of ethanol that can be blended as E10 in the future, we would not expect D6 RIN prices to return to the prices seen from 2010 to 2012.[20]

Figure 7
Generation of Non-Ethanol D6 RINs and D6 RIN Price



*RIN Prices from OPIS Ethanol and Biodiesel Information Services

RIN Price Impact on Transportation Fuel Prices

[19] Grandfathered facilities are those that commenced construction on or before December 17, 2007, or any ethanol plant fired by natural gas, biomass, or a combination thereof that commenced construction before December 31, 2009. These facilities are exempt from the 20% GHG reduction requirement for the generation of D6 RINs, however they still must use a feedstock that meets the renewable biomass definition and meet all other reporting and recordkeeping requirements.

[20] RIN prices could return to historic low levels of a few cents if the price of ethanol or other renewable fuels fell sufficiently below the cost of gasoline on an energy equivalent basis

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The high RIN prices observed in 2013 prompted questions not only regarding the cause of the increase, but also to questions about the impact the RIN prices would have on the retail price of transportation fuel. Some have suggested that higher RIN prices necessarily lead to higher retail prices for all transportation fuels.[21] Our analysis, however, indicates that this is not likely to be the case. In short, this is due to the fact that, rather than being an additional cost, RINs can be viewed as transfer payments from obligated parties to renewable fuel blenders to incentivize the blending of renewable fuels and the sale of fuel blends with higher renewable content. These payments, while having no net impact on the overall cost of transportation fuel, can reduce the price of fuels with high renewable content, such as E85, at the expense of fuels such as diesel that generally contain a small percentage of renewable fuel. This can ultimately increase the demand for renewable fuels by giving the fuel blenders a greater incentive to increase the renewable content of the fuel blends they sell.

If the cost of producing ethanol and gasoline blendstocks (or biodiesel and diesel fuel) remains unchanged, then the overall cost of the blended fuels should not be impacted by RIN prices.[22] This does not mean that there is no cost to increasing the volume of renewable fuels required to be blended into the transportation fuel pool. If renewable fuels cost more on an energy-equivalent basis than the petroleum fuels they displace there is a cost to using these renewable fuels; and the higher the required volume of these fuels, the higher the cost will be. As can be seen in examining the available data, however, the sharp rise in D6 RIN prices did not have a measurable impact on the prices of ethanol with attached RINs (see Figure 8). Renewable fuel blenders acquire RINs by purchasing renewable fuels with attached RINs.[23] They sell these RINs to obligated parties, who look to recover the cost of these RINs in the price of the blendstocks they sell to the fuel blenders. Higher blendstock prices are in turn offset by the RIN value captured by blenders when they blend renewable fuels. We expect that higher RIN prices may increase the magnitude of these payments between obligated parties and renewable fuel blenders, as well as the relative pricing of fuel blends containing higher volumes of renewable fuels versus those containing little or no renewable fuel (see Figures 9 and 10 below), but that the net impact of these transfers on the cost of transportation fuel would be minimal.

[21] For example see "Gasoline Price Inflated by Ethanol in Oil Boom: Energy Markets" by Mario Parker, published by Bloomberg on March 21, 2013. Available online < http://www.bloomberg.com/news/2013-03-21/gasoline-price-inflated-by-ethanol-in-oil-boom-energy-markets.html>

[22] As stated in the previous paragraph, however, varying RIN prices are expected to impact the relative prices of different fuel types such as E85, E10, E0, B20, B5, etc.

[23] As noted previously, renewable fuels with attached RINs can be purchased directly by obligated parties, and many obligated parties also blend renewable fuels to produce transportation fuel

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Figure 8
Ethanol (with attached RIN) and D6 RIN

Prices

To illustrate this we examined the expected price of fuel supplied to the retailer for both E10 and E85. We did this first assuming a relatively low average RIN price and then again using the average RIN prices in 2013. The prices used for this example are shown in Table 1 below. The RIN obligation percentages are based on the 2013 volume requirements and standards. We note that because the standards are nested, the D6 RIN obligation percentage is equal to the total renewable fuel percentage standard minus the advanced biofuel percentage standard. Similarly, the D5 RIN obligation percentage is equal to the advanced biofuel percentage standard minus the biomass-based diesel percentage standard. For this example we have ignored the very small cellulosic biofuel requirement.

The total RIN cost is calculated by summing the product of the RIN obligation percentages by the corresponding RIN price for each of the RIN types.[24] The structure of the RFS program is such that every gallon of gasoline or diesel fuel produced or imported in the United States has an equal RIN obligation, including cellulosic, biomass-based diesel, advanced, and total renewable RINs. This means that the RIN cost for a gallon of gasoline is impacted by the price of the biomass-based diesel RIN, even though biodiesel cannot be blended into gasoline. Our examples reflect this structure, with identical RIN costs for gasoline and diesel that vary with different RIN prices. For these examples we have ignored transportation, overhead, and profit-taking[25] to simplify our analysis. While these are all factors that will impact the cost paid by retailers for blended fuels, we would not expect them to vary with RIN prices and have therefore not explicitly considered them in

[24] Per Gallon RIN Cost = D6 RIN Obligation * D6 RIN Price + D5 RIN Obligation * D5 RIN Price + D4 RIN Obligation * D4 RIN Price. This is the RFS "compliance cost" for each gallon of gasoline and diesel produce or imported by an obligated party.

[25] The opportunity for profit taking as a result of high RIN prices is discussed in further detail in Section IV.C.1.b of the preamble. EPA has examined some data that suggests increased profit taking during times of high RIN prices in the E85 market, but believe this will decrease as competition in the E85 marketplace increases.

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our example.

Table 1
Illustrative Commodity Prices for Exploring RIN Price Impacts on Retail Fuel Prices

	Low RIN Prices	High RIN Prices (2013 Average for RIN Prices)
Ethanol (with attached RIN)[26]	$2.25/gallon	$2.25/gallon
Gasoline blendstock (without RIN costs)	$2.75/gallon	$2.75/gallon
Biodiesel (with attached RIN)	$4.00/gallon	$4.00/gallon
Diesel blendstock (without RIN costs)	$3.25/gallon	$3.25/gallon
D6 RIN Price	$0.05	$0.60
D4 RIN Price	$0.50	$0.73
D5 RIN Price	$0.25	$0.71
D6 RIN Obligation	8.12%	8.12%
D4 RIN Obligation	1.13%	1.13%
D5 RIN Obligation	0.49%	0.49%
Total RIN Cost per gallon(All RIN obligations)	$0.01	$0.06

Using these assumptions for commodity prices, and based on our schematic of the RIN and fuel market shown in Figure 2 above, we can follow each of the fuel types through the RIN and fuel market to estimate the impacts on the price paid by retailers for both E10 and E85.

For the low RIN price scenario, we begin with the purchase of ethanol by the fuel blender from the renewable fuel producer. In this transaction the fuel blender receives one gallon of ethanol and the corresponding D6 RIN from an ethanol fuel producer for $2.25. After receiving the ethanol from the ethanol producer the fuel blender separates the D6 RIN and sells it to an obligated party for $0.05. The net purchase price for the ethanol without the RIN is therefore $2.20. The fuel blender next purchases gasoline blendstock from a refiner. The price the refiner would charge for one gallon of gasoline blendstock in the absence of the RFS program in this example is assumed to be $2.75 per gallon. Anticipating the need to purchase RINs to satisfy the RIN obligation associated with selling the gallon of gasoline blendstock, the refiner instead charges the fuel blender $2.76 per gallon ($2.75 for the cost of the gasoline blendstock and $0.01 to cover the per gallon cost of the RIN obligations). The fuel blender has effectively paid $2.20 per gallon of ethanol ($2.25 per gallon with attached RIN - $0.05 cost recovered in the sale of the RIN) and $2.76 per gallon of gasoline blendstock ($2.75 for the blendstock + $0.01 RIN recovery cost). The cost of producing blended fuels can be calculated by taking the average of these two fuel component costs weighted by the proportion of each component in the finished fuel blend.[27] The resulting

[26] As shown in Figure 8, data from 2013 strongly suggests that the price of ethanol with an attached RIN is not a function of the RIN price

[27] For this example we have assumed E10 contains 10% ethanol and 90% gasoline blendstock and E85 contains 74% ethanol and 26% gasoline blendstock. The equations to calculate the cost are therefore E10 =

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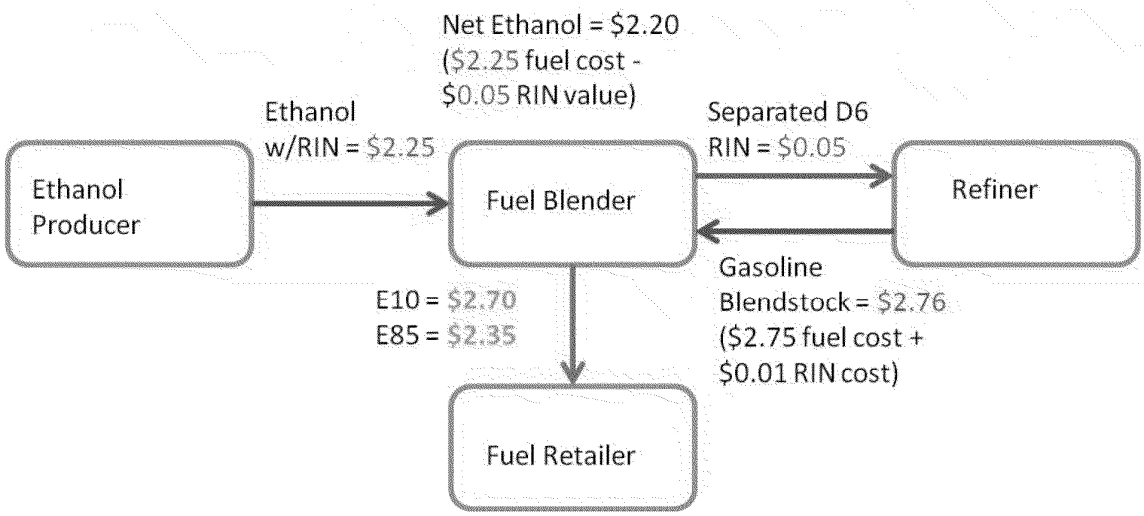
blended fuel costs are $2.70 per gallon for E10 and $2.35 per gallon of E85. The prices and flows of the various commodities are shown in Figure 9 below.

Figure 9
Impact of Low RIN Prices on the Cost of Gasoline to Retailers



A similar scenario can be examined with high RIN prices, such as those observed in 2013. For this scenario, we begin in the same place, with the purchase of ethanol by the fuel blender from the renewable fuel producer. As in the previous scenario, the fuel blender receives one gallon of ethanol and the corresponding D6 RIN from an ethanol fuel producer for $2.25. In this case, however, after being separated from the gallon of ethanol the RIN is sold to an obligated party for $0.60. The net purchase price for the ethanol without the RIN is therefore $1.65 rather than $2.20 in the previous scenario. In response to the higher RIN prices, the refiner must charge more for each gallon of gasoline blendstock sold to cover the cost of purchasing RINs to fulfill their RVO. The refiner now charges the fuel blender $2.81 per gallon of gasoline blendstock ($2.75 for the cost of the gasoline blendstock and $0.06 to cover the cost of the RIN obligations). In this high RIN price scenario, the fuel blender has effectively paid $1.65 per gallon of ethanol ($2.25 per gallon with attached RIN - $0.60 cost recovered in the sale of the RIN) and $2.81 per gallon of gasoline blendstock ($2.75 for the blendstock + $0.06 RIN recovery cost). The resulting blended fuel costs are $2.69 per gallon for E10 and $1.95 per gallon of E85. The prices and flows of the various commodities are shown in Figure 10 below.

0.1*[net ethanol cost] + 0.9*[net gasoline blendstock cost] and E85 = 0.74*[net ethanol cost] + 0.26*[net gasoline blendstock cost]

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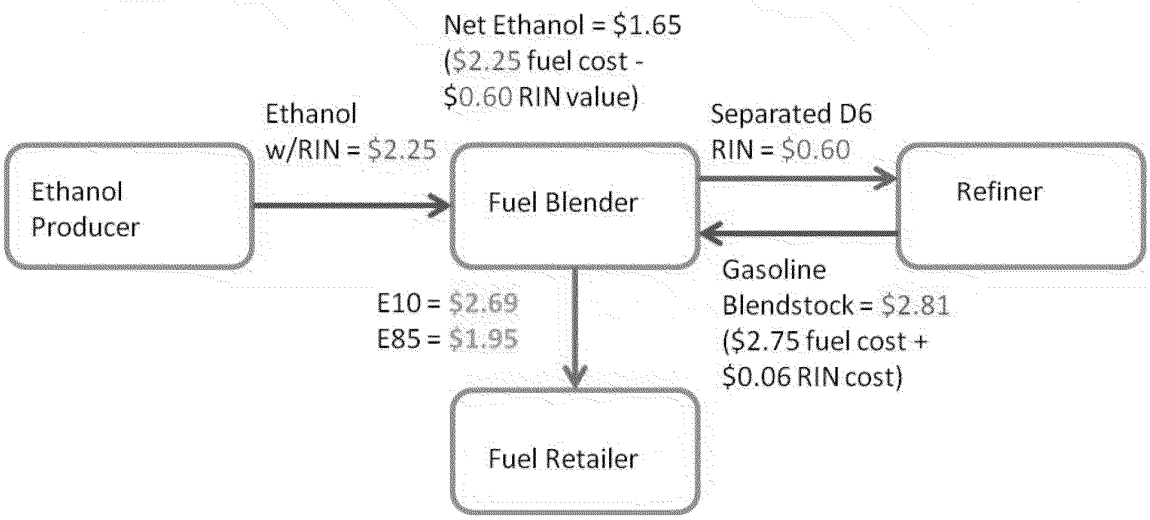
Figure 10
Impact of High RIN Prices on the Cost of Gasoline to Retailers



As these two scenarios demonstrate, rising RIN prices alone are not expected to increase the price of transportation fuel to retail station owners, however they have a significant impact on the relative prices of fuels with a relatively high renewable content (E85) as compared to those with a relatively low renewable content (E10). As the cost of acquiring RINs rises, refiners and other obligated parties are expected to respond to this cost by increasing the price of the gasoline blendstock they are selling to recover their increasing RIN costs. While this does increase the market price for the gasoline blendstock, this increase is generally offset by the lower net price paid for the ethanol with which the gasoline blendstock is blended.

The same market dynamics are at work in the diesel fuel marketplace. When considering the impact of RIN prices on cost of fuel to the retailer, we begin with the purchase of biodiesel by the fuel blender from the renewable fuel producer. The fuel blender receives one gallon of biodiesel and 1.5 D4 RINs from a biodiesel producer for $4.00. Each gallon of biodiesel generates 1.5 RINs due to the higher energy content of biodiesel relative to ethanol. After being separated from the gallon of biodiesel, the RINs are sold to an obligated party for $0.50 each (the blender receives the total RIN value associated with a gallon of biodiesel; $0.75 in the low RIN price scenario). The net purchase price for the biodiesel without the RIN is therefore $3.25. For the purposes of this example we are not considering the impact of any blenders tax credit on the cost of biodiesel blends to retail stations. To cover the anticipated cost of their RIN obligation, the refiner charges the fuel blender $3.26 per gallon of diesel blendstock ($3.25 for the cost of the diesel blendstock and $0.01 to cover the cost of the RIN obligations). In this scenario, the fuel blender has effectively paid $3.25 per gallon of biodiesel ($4.00 per gallon with attached RIN - $0.75 cost recovered in the sale of the RINs) and $3.26 per gallon of gasoline blendstock ($3.25 for the blendstock + $0.01 RIN recovery cost). The resulting blended fuel costs are an identical $3.26 per gallon for B0, B5 and B2.5 (the average blend rate if every gallon of diesel fuel sold contained biodiesel). The prices and flows of the various commodities are

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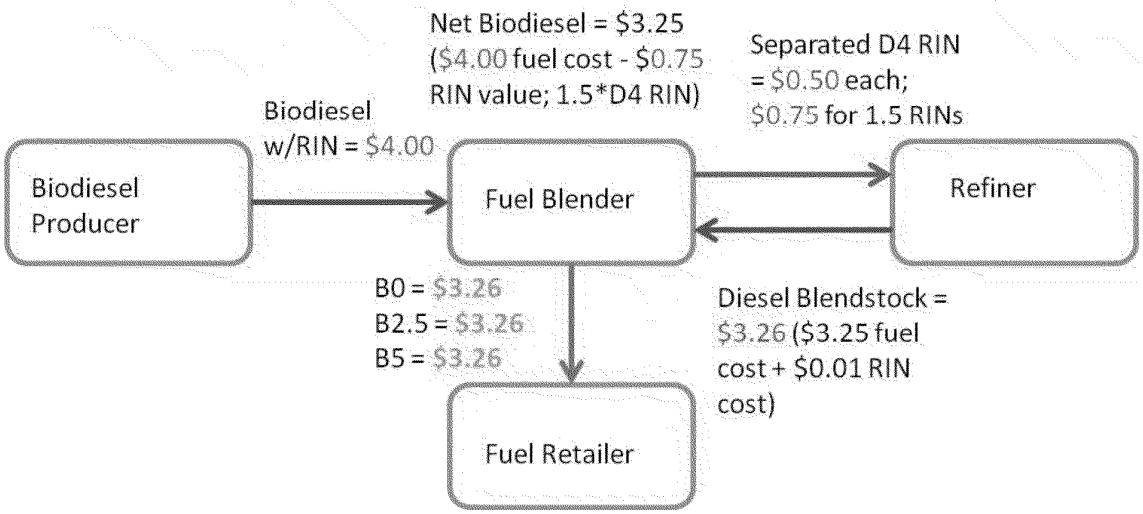
shown in Figure 11 below.

Figure 11
Impact of Low RIN Prices on the Cost of Diesel to Retailers



For the high RIN price scenario, the cost of the biodiesel with attached RINs to the fuel blender is the same $4.00 per gallon. The net purchase price for the biodiesel without the RINs is now reduced to $2.90 per gallon ($4.00 per gallon of biodiesel – 1.5 RINs * $0.73 per RIN). In response to the higher RIN prices, the refiner must charge an additional $0.06 for each gallon of diesel blendstock sold, resulting in a per gallon price of $3.31 per gallon for diesel blendstock. In this high RIN price scenario, the fuel blender has effectively paid $2.90 per gallon of biodiesel ($4.00 per gallon with attached RIN - $1.10 cost recovered in the sale of the RINs) and $3.31 per gallon of diesel blendstock ($3.25 for the blendstock + $0.06 RIN recovery cost). The resulting blended fuel costs are $3.31 per gallon for B0, $3.19 per gallon of B5, and $3.30 per gallon of B2.5. The prices and flows of the various commodities are shown in Figure 12 below.

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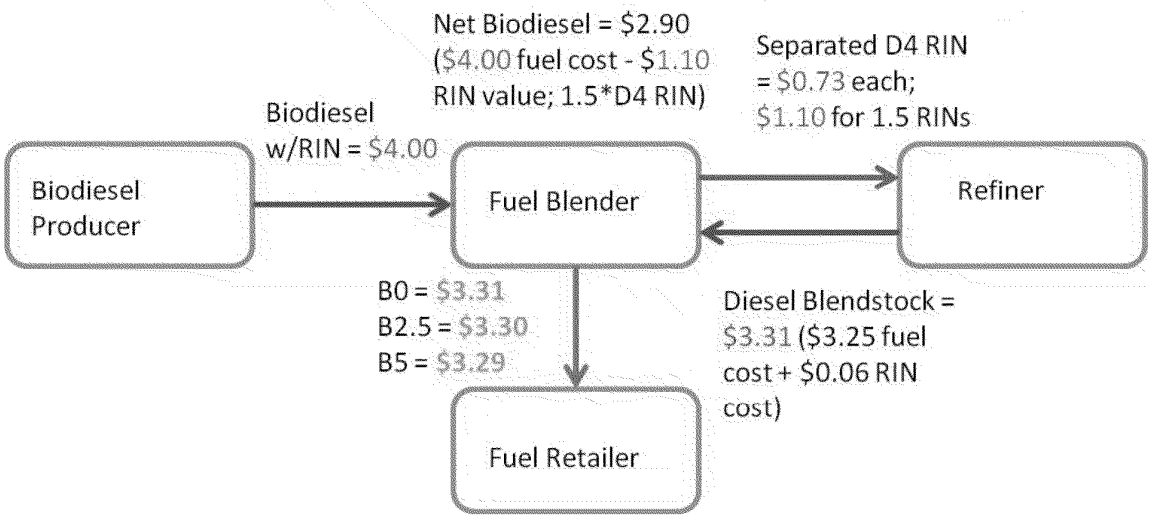
Figure 12
Impact of High RIN Prices on the Cost of Diesel to Retailers



When comparing the impact of high versus low RIN prices on the cost of gasoline and diesel fuel blends to retailers we note two key differences. The first is that the price of gasoline and ethanol fuel blends are much more sensitive to high RIN prices than the price of diesel and biodiesel fuel blends (see Table 2 below). This is due to the fact that the renewable content of gasoline is generally much higher than for diesel fuel (almost all gasoline sold in the United States contains 10% ethanol, with limited availability of blends containing up to 85% ethanol; biodiesel is generally sold at blends containing 5% biodiesel or less, with few blends offered that contain more than 20% biodiesel).

Table 2
Impact of High RIN Prices on Retail Fuel Prices

	No RIN Price (No RFS)	Low RIN Prices	High RIN Prices
E0	$2.75	$2.76	$2.81
E10	$2.70	$2.70	$2.69
E85	$2.38	$2.35	$1.95
B0	$3.25	$3.26	$3.31
B2.5	$3.27	$3.26	$3.30
B5	$3.29	$3.26	$3.29

The second difference that can be observed is that increasing D6 RIN prices are expected to cause a slight decrease in gasoline prices and an increase in diesel prices. In the example above, which is designed to be reflective of a perfectly competitive market, any cost decreases that result from lower prices of gasoline-ethanol blends are offset by cost increases resulting from higher diesel fuel prices. The per gallon pricing changes for diesel

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fuel are high relative to the pricing changes in E10 and low relative to the pricing changes in E85 primarily due to the relative renewable fuel content of these three fuel blends.

While not shown in the examples above, increasing D4 RIN price while holding the D6 RIN price constant would be expected to result in a slight increase in blended gasoline prices and a decrease in diesel prices. This is a result of the structure of the RFS program. Both gasoline and diesel blendstocks are subject to the same renewable volume obligations, and therefore the same costs associated with acquiring the necessary RINs. As shown in Table 1, this cost is $0.01 per gallon under the low D6 RIN price scenario and $0.06 per gallon under the high D6 RIN price scenario. In the scenarios presented above, the high D6 RIN prices can be used to reduce the net purchase price of fuels that generate D6 RINs, which in the majority of cases is corn ethanol. Gasoline-ethanol blends, such as E10 and E85, benefit from the lower net ethanol costs enabled by the higher D6 RIN prices, while diesel and biodiesel blends do not benefit as ethanol cannot be added to these fuels. The reverse scenario would also be true. If D4 RIN prices increased while D6 RIN prices were relatively unchanged the RIN cost for producing petroleum-based gasoline and diesel blendstocks would increase by the same amount. This would be expected to decrease the price of biodiesel blends (as the D4 RIN price reduced the net price of biodiesel) and cause slight increases in the price of gasoline-ethanol blends (which cannot be blended with biodiesel and therefore experience only a RIN cost). The magnitude of this impact, however, would likely be smaller as the D4 RVO is significantly lower than the D6 RVO.

Finally, we note that the price for unblended gasoline and diesel fuel increases in both the high and low RIN price scenarios as compared to a scenario where there are no RIN prices (no RFS). For E10, the most common fuel type sold for use in gasoline vehicles, this cost increase is offset by the effective cost reduction in the price of ethanol, resulting in little or no net change to the price of E10. For diesel-biodiesel fuel blends, however, this is not the case. The lowest price diesel fuel across the three scenarios is for unblended diesel in the no RIN price case. While it is true that in low and high RIN cases biodiesel blends are the same price as, or cheaper than unblended diesel fuel all of these products are more expensive than unblended diesel in the scenario where there is no RIN price.

Observing RIN Price Impacts in the Marketplace

After considering these simplified examples of how increasing RIN prices might impact the price of blended fuel to retailers, EPA examined available price information to determine if the expected price impacts (higher costs for petroleum blendstocks and lower net costs for renewable fuels) could be observed in the data. Due to the many independent factors that impact the cost of transportation fuels, this is not a straight-forward exercise. For example, it is not enough simply to observe the retail price of transportation fuel as the RIN prices fluctuate. If changes in RIN prices corresponded with changes in the price of crude oil (the primary cost of producing gasoline blendstocks), simply observing the relationship between RIN prices and retail fuel prices may give the false impression that increasing RIN prices have a direct impact on the retail pricing of blended fuels. Conversely, decreasing crude oil prices might mask the impact that changing RIN prices have on the price of gasoline blendstocks at the wholesale level or the retail price of blended fuels.

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If the market is reacting to changes in RIN prices in the way that the scenarios presented in the previous section suggest, there are two places we expect we would be able to observe the impacts of the changing RIN prices in the market. The first is in the wholesale pricing of similar types of fuel with and without a RIN obligation. The scenarios presented above suggest that if RIN prices increase, obligated parties will respond by increasing the price they charge for petroleum based fuels to recover the cost of purchasing RINs to satisfy the RVO associated with the sale of these fuels. We would not, however, expect to see an increase in the price of similar fuels that are not subject to a RIN obligation. If we observed a sustained price delta between similar types of fuels with and without a RIN obligation, and if this price delta was approximately equal to the RIN cost associated with producing a gallon of petroleum based fuel transportation fuel, it would provide support for our argument that obligated parties are able to increase the cost of their petroleum blendstocks in order to recover the cost of their RIN obligations.

In the current market there exist several pairs of similar types of fuels wherein one of the pair carries a RIN obligation while the other does not. This allows us to examine the impact of RIN prices on the wholesale price of petroleum fuels. One such pair of fuels consists of gasoline produced for the domestic market (which is subject to an RVO) and gasoline sold for export to the European market (which carries no RIN obligation). A second pair is diesel based: diesel fuel is very similar to jet fuel and heating oil sold in the United States, but diesel fuel produced or imported into the U.S. has a RIN obligation while heating oil and jet fuel do not. EPA examined available pricing data for these three pairs of fuels (gasoline sold in the domestic v. foreign markets, diesel v. jet fuel, and diesel v. heating oil). Figure 13 shows the future quotes for RBOB Gasoline vs. Euro-bob Oxy for the December futures (the price difference between gasoline grades sold for the United States and European markets) and the RIN obligation cost for gasoline produced or imported into the United States. Figures 14 and 15 show the price differentials between diesel and heating oil and diesel and jet fuel and the RIN obligation costs associated with diesel fuel. The correlation between the price differences of these similar fuels and the RIN obligation costs suggests that obligated parties were generally able to increase the price they charge for the RIN obligated petroleum products they sell for use as transportation fuel in the US to help recover their compliance costs under the RFS program.[28]

[28] Or alternatively, that the market price adjusted to reflect the RIN cost

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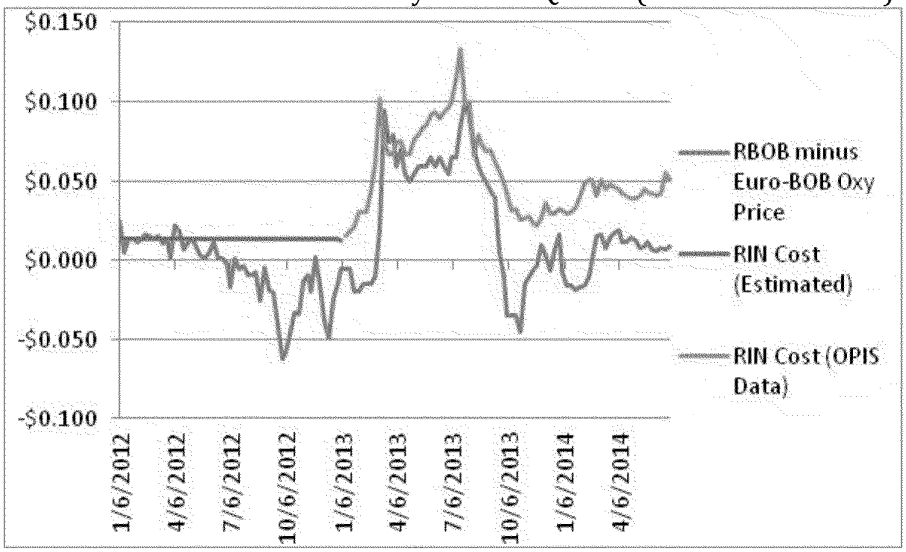
Figure 13
RBOB Gasoline vs. Euro-bob Oxy Futures Quotes (December Futures)



RIN Prices from OPISEthanol and Biodiesel Information Services
RBOB Gasoline vs. Euro-bob Oxy Futurer prices from CME Group

Figure 14
ULSD Price Minus Heating Oil Price (New York Harbor) and Per Gallon RIN Cost

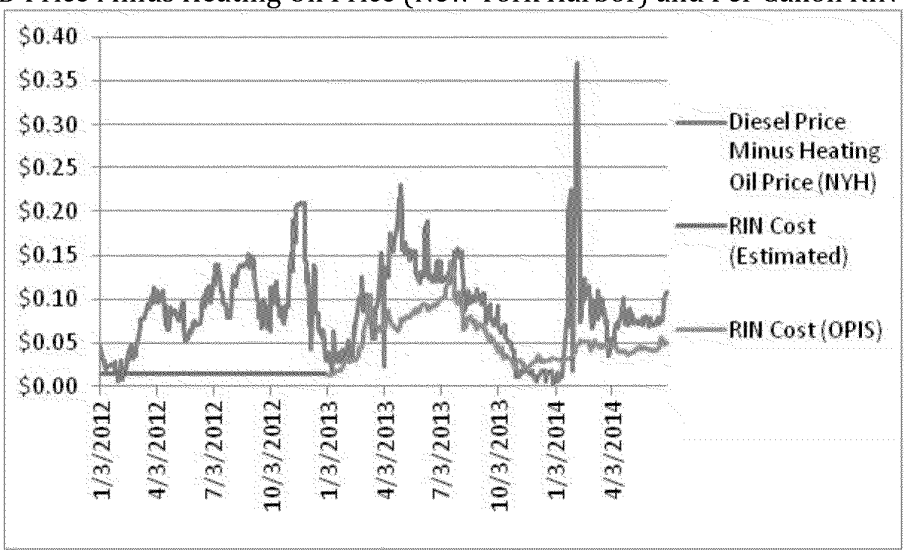
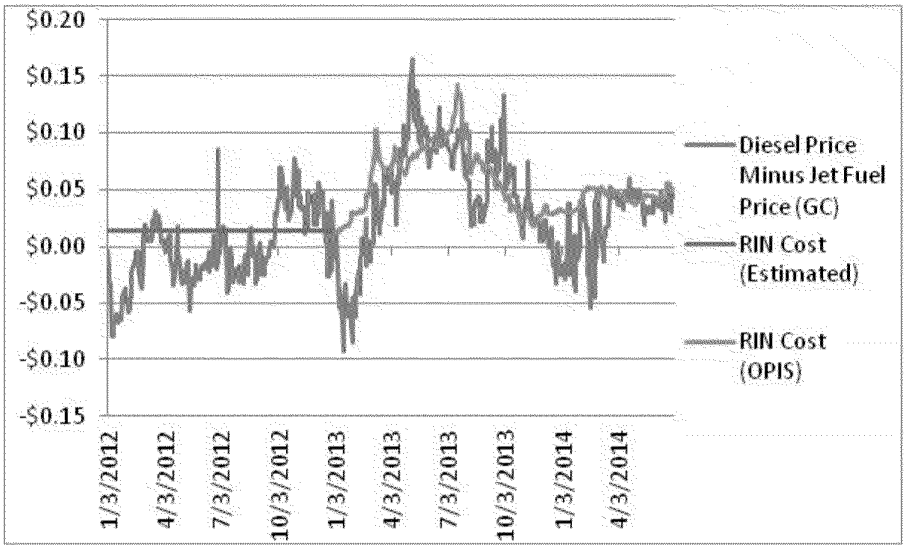


Figure 15
ULSD Price Minus Jet Fuel Price (Gulf Coast) and Per Gallon RIN Cost



The second area EPA examined to corroborate the results of our example scenarios was the pricing of ethanol, unblended gasoline, and blended fuels (such as E10 or E85) at the wholesale level. Examining this data should indicate whether or not the value of the RIN, which can be separated by the fuel blender when the ethanol is blended to produce a transportation fuel, is reflected in the wholesale price of the blended fuels. If the wholesale price for blended fuels, such as E10 and E85, is equal to or slightly greater than the volume weighted average price of neat ethanol (E100) and clear gasoline (E0) it would indicate that the RIN value is not reflected in the wholesale price of the blended fuels.[29] In this scenario, the fuel blender would retain any value associated with the separation and sale of the RIN. If, however, the price for the blended fuels was lower than the volume weighted average of neat ethanol and clear gasoline, it would indicate that the RIN value was at least partially reflected in the price of the blended fuels at the wholesale level.

The fuel blender can only profitably sell a blended fuel for less than the component costs of that fuel if they are realizing value elsewhere. Fuel blenders are able to separate and sell a RIN every time they blend a gallon of renewable fuel, and the RIN value can be used to discount the price of the blended fuel and offer it at a competitive price. Alternatively, the fuel blenders may attempt to retain some or all of the RIN value, especially in less competitive markets. As in the case where we examined the price delta between similar fuels with and without RIN obligations, if the difference between the blended fuel price and the volume weighted average price of neat ethanol and clear gasoline was approximately equal to the RIN value for each of these fuels, this would provide support for the argument that the RIN value is the basis for this difference.

For this analysis we used terminal pricing information from Des Moines, Iowa. We chose to

[29] This is true when RIN prices are relatively high. When D6 RIN prices are only a few cents any blended fuel discount due to the sale of the RIN may be masked by a mark-up of the fuel price at the fuel blender

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use Des Moines for two reasons. First, unlike many terminals in other states, clear gasoline (E0) is readily available in Iowa at the wholesale level. Knowing the price of clear gasoline allows us to see RIN price impacts on petroleum blendstocks before they are blended with ethanol. Second, Iowa contains a relatively high number of ethanol plants that currently market E85 fuel blends, making it more likely to represent a competitive marketplace for E85. This increase in the competition in the E85 wholesale market increases the likelihood that the RIN value will be reflected in the price of E85 at the wholesale level (see Figure 6, where E85 sales in Iowa increased when RIN prices were high). In other markets, where blenders of E85 face less competition, they may be able to retain more of the RIN value for these higher level ethanol blends rather than reflecting them in the wholesale pricing of these blends.[30] Figure 16 shows the pricing of neat ethanol (E100), clear gasoline (E0), and E10 at the Des Moines terminal, as well as the average price for E85 available at the terminal and direct from ethanol production facilities.[31] Figure 17 compares the difference between the reported price of E10 and the calculated price using a volume weighted average of the component fuels (E100 and E0)[32] to the RIN value associated with E10.[33] Figure 18 compares the difference between the reported price of E85 and the calculated prices using a volume weighted average of the component fuels (E100 and E0)[34] to the RIN value associated with E85.[35]

[30] Over time, however, we would expect markets that are currently relatively uncompetitive to see increased competition and a decreasing opportunity to withhold RIN value from fuel costomers

[31] Prices for E0, E10, and E100 are Des Moines rack average prices, provided to EPA by Iowa RFA. Price for E85 is the average of all prices listed on the Iowa RFA Wholesale E85 Price Listing website (http://www.iowarfa.org/E85PastPriceProgram.php)

[32] Component E10 price = 0.9 * E0 price + 0.1 * E100 price

[33] E10 RIN value = 0.1 * D6 RIN price (RIN price information from OPIS Ethanol and Biodiesel Information Service

[34] Component E85 price = [1 – Ethanol Content] * E0 price + [Ethanol Content] * E100 price; Ethanol content is calculated based on the weekly average of all E85 offerings reported by Iowa RFA

[35] E85 RIN value = [Ethanol content of E85] * D6 RIN price (Ethanol content is calculated based on the weekly average of all E85 offerings reported by Iowa RFA ; RIN price information from OPIS Ethanol and Biodiesel Information Service

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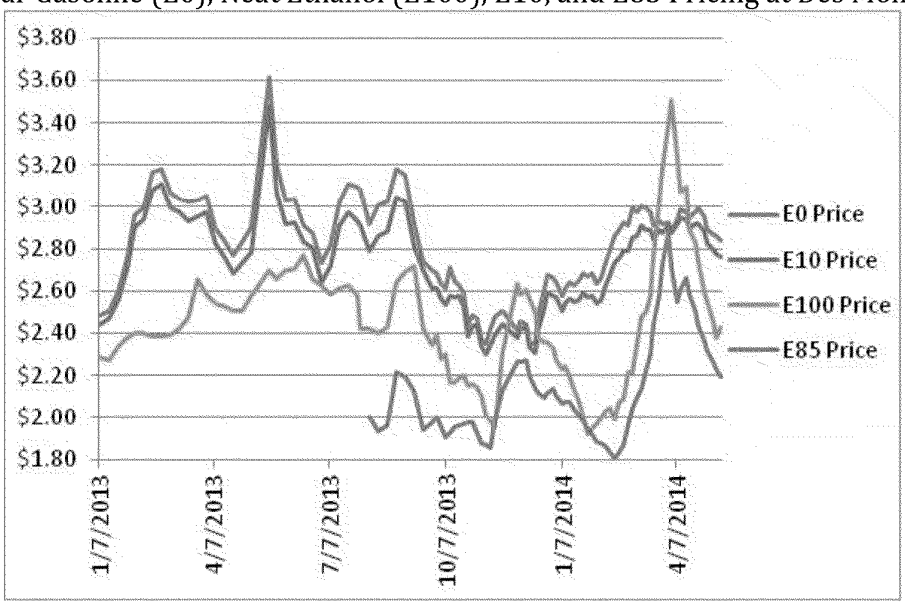
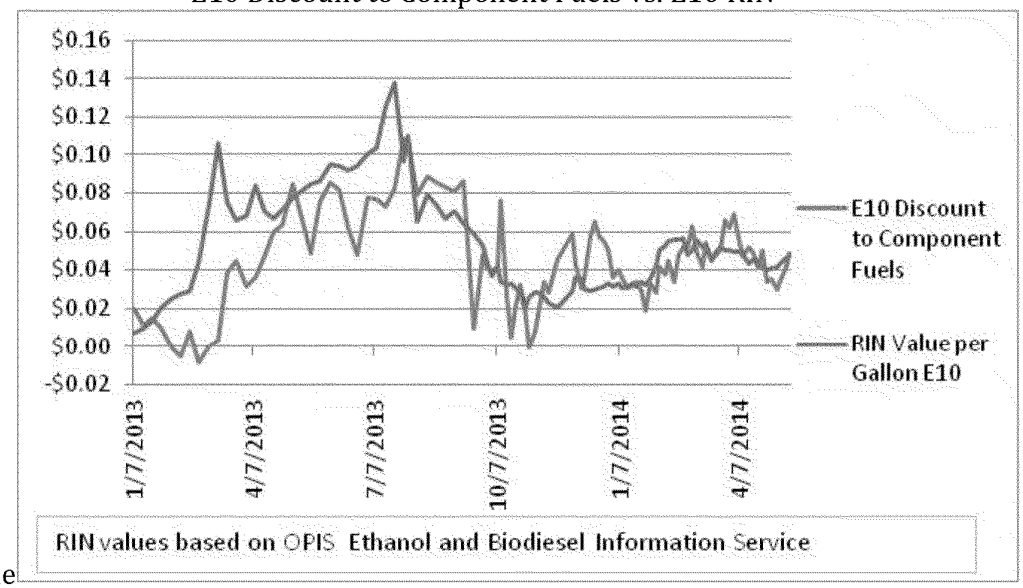
Figure 16
Clear Gasoline (E0), Neat Ethanol (E100), E10, and E85 Pricing at Des Moines



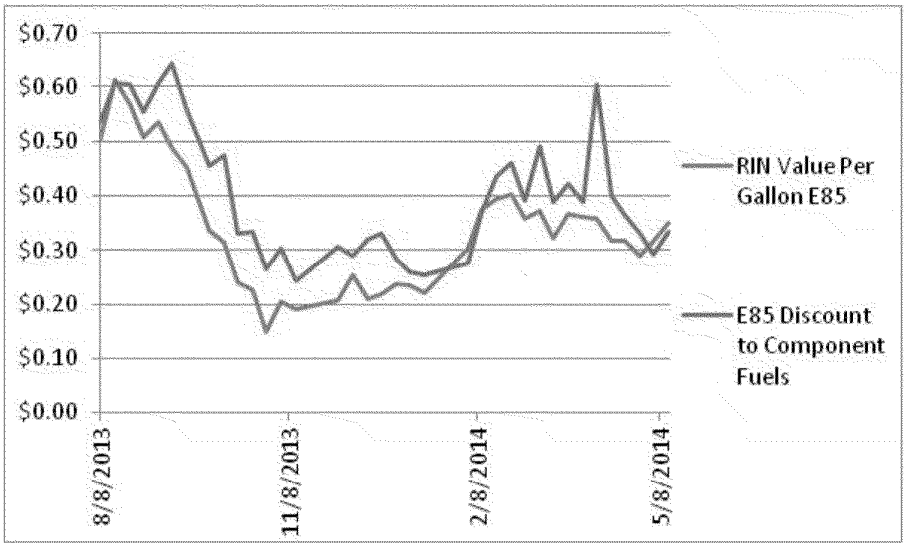
Fuel Prices from Iowa RFA (E85 Prices only available after August 8, 2014)

Figure 17
E10 Discount to Component Fuels vs. E10 RIN



Value

Figure 18
E85 Discount to Component Fuels vs. E85 RIN Value; August 2013 – May 2014



In reviewing the available data, it appears that, as predicted by scenarios in the previous section, the blended fuel prices at the wholesale level generally reflect the changing RIN prices. To state this another way, when determining the price at which to offer blended fuels, the data suggests the fuel blenders are taking into account the value received in the sale of the RIN. This further supports EPA's argument that, if all else remains equal, rising RIN prices may impact the relative pricing of fuel blends containing differing amounts of renewable fuel, but should not result in overall increases to blended fuel prices. We expect that these dynamics will hold when there are generally competitive markets for blended fuels at the wholesale and retail level. This is currently the case for much of the United States for E10 blends, however in most of the United States there is limited competition for E85 at both the wholesale and retail level. In their efforts to maximize profit, E85 wholesalers and retailers who face less competition may choose to withhold some or all or the RIN value if they believe that any increased sales volumes that result from lower priced E85 will be insufficient to overcome the lower per gallon profit margin. These high per-gallon profit margins may over time result in new parties entering the E85 wholesale or retail marketplace, and ultimately greater competition and lower E85 fuel prices for customers.[36]

While EPA has examined the available data in the marketplace to answer these two questions (Are obligated parties increasing the price of their RIN obligated fuels to recover RIN costs? And are fuel wholesalers reflecting the price of the RIN in their blended fuels?) we have not conducted a comprehensive analysis to address the question of whether or not a causal relationship between RIN prices and retail gasoline prices could be observed. EPA is aware, however, of others who have directly explored this issue, including an analysis released by the Renewable Fuels Association conducted by Informa Economics[37] and Scott

[36] See Section IV.C.1.b of the preamble for a larger discussion of E85 sales in 2013 and the limited impact of RIN prices on E85 retail prices, and ultimately E85 consumption in 2013.
[37] "Analysis of Whether Higher Prices of Renewable Fuel Standard RINs Affected Gasoline Prices in 2013."

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Irwin and Darrel Good of FarmDoc Daily,[38] and concluded that RIN prices in 2013 did not cause higher gasoline retail prices.

RIN Price Impacts on Merchant and Integrated Refiners

After RIN prices surged in 2013, several parties argued that high RIN prices would put merchant refiners (refiners that do not blend the petroleum blendstocks they produced with renewable fuels) at a competitive disadvantage relative to integrated refiners (refiners who do own fuel blending operations). EPA maintains that this conclusion is based on a flawed analysis of the RIN and transportation fuel markets. Specifically, this argument rests on the assumption that parties who blended renewable fuels with petroleum-based fuels to produce transportation fuel were able to separate RINs from renewable fuel and obtain them at a lower cost, while merchant refiners were forced to buy RINs at the market price. Those who raised this concern argued that while this dynamic existed even when RIN prices were low, the high RIN prices in 2013, specifically the high D6 RIN prices, put them at a significant competitive disadvantage.

The misunderstanding at the heart of this flawed conclusion concerns the manner in which merchant refiners acquire RINs, which may differ from the method generally used by integrated refiners. Because merchant refiners do not own fuel blending infrastructure, they generally purchase RINs from fuel blenders who do not have RIN obligations, or other parties who have RINs in excess of their obligations. For these merchant refiners there is a direct and obvious cost of purchasing RINs to satisfy their obligations. Integrated refiners generally obtain RINs by purchasing renewable fuels with attached RINs. As a result, integrated refiners are not paying a separate price for the RINs they acquire, but rather simultaneously purchasing both the renewable fuel and the associated RINs. At the same time, the increased value merchant refiners receive for their petroleum fuel is hidden in the market pricing of the fuels. Several merchant refiners have claimed that they cannot increase the price of their petroleum products, as the price they receive is determined by market listings such as NYMEX. However, even if true, the higher NYMEX price for gasoline sold in the United States relative to the price of gasoline in foreign markets shown in Figure 13 suggests that the NYMEX prices reflect the RIN cost incurred by refiners who sell petroleum products into the U.S. market. While these merchant refiners may simply be receiving prices for their products based on market listings, the data we have reviewed suggests that the market has adjusted to increased D6 RIN prices and they are nevertheless receiving a higher price for their products that generally reflects their RIN costs. If this is the case, exempting merchant refiners (or any other obligated party) from their RIN

Informa Economics. January 2014. In examining the available information, Informa Economics concluded that RIN prices did not have a causal relationship with gasoline prices. Other factors, notably the refiner crude oil composite acquisition cost, were found to have a causal relationship with gasoline prices in 2013. While this paper does not explore the mechanics of the RIN and transportation fuels market, and therefore cannot be used to verify EPA's understanding of the RIN market dynamics, it nevertheless supports our conclusion that high RIN prices did not cause higher gasoline prices in 2013.

[38] Irain, Scott, and Darrel Good. "High Gasoline and Ethanol RIN Prices: Is There a Connection?" FarmDoc Daily. Department of Agriculture and Consumer Economics, University of Illinois Urbana-Champaign, 27 Mar. 2013. Web. 10 Sept. 2014.

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obligation while maintaining RIN obligations for other obligated parties would allow the exempted parties to benefit from higher petroleum prices that reflect RIN costs while incurring no RIN costs themselves. This would allow the exempted parties to benefit from increased profit margins relative to other obligated parties as a direct result of the RFS program.

The data EPA has analyzed also indicates that parties that blended renewable fuels were not able to retain the full RIN value. Rather, the price received for a RIN was effectively used to subsidize the price of the renewable from which it was separated, and the price of blended fuels generally reflected this lower renewable fuel price. As discussed in the preceding section and shown in Figures 17 and 18 above, the data EPA has reviewed for Iowa shows that the price of blended fuels at the wholesale level in 2013 was generally less than the weighted average prices of the component fuels. This difference was related to the RIN value associated with the renewable fuel content in these blended fuels. This suggests that fuel blenders who purchased renewable fuels with attached RINs, whether independent or owned and operated by integrated refiners, were selling the renewable fuels for significantly less than the purchase price after the renewable fuels had been blended to produce transportation fuel and the RINs had been separated. Whether the integrated refiners attribute this cost to their renewable fuel acquisition operations, blending operations, or refining operations, they are subject to a cost for acquiring RINs just like the merchant refiners as long as they are selling renewable fuels at a price lower than the purchase price. If the integrated refiners were to attempt to recover the full purchase price of the renewable fuels in the price of the blended fuel they would likely not be competitive with the independent fuel blenders as the available data suggests blended fuel prices generally reflect discounted renewable fuel prices (net the RIN value).

We further believe that the obligated parties were generally able to recover this increase in the cost of meeting their RIN obligations in the price they received for their petroleum-based products in 2013. We do not argue the fact that higher RIN prices lead to higher compliance costs for obligated parties. We do believe, however, that these higher costs have a similar impact on all obligated parties. This includes not only merchant and integrated refiners, but also fuel importers who may import only a single product, such as gasoline or diesel fuel, as the primary mechanism for recovering the RIN cost is through the sales price of the petroleum based blendstocks. There are a number of factors that may impact an individual obligated party's RIN costs, including their RIN purchasing strategy (contract v. spot purchases, separated RINs v. RINs attached to renewable fuels), investments in renewable fuel production and blending infrastructure, and many others unique to each obligated party's business. While changing RIN prices may result in profit or costs for one obligated party relative to another, these impacts are largely due to individual business decisions rather than the systematic design of the RFS program. In this way the increasing RIN prices are similar to an increase in the price of crude oil. A rise in the price of crude oil has a significant impact on a refiners cost to produce gasoline blendstocks, but it will likely not impact their competitiveness, as all refiners are similarly impacted. The impacts on individual refiners may have slight variations due to crude oil purchase contracts or crude supply options, but these differences are indicative of market positions taken by individual refineries rather than a systematic competitive

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disadvantage.[39]

In the preceding section we examined available data on the price obligated parties received for similar fuel types with and without RIN obligations. In demonstrating that there was a difference in the prices for these fuels, this data, shown in Figures 13 and 16, suggests that obligated parties are generally able to recover the cost of meeting their RIN obligations in the price of their petroleum blendstocks. If this were not the case, we would expect that merchant refiners would have an incentive to export the gasoline and diesel fuel they produce or to increase production of heating oil or jet fuel, as these fuels do not incur a RIN obligation. If a significant volume of fuel was exported to foreign markets this would create a shortage of supply in the U.S., prices in the U.S. would rise. These higher domestic prices would provide a price signal to increase domestic production, increase fuel imports, or reduce exports to meet the demand, despite this fuel being subject to an RVO.

Finally, claims that high RIN prices put merchant refiners at a competitive disadvantage relative to integrated refiners ignore the compliance flexibility built into the RIN system. Obligated parties, including independent refiners, may acquire RINs by purchasing renewable fuel with attached RINs and retaining the RINs after selling or blending the renewable fuel, by purchasing separated RINs on the RIN spot market, or through contract arrangements. A merchant refiner's status does not mandate that the refiner purchase only separated RINs. Rather, all obligated parties can choose how and when to acquire RINs to comply with the RFS program. To the extent that merchant refiners choose—for economic or other reasons—to limit themselves to purchasing RINs on the market, that choice is their own, and not one required by EPA's rule. If merchant refiners believe that owning and operating blending operations would present a significant financial or strategic advantage, they may enter the marketplace in this capacity.

Conclusion

In this memo we have examined the RIN, renewable fuels, and transportation fuels marketplace. We have explored the question of the cause of elevated D6 RIN prices observed in 2013 and shown that the E10 blendwall was a significant factor in these rising RIN prices. Due to the complexity of the RIN market, we cannot precisely predict the future price of D6 RINs. We would not, however, expect the D6 RIN price to return to the prices experienced from 2010 to 2012 unless the cost of production of ethanol or other renewable fuels fell sufficiently below the cost of gasoline on an energy-equivalent basis.

We also examined data from 2013 and which suggested that rising RIN prices did not result in an increase in retail transportation fuel prices in 2013 (considering both gasoline and diesel together), due to the lower net cost of renewable fuels enabled by the high RIN

[39] There are significant similarities between the RIN markets and how refiners make their crude oil purchasing decisions. Integrated refiners may process their own crude or procure it from the open market, while independent refiners must purchase all of their crude oil. Refiners, both integrated and independent, are differently situated to process or option different crudes. They have differing business strategies for making these decisions that may impact their relative profitability.

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prices. While higher RIN prices increase the cost of RFS compliance for obligated parties purchasing separated RINs, they are generally able to recover these costs in the price of their petroleum blendstocks. As a result, a slight decrease in the price of ethanol-gasoline blends, which contain a relatively large amount of renewable fuels, is expected to be offset by an increase in the price of diesel fuel, which generally contains lower levels of renewable fuel. This does not necessarily mean that there is no cost to increasing the volume of renewable fuels required to be blended into the transportation fuel pool. If renewable fuels cost more on an energy-equivalent basis than the petroleum fuels they displace, as they did in 2013, there is a cost to using these renewable fuels. The higher the required volume of these fuels, the higher this cost will be. As a result, blending increasing volumes of renewable fuels likely increased the total cost of transportation fuel in the United States in 2013, relative to a scenario where there was not mandate for renewable fuels.

Finally we examined how merchant refiners and integrated refiners were impacted by high RIN prices. The available data suggests that while there may be some variation in how high RIN prices impact individual obligated parties due to differing business decisions, RIN acquisition strategies, and many other factors, the structure of the RFS program does not cause a systematic competitive advantage for one type of refiner or the other. The RIN, renewable fuel, and transportation fuel market is complex, and there are limitations to the available data. EPA will continue to monitor market prices and impacts over time in an attempt to better understand the dynamics and watch for signs of market disruption. Based on available data, however, the RIN market seems to be functioning generally as expected; providing an incentive for the continued growth of renewable fuels in the transportation fuel market without causing overall increases to the retail price of transportation fuel.

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To: Stock, James[james_stock@harvard.edu]
From: Hengst, Benjamin
Sent: Mon 5/4/2015 1:19:13 PM
Subject: In case you missed it

http://www.biofuelsdigest.com/bdigest/2015/05/04/its-time-for-epa-to-get-the-rfs-back-on-track/?preview=true

To: Fialkov, David[dfialkov@steptoe.com]
From: Hengst, Benjamin
Sent: Wed 4/29/2015 8:30:47 PM
Subject: RE: Consent Decree -- Comments?
Draft proposed CD RFS 113(g) FR Notice.pdf

Hey David. See attached. Thanks, Ben

From: Fialkov, David [mailto:dfialkov@steptoe.com]
Sent: Wednesday, April 29, 2015 2:06 PM
To: Hengst, Benjamin
Subject: Consent Decree -- Comments?

Hi Ben,

Do you have any sense of when EPA will issue the Fed Reg notice allowing the public an opportunity to comment on the proposed consent decrees?

David H. Fialkov

Associate

dfialkov@steptoe.com

Steptoe

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To: Jonna Hamilton[JHamilton@ucsusa.org]
From: Hengst, Benjamin
Sent: Fri 4/24/2015 1:56:25 PM
Subject: RE: May 1 at 10:30

Sounds good. 3:30 on 5/14

From: Jonna Hamilton [mailto:JHamilton@ucsusa.org]
Sent: Friday, April 24, 2015 9:50 AM
To: Hengst, Benjamin
Subject: RE: May 1 at 10:30

Thanks, Ben. I have a meeting that goes until 3 – can we push it to 3:30? Jeremy and I are both available at that time.

Thanks,

Jonna

From: Hengst, Benjamin [mailto:Hengst.Benjamin@epa.gov]
Sent: Thursday, April 23, 2015 5:36 PM
To: Jonna Hamilton
Subject: Re: May 1 at 10:30

How about 3pm on Thursday May 14?

On Apr 23, 2015, at 1:59 PM, Jonna Hamilton <JHamilton@ucsusa.org> wrote:

> Just realized I didn't reply to you - that is good. Should I just call you at your desk?
>
> Also realizing my schedule is already getting a little crazy for early May – can we go ahead and get something on the calendar to talk RFS the week of the 4th or 11th?

Thanks also for putting me in touch with Gwen. We had the Chris meetings figured out quickly – it was great.

Thanks,

Jonna

Jonna Hamilton

Senior Washington Representative

Clean Vehicles Program

Union of Concerned Scientists

1825 K Street NW, Suite 800

Washington, DC 20001

202-331-5451

JHamilton@ucsusa.org

To: Jonna Hamilton[JHamilton@ucsusa.org]
From: Hengst, Benjamin
Sent: Thur 4/23/2015 9:36:23 PM
Subject: Re: May 1 at 10:30

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On Apr 23, 2015, at 1:59 PM, Jonna Hamilton <JHamilton@ucsusa.org> wrote:

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Thanks,

Jonna

Jonna Hamilton

Senior Washington Representative

Clean Vehicles Program

Union of Concerned Scientists

1825 K Street NW, Suite 800

Washington, DC 20001

202-331-5451

JHamilton@ucsusa.org

To: Jonna Hamilton[JHamilton@ucsusa.org]
From: Hengst, Benjamin
Sent: Tue 4/21/2015 7:34:36 PM
Subject: RE: many meetings

Let's do 10:30 on the 1st.

From: Jonna Hamilton [mailto:JHamilton@ucsusa.org]
Sent: Tuesday, April 21, 2015 2:27 PM
To: Hengst, Benjamin
Subject: RE: many meetings

Hi Ben,

I have something off campus right up to 10, but could do 10:10-10:30/40 or 10:30-11.

I have some new timing information for the preferred times for Chris to meet with the broad coalition of supporters, based on the availability of a key player to get to town – sometime May 11, May 12, May 21, or May 22 (hard because right before memorial day weekend, might not be great for turn out) would be best if we can swing it.

Thanks so much and I'm happy to work directly with Gwen.

Jonna

From: Hengst, Benjamin [mailto:Hengst.Benjamin@epa.gov]
Sent: Monday, April 20, 2015 9:06 PM
To: Jonna Hamilton
Subject: Re: many meetings

Hi Jonna,

Thanks. Let me work with Chris's schedule on items 1 and 2. Gwen Stewart is her name; I think it'll be easier to just have her work with you but I will talk to her first. I think May 12 from 4-5 may not work so we will explore your other alternatives.

For Aircraft, how about a call on May 1, from 10-:30? I think that should suffice but if you'd like to come in, that's fine too.

For RFS, let's do that one a bit later--I'll suggest some times.

Thanks

Ben

From: Jonna Hamilton <JHamilton@ucsusa.org>
Sent: Friday, April 17, 2015 10:34 AM
To: Hengst, Benjamin
Subject: many meetings

Hi Ben,

It was good to chat the other day. We have several meetings to set up –

1) Chris to talk with the Heavy Duty Forum – we can host if he is interested in coming off site. The current date that is scheduled is May 12 from 4-5. I think we could move that earlier in the day if that is more convenient. I also think that we could move the meeting to the afternoon of Wednesday May 13, Monday May 18, or Tuesday May 19. Please let me know what may work on his calendar and I will get it nailed down. This is a monthly call (will do the meeting with Chris in person) and our call is next Tuesday, so if we can nail down a time by then, that would be helpful.

2) Chris to talk about LDVs. I would ideally like to do this before the HDV rule is out if possible. If you are able to suggest some blocks of time that work for him somewhere in the weeks of May 4, 11, 18, I can do a quick doodle poll and get that set up quickly.

3) RFS meeting with Jeremy – just let us know and we'll make a time work. It doesn't look like either of us has any vacation planned for May.

4) Endangerment finding for aircraft – I would love to get a download from you on what this is going to look like so that I can bring it to our planning retreat in early June. So – sometime in May?

Thanks,

Jonna

Jonna Hamilton

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Washington, DC 20001

202-331-5451

JHamilton@ucsusa.org

To: Jonna Hamilton[JHamilton@ucsusa.org]
From: Hengst, Benjamin
Sent: Tue 4/21/2015 6:36:17 PM
Subject: RE: many meetings

OK, thanks.

How about this: for the HD and LD meetings, please just write Gwen directly. Mention that I spoke with Gwen already on this (she and I chatted this morning). You should just ask for the 2 meetings, and indicate that one would be in Chris's office, while the other would be in DC but outside the office. Also indicate the dates. Just copy me and I'll help from this end.

Sound good? She's at stewart.gwen@epa.gov

Hopefully not too much of a hassle to write another email on this.

Thanks

Ben

From: Jonna Hamilton [mailto:JHamilton@ucsusa.org]
Sent: Tuesday, April 21, 2015 2:27 PM
To: Hengst, Benjamin
Subject: RE: many meetings

Hi Ben,

I have something off campus right up to 10, but could do 10:10-10:30/40 or 10:30-11.

I have some new timing information for the preferred times for Chris to meet with the broad coalition of supporters, based on the availability of a key player to get to town – sometime May 11, May 12, May 21, or May 22 (hard because right before memorial day weekend, might not be great for turn out) would be best if we can swing it.

Thanks so much and I'm happy to work directly with Gwen.

Jonna

From: Hengst, Benjamin [mailto:Hengst.Benjamin@epa.gov]
Sent: Monday, April 20, 2015 9:06 PM
To: Jonna Hamilton
Subject: Re: many meetings

Hi Jonna,

Thanks. Let me work with Chris's schedule on items 1 and 2. Gwen Stewart is her name; I think it'll be easier to just have her work with you but I will talk to her first. I think May 12 from 4-5 may not work so we will explore your other alternatives.

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Ben

From: Jonna Hamilton <JHamilton@ucsusa.org>
Sent: Friday, April 17, 2015 10:34 AM

To: Hengst, Benjamin
Subject: many meetings

Hi Ben,

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1) Chris to talk with the Heavy Duty Forum – we can host if he is interested in coming off site. The current date that is scheduled is May 12 from 4-5. I think we could move that earlier in the day if that is more convenient. I also think that we could move the meeting to the afternoon of Wednesday May 13, Monday May 18, or Tuesday May 19. Please let me know what may work on his calendar and I will get it nailed down. This is a monthly call (will do the meeting with Chris in person) and our call is next Tuesday, so if we can nail down a time by then, that would be helpful.

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Thanks,

Jonna

Jonna Hamilton

Senior Washington Representative

Clean Vehicles Program

Union of Concerned Scientists

1825 K Street NW, Suite 800

Washington, DC 20001

202-331-5451

JHamilton@ucsusa.org

To: Jonna Hamilton[JHamilton@ucsusa.org]
From: Hengst, Benjamin
Sent: Tue 4/21/2015 1:06:16 AM
Subject: Re: many meetings

Hi Jonna,

Thanks. Let me work with Chris's schedule on items 1 and 2. Gwen Stewart is her name; I think it'll be easier to just have her work with you but I will talk to her first. I think May 12 from 4-5 may not work so we will explore your other alternatives.

For Aircraft, how about a call on May 1, from 10-:30? I think that should suffice but if you'd like to come in, that's fine too.

For RFS, let's do that one a bit later--I'll suggest some times.

Thanks

Ben

From: Jonna Hamilton <JHamilton@ucsusa.org>
Sent: Friday, April 17, 2015 10:34 AM
To: Hengst, Benjamin
Subject: many meetings

Hi Ben,

It was good to chat the other day. We have several meetings to set up –

1) Chris to talk with the Heavy Duty Forum – we can host if he is interested in coming off site. The current date that is scheduled is May 12 from 4-5. I think we could move that earlier in the day if that is more convenient. I also think that we could move the meeting to the afternoon of Wednesday May 13, Monday May 18, or Tuesday May 19. Please let me know what may work on his calendar and I will get it nailed down. This is a monthly call (will do the meeting with Chris in person) and our call is next Tuesday, so if we can nail down a time by then, that would be helpful.

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Thanks,

Jonna

Jonna Hamilton

Senior Washington Representative

Clean Vehicles Program

Union of Concerned Scientists

1825 K Street NW, Suite 800

Washington, DC 20001

202-331-5451

JHamilton@ucsusa.org

To: tim@cvenergy.com[tim@cvenergy.com]
From: Hengst, Benjamin
Sent: Thur 4/9/2015 4:01:58 PM
Subject: Contact

Hi Tim,

I help run the EPA's Office of Transportation and Air Quality, the group within EPA responsible for implementing, among other things, programs related to transportation fuels (including the RFS) and vehicle air pollution and GHG emissions.

I was hoping we could talk at some point. I had called your office looking for Kevin Book, but was told by the person answering the phone it might be good to speak with you as well. Please give me a ring at your convenience.

Thanks,

Ben Hengst

Associate Director

Office of Transportation and Air Quality

US EPA

202-564-1495

To: Dower, Tom[tom.dower@arcelormittal.com]
Cc: Shaffer, Patricia[Shaffer.Patricia@epa.gov]
From: Hengst, Benjamin
Sent: Thur 3/26/2015 9:52:47 PM
Subject: Re: Meeting request

Come to the Clinton North building right at the entrance to the Federal Triangle metro stop. When you get here tell security you are here to meet me. Pat Shaffer (copied) will probably be there to greet you and bring you upstairs. You can also email me when you are close.

Thanks. Ben

On Mar 26, 2015, at 3:09 PM, Dower, Tom <tom.dower@arcelormittal.com> wrote:

Where should I come tomorrow and who should I ask for to get up to you?

Thanks, Ben.

-Tom

From: Hengst, Benjamin [mailto:Hengst.Benjamin@epa.gov]
Sent: Wednesday, March 25, 2015 10:20 PM
To: Dower, Tom
Subject: Re: Meeting request

In DC, it'll be me and Paul Argyropoulos. In Ann Arbor, Chris Grundler may or may not be joined by a few others.

thanks

Ben

From: Dower, Tom <tom.dower@arcelormittal.com>
Sent: Wednesday, March 25, 2015 10:12 PM
To: Hengst, Benjamin
Subject: RE: Meeting request

Ben - I will definitely be joining you for the video. Do you know who else will be participating either in Ann Arbor or DC?

We'll be sending over a suggested agenda tomorrow and it will just be me and Laurel Harmon (in Ann Arbor).

I'm looking forward to seeing you.

Thanks,

Tom

Tom Dower | Senior Director, Government Relations

ArcelorMittal Americas

1808 Eye Street, NW, 5th Floor

Washington, DC 20006

T +1 202 835 3311 | **M** +1 202 525 8483

tom.dower@arcelormittal.com

www.arcelormittal.com

From: Hengst, Benjamin [Hengst.Benjamin@epa.gov]
Sent: Thursday, March 19, 2015 1:45 PM
To: Dower, Tom
Subject: RE: Meeting request

Sure—no problem. I'll be attending the meeting and we would be in the same room here, so that's easy

From: Dower, Tom [mailto:tom.dower@arcelormittal.com]
Sent: Thursday, March 19, 2015 1:34 PM
To: Hengst, Benjamin
Subject: RE: Meeting request

Ben, I may take you up on the suggestion of doing this by video conference from HQ if that option is viable. I first need to see if there is any way I can physically get to Ann Arbor.

From: Stewart, Gwen [mailto:Stewart.Gwen@epa.gov]
Sent: Thursday, March 19, 2015 12:23 PM
To: Dower, Tom
Cc: Hengst, Benjamin
Subject: RE: Meeting request

Good Afternoon Mr. Dower:

Thank you for the below e-mail message.

The meeting is confirmed for March 27, 2015 – 11:00 AM – 12:00 PM

in Christopher Grundler's Ann Arbor Office.

I have attached for your review a copy of the Security/Entrance Instructions.

Please forward a copy of your Agenda and Participants List prior to the meeting.

If I maybe of further assistance, please do not hesitate to contact me.

Thank you

Gwen Stewart

Office of Transportation and Air Quality

202 564-1682 – Telephone

202 564-1686 – Fax Number

Stewart.gwen@epa.gov

From: Dower, Tom [mailto:tom.dower@arcelormittal.com]
Sent: Wednesday, March 18, 2015 3:10 PM
To: Stewart, Gwen
Subject: RE: Meeting request

Hi, Gwen. Does the below scheduling item still look possible for next Friday (3/27) at 11 AM? If yes, any strong feelings on location--whatever would be most convenient for Mr. Grundler?

Thanks,

Tom

From: Hengst, Benjamin [mailto:Hengst.Benjamin@epa.gov]
Sent: Friday, March 13, 2015 5:02 PM
To: Dower, Tom
Cc: Stewart, Gwen; Laurel Harmon (laurel@lanzatech.com)
Subject: Re: Meeting request

Tom, let's pencil in 11am on the 27th for now. Gwen will help confirm when she's back next week. Not sure where Chris will be at this point but we will let you know when we can. Ben

On Mar 12, 2015, at 6:06 PM, Dower, Tom <tom.dower@arcelormittal.com> wrote:

Gwen,

Thanks again for your help in coordinating a meeting with Mr. Grundler. Ben and I spoke today. We discussed the possibility of a meeting in Washington or Ann Arbor as there are people in both locations, basically whatever is most convenient for Mr. Grundler.

Just to get the ball rolling, Laurel Harmon with LanzaTech (copied) is in DC next week on Tues (3/17) and Friday (3/20) if those dates happen to coincide with Mr. Grundler's DC office days. Any day the following week (3/23-27) could work as well in either location.

Please let us know if you need to look beyond those dates, but we wanted to give you something to work with.

Thanks much,

Tom

From: Stewart, Gwen [mailto:Stewart.Gwen@epa.gov]
Sent: Wednesday, March 11, 2015 10:43 AM
To: Dower, Tom
Cc: Hengst, Benjamin
Subject: FW: Meeting request

Good Morning Mr. Dower:

I wanted to touch base with you regarding the below e-mail invitation on behalf of Christopher Grundler.

Christopher Grundler is out of the office and I would be more than happy to set up a meeting for you

in the next couple of weeks. As of this moment, I am unsure of when Christopher Grundler will be back in his

DC Office. However, in the interim Benjamin Hengst, Associate Director is available

to speak with you regarding the below meeting request. Benjamin can be reached on: 202 564-1495.

Once I know when Christopher Grundler will be in the DC Office, I will be in contact to schedule

a meeting.

Thank you

Gwen Stewart

Office of Transportation and Air Quality

202 564-1682 – Telephone

202 564-1686 – Fax Number

Stewart.gwen@epa.gov

From: Atkinson, Emily
Sent: Tuesday, March 10, 2015 8:59 AM
To: tom.dower@arcelormittal.com
Cc: Stewart, Gwen; Hengst, Benjamin
Subject: FW: Meeting request

Hi Tom,

Unfortunately, Janet McCabe is not available for a meeting on March 12 or 13 but Chris Grundler would be happy to arrange a time to meet. I am copying his scheduler, Gwen Stewart, on this note and she will be in touch today to get something arranged.

Emily

Emily Atkinson
Staff Assistant

Immediate Office of the Acting Assistant Administrator

Office of Air and Radiation, USEPA
Room 5406B, 1200 Pennsylvania Avenue NW
Washington, DC 20460
Voice: 202-564-1850
Email: atkinson.emily@epa.gov

From: Dower, Tom [mailto:tom.dower@arcelormittal.com]
Sent: Friday, March 06, 2015 10:15 AM
To: Atkinson, Emily
Cc: Carl Wolf (carl.wolf@lanzatech.com); Laurel Harmon (laurel@lanzatech.com)
Subject: RE: Meeting request

Of course. Most of the background is included in the very first communication below (dated Nov. 12), but in essence it is to discuss: 1) the process by which LanzaTech can have its "pathway" considered for inclusion in the RFS2; and 2) the air quality benefits of this unique process which we are considering implementing at a steelmaking facility in Northwest Indiana.

Please let me know if this gives you enough or you need more.

Thanks again,

Tom

From: Atkinson, Emily [mailto:Atkinson.Emily@epa.gov]
Sent: Friday, March 06, 2015 10:12 AM
To: Dower, Tom
Cc: Carl Wolf (carl.wolf@lanzatech.com); Laurel Harmon (laurel@lanzatech.com)
Subject: RE: Meeting request

Hi Tom,

Just want to check in and find out if you could provide an agenda of what you would like to talk about. Want to be sure we can include the right staff in on the meeting.

Thanks.

Emily

Emily Atkinson
Staff Assistant

Immediate Office of the Acting Assistant Administrator
Office of Air and Radiation, USEPA
Room 5406B, 1200 Pennsylvania Avenue NW
Washington, DC 20460
Voice: 202-564-1850
Email: atkinson.emily@epa.gov

From: Dower, Tom [mailto:tom.dower@arcelormittal.com]
Sent: Monday, March 02, 2015 11:29 AM
To: Atkinson, Emily
Cc: Carl Wolf (carl.wolf@lanzatech.com); Laurel Harmon (laurel@lanzatech.com)
Subject: Meeting request

Emily,

I was at a meeting with Janet last week and wanted to brief her on the below issue, but the venue and timing weren't right. Would you be able to find some time on her schedule for us on March 12 or 13? The meeting would include Dr. Jennifer Holmgren, CEO of LanzaTech, as

well as her team (copied) and myself from ArcelorMittal, the world's largest steel company with extensive Indiana presence – she knows us well.

Thanks very much for your consideration.

Best,

Tom

From: Atkinson, Emily [mailto:Atkinson.Emily@epa.gov]
Sent: Monday, November 17, 2014 2:47 PM
To: Dower, Tom
Cc: Hengst, Benjamin; Stewart, Gwen
Subject: RE: Meeting request
Importance: High

Hi Tom,

Sorry for the delay in getting back to you on this. Janet McCabe is on travel Wednesday, 11/19 but Chris Grundler from the Office of Transportation and Air Quality (OTAQ) will be happy to meet with you. I am copying his scheduler, Gwen Stewart, on this message and she will be in touch today about setting this up.

Emily

Emily Atkinson

Staff Assistant

Immediate Office of the Acting Assistant Administrator
Office of Air and Radiation, USEPA
Room 5406B, 1200 Pennsylvania Avenue NW
Washington, DC 20460
Voice: 202-564-1850
Email: atkinson.emily@epa.gov

From: Dower, Tom [mailto:tom.dower@arcelormittal.com]
Sent: Monday, November 17, 2014 1:56 PM
To: Atkinson, Emily
Cc: 'carl.wolf@lanzatech.com'
Subject: RE: Meeting request

Hi, Emily. Would you be able to give us an update on our chances for a meeting Wednesday?

Many thanks,

Tom

From: Atkinson, Emily [mailto:Atkinson.Emily@epa.gov]
Sent: Thursday, November 13, 2014 11:22 AM
To: Dower, Tom
Cc: 'carl.wolf@lanzatech.com'
Subject: RE: Meeting request

Hi Tom,

I will be in touch shortly with scheduling options.

Emily Atkinson
Staff Assistant

Immediate Office of the Acting Assistant Administrator
Office of Air and Radiation, USEPA
Room 5406B, 1200 Pennsylvania Avenue NW
Washington, DC 20460
Voice: 202-564-1850
Email: atkinson.emily@epa.gov

From: Dower, Tom [mailto:tom.dower@arcelormittal.com]
Sent: Wednesday, November 12, 2014 5:53 PM
To: Goffman, Joseph; Atkinson, Emily
Cc: 'carl.wolf@lanzatech.com'
Subject: Re: Meeting request

Thanks, Joe. Emily - an addendum to this is that the meeting would just be me and Dr. Holmgren.

Please let me know if you have any questions.

-Tom

202-835-3311

Tom Dower
Senior Director, Government Relations
ArcelorMittal
202.835.3311

From: Goffman, Joseph [mailto:Goffman.Joseph@epa.gov]
Sent: Wednesday, November 12, 2014 05:50 PM
To: Dower, Tom; Atkinson, Emily <Atkinson.Emily@epa.gov>
Cc: Carl Wolf (carl.wolf@lanzatech.com) (carl.wolf@lanzatech.com) <carl.wolf@lanzatech.com>
Subject: Re: Meeting request

+ Emily

- Joseph Goffman

Sent from my iPhone

On Nov 12, 2014, at 3:47 PM, "Dower, Tom" <tom.dower@arcelormittal.com> wrote:

Joe,

Would you be able to assist me in requesting a meeting with Acting Assistant Administrator McCabe for next **Wednesday, November 19th at 2 pm or later**? The meeting would include me on behalf of ArcelorMittal and Dr. Jennifer Holmgren, CEO of LanzaTech, as well as two members of her team (Carl Wolf and Laurel Harmon).

ArcelorMittal, the world's leading steel and mining company with over 20,000 employees in the US, is working closely with LanzaTech, which is a US-based technology company focused on the conversion of off-gases from steel production to produce biofuels, such as ethanol. We are discussing a potential US project at one of our facilities in Indiana.

LanzaTech has demonstrated its technology in 4 steel mills globally, including mills in New Zealand, China and Taiwan – in capacities up to 100,000 gallons a year, with thousands of hours of operation. LanzaTech is performing engineering on its first commercial steel-gas-to-ethanol facility in China, which will start construction next year. The project that we are jointly pursuing has the potential to improve the environmental and steel production performance and efficiency of the steel mill, while producing clean, low carbon fuel that does not compromise food or land resources, creating green jobs and enhancing competitiveness for the US steel industry.

Currently, LanzaTech's technology for converting steel mill off gases to ethanol is not explicitly included within the renewable

fuel standard because it was developed and scaled up after RFS2 was implemented. LanzaTech is working with technical staff at EPA on how this process could fit within the existing legislation. LanzaTech plans to submit a petition for a pathway to the EPA's Transportation and Air Quality Office in the near future.

We would greatly appreciate being able to outline this technology for Ms. McCabe given the broad environmental benefits across the Air Office's jurisdiction and Dr. Holmgren's planned visit to Washington. We understand this request is on short notice so are grateful for the consideration.

Thanks for your assistance. Dr. Holmgren's bio is below. Carl Wolf with LanzaTech is copied as well for any questions.

Best,

Tom

Tom Dower | Senior Director, Government Relations

ArcelorMittal

1808 Eye Street, NW, 5th Floor

Washington, DC 20006

T +1 202 835 3311 | **M** +1 202 525 8483

tom.dower@arcelormittal.com

Jennifer Holmgren, LanzaTech CEO

Dr. Jennifer Holmgren is the Chief Executive Officer of LanzaTech. Jennifer has over 20 years of experience in the energy sector including a proven track record in the development and commercialization of fuels and chemicals technologies. Prior to joining LanzaTech, she was Vice President and General Manager of the Renewable Energy and Chemicals business unit at UOP LLC, a Honeywell Company. In that role, she led UOP's renewable business from its inception through to the achievement of significant revenues from the commercialization of multiple novel biofuels technologies.

Dr. Jennifer Holmgren holds a B.Sc. degree from Harvey Mudd College, a Ph.D. from the University of Illinois at Urbana-Champaign and an MBA from the University of Chicago. She currently serves on multiple external advisory boards. She is the author or co-author of 50 US patents, 20 scientific publications and is the 2003 recipient of the Council for Chemical Research's (CCR) Malcolm E. Pruitt Award.

To: Keith Rutlin[rutlin@ksu.edu]
From: Hengst, Benjamin
Sent: Wed 2/11/2015 10:48:58 PM
Subject: Re: Request for speaker

Hi Keith,

Thank you for the offer but I'm afraid I won't be able to attend. This is primarily due to workload issues related to ongoing work on the RFS program itself.

Thanks and regards. Ben

On Feb 10, 2015, at 4:30 PM, Keith Rutlin <rutlin@ksu.edu> wrote:

Hi Ben,

I was given your name from Christie St. Claire at EPA.

Our annual Kansas State University Energy Symposium will be on April 8-9, 2015 at Kansas State University, Manhattan, Kansas.

We are requesting (if possible) that you present at our Energy Symposium on April 8, 2015. We are requesting a 45 minute presentation followed by a 5-10 minute Q&A period on the RFS and its enforcement.

Listed below is a Save the Date announcement on our Symposium. We will pay for your flight, hotel room, per diem, etc.

Please let me know if you can assist with our request.

Best regards,

Keith Rutlin
Educational Programs Administrator
Center for Sustainable Energy

Kansas State University
1005 Durland Hall

Manhattan, KS 66506

785-532-2029
http://cse.ksu.edu

<image003.jpg>

Cc: Niebling, William[Niebling.William@epa.gov]
To: tdriscoll@nfudc.org[tdriscoll@nfudc.org]
From: Hengst, Benjamin
Sent: Wed 1/7/2015 1:10:51 AM
Subject: Fw: Follow-up from yesterday's RFS hearing; National Farmers Union

Mr. Driscoll--

Will Niebling put me in touch with you with regards to your request to meet on the RFS. (I'll admit he did so earlier, and I failed to immediately follow up following the hearing last month -- my apologies for not getting back to you earlier.)

I work in the office responsible for implementing the RFS, and I'd be happy to set up a meeting and make sure the right folks are in attendance. Did you have a timeframe in mind? Perhaps as early as next week?

Feel free to email or call me at 202-564-1495.

Thanks,
Ben Hengst

[redacted]

Mr. Niebling:

Happy New Year.

I wanted to follow up and see whether you would be able to meet to discuss any way National Farmers Union may be able to be helpful with regards to the RFS. It is a major priority for our members. Do you have any availability this month?

Thank you for your consideration.

Sincerely,

Thomas Driscoll

Government Relations Representative

National Farmers Union

20 F St. NW Suite 300

Washington, DC 20001

202-554-1600 Main

From: Thomas Driscoll
Sent: Thursday, December 11, 2014 1:13 PM
To: 'niebling.william@epa.gov'
Subject: Follow-up from yesterday's RFS hearing; National Farmers Union

Mr. Niebling:

Thank you for taking the time to speak with me after yesterday's House Oversight Committee hearing.

I am a government relations representative with National Farmers Union here in Washington, DC. NFU is the second-oldest and second-largest general farm organization in the U.S. We represent about 200,000 family farmers and ranchers.

The Renewable Fuel Standard is a matter of serious importance to our members. We did a lot of work to present a more nuanced view from rural America on WOTUS, and I believe our efforts created some value for the agency. We would appreciate the opportunity to be as helpful with the RFS. Please let me know how we can contribute.

Thank you for your consideration.

Best regards,

Thomas Driscoll

Government Relations Representative

National Farmers Union

20 F St. NW Suite 300

Washington, DC 20001

202-554-1600 Main

Examining the RIN Market and the Effect of RIN Prices on the Price of Transportation Fuel and Obligated Parties

Dallas Burkholder, Office of Transportation and Air Quality, US EPA
October 28, 2014

Abstract

In 2013 the price of renewable identification numbers (RINs) for renewable fuels generated under the Renewable Fuel Standard (RFS) program increased significantly. The purpose of this memo is to examine available data in an attempt to describe and explain the factors that caused this increase in the price of one variety of renewable fuel (D6) RINs, and the impact this increase in RIN prices may have had on retail fuel prices. We also examine the impact of high RIN prices on merchant refiners (i.e. refiners who do not blend the majority of the petroleum products they produce with renewable fuels), who have claimed they are disadvantaged relative to integrated refiners by high RIN prices. For the purposes of this memo we have primarily considered available data from 2013, and have assumed constant renewable volume obligations (RVOs) and prices for renewable fuels with attached RINs. We have not considered a situation where the RVOs exceed the market's ability to supply the necessary RINs to obligated parties. We have also not attempted to quantify the total cost of the RFS program to consumers or other parties. We acknowledge, however, that the program is likely to have a cost if the cost of renewable fuels is greater than the petroleum based fuels they replace on an energy equivalent basis and if this cost outweighs the overall decrease in the cost of transportation fuel that results from increased fuel supply.[1]

In examining the available data we found that the rise in D6 RIN prices can largely be explained by the increasing total renewable fuel requirement of the RFS program. For the first time in 2013 this standard was established at a level beyond what could be achieved by the blending of ethanol as E10. This meant that the D6 RIN price was largely driven by the marginal cost of blending ethanol as E85,[2] or the cost of blending other non-ethanol renewable fuels where available, since nearly all gasoline sold in the United States already contained 10 percent ethanol. The demand price for ethanol sold in an E85 blend is significantly less than the demand price for ethanol sold as an E10 blend, as the lower energy density of the fuel, and therefore lower fuel economy of a vehicle operating on E85, are much more noticeable in higher level ethanol blends. Alternative fuel choices to E85, such as E10, are also widely available, giving consumers the opportunity to purchase the lowest cost fuel. With the exception of two brief spikes in the price of D6 RINs, which may be the result of the market adjusting to new supply and demand realities,[3] the D6 RIN prices in 2013 generally reflect what would be expected as the

[1] Several parties have credited the increased availability of renewable fuels with a decrease in the market price of petroleum derived fuels (relative to a scenario with no renewable fuels) as renewable fuels increase to the global supply of transportation fuel. While we acknowledge that increasing available volumes of renewable fuels may have had some effect on global petroleum prices, there is much uncertainty surrounding the magnitude of this impact and quantifying it is beyond the scope of this memo.

[2] Additional RINs can also be generated by blending non-ethanol fuels

[3] These price spikes, reported by Oil Price Information Service (OPIS), may overstate the average RIN price as

demand price for ethanol shifts from a volumetric relationship with gasoline, as was the case for E10, to an energy equivalent relationship with gasoline, as is expected to be the case for E85. We did not find evidence that the price of D6 RINs was driven by scarcity pricing,[4] as some have suggested.

While RIN prices were significantly higher in 2013 than in previous years we did not see, nor would we expect to see, a corresponding increase in the overall retail price of transportation fuels. This is because the RIN price, rather than acting as an additional cost, generally acts as a transfer payment between parties that blend renewable fuels and obligated parties who produce or import petroleum-based fuels and are required to obtain RINs for compliance purposes.[5] RINs are generated by renewable fuel producers and sold attached to volumes of renewable fuels to fuel blenders or obligated parties. When the RINs are separated from the renewable fuel and sold independently, the RIN seller may use the revenue received for the RIN to discount the effective cost of the renewable fuel. In order to recover the cost of purchasing RINs, however, obligated parties are expected to increase the selling price of the petroleum products they produce. If fuel prices are fully flexible and markets are perfectly competitive, these two price impacts, the discounting of renewable fuels enabled by the sale of the RINs and the higher petroleum prices that result from the cost of purchasing RINs, are thus expected to offset each other resulting in the RIN price having no net impact across the entire fuel pool.

We note, however, that higher RIN prices are expected to have an impact on particular types of transportation fuels such as E85, E10, and diesel fuel. In some cases high RIN prices are expected to decrease the retail price of the fuel, while in others they are expected to result in an increase in the retail price of the fuel. High RIN prices are expected to reduce the price of fuel blends that contain a higher percentage of renewable fuels, such as E85 or B20, while increasing the price of fuels that contain little or no renewable fuels.[6] An increase in D6 RIN prices, as seen in 2013, is expected to result in a significant decrease in the price of E85, a marginal decrease in the price of E10, and an increase in the price of diesel fuel. This is because the RIN costs of a gallon of fuel (the price increase of the petroleum blendstock due to the RIN obligations) is proportional to the amount of petroleum blendstock contained in a fuel blend, while the RIN value (the effective price reduction of the renewable fuel content enabled by the sale of the RIN) is proportional to the renewable content of the blend. These price impacts are one of the primary ways the RFS program can incentivize the increased blending and consumption of renewable fuels in the United States. In blends such as E10 RIN prices are expected to have little overall impact as the RIN cost is approximately equal to the RIN value.

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many RINs are purchased through long term contracts or acquired attached to renewable fuels. The prices reported by OPIS are more reflective of the price for separated RINs in the spot market.

[4] Scarcity pricing occurs when the price of a good increases significantly due to concerns over a limited supply. In this context we use the term scarcity pricing to refer to a situation where the price of D6 RINs rises significantly beyond what would be expected when considering the price of ethanol and the consumer demand price for ethanol when sold as E85.

[5] In some cases the fuel blender and obligated party may be the same company

[6] This is expected to be true in a competitive market, however, as discussed in Section IV.C.1.b of the preamble many of these expected price reductions may not be realized for fuels such as E85 that at the current time generally face little competition at the wholesale and retail level. As the availability of these fuels increases we anticipate that a higher proportion of the expected price decrease will be realized by consumers.

Finally, we examined available data to determine if the expected impacts of high RIN prices could be observed. We were able to observe these impacts in several areas, notably in price differences between petroleum-based fuels with and without RIN obligations and in lower wholesale and retail prices for fuel blends containing higher percentages of renewable fuels. The higher market prices for petroleum fuels with RIN obligations relative to those without RIN obligations suggest that obligated parties are generally recovering their RIN costs in the price of the petroleum fuels they produce. Merchant refiners, who largely purchase separated RINs to meet their RFS obligations, should not therefore be disadvantaged by higher RIN prices, as they are recovering these costs in the sale price of their products. We also note several other strategies available to merchant refiners, such as contractual arrangements and investing in fuel blending and distribution infrastructure, which are available to merchant refiners looking for alternative methods for meeting their RIN obligations.

Each of these conclusions, and the available data that EPA examined to arrive at these conclusions, is presented in further detail below. While the focus of this memo is explaining the rise in RIN prices and resulting fuels marketplace impacts in 2013, we expect a similar set of issues and market forces will be at work in future years.

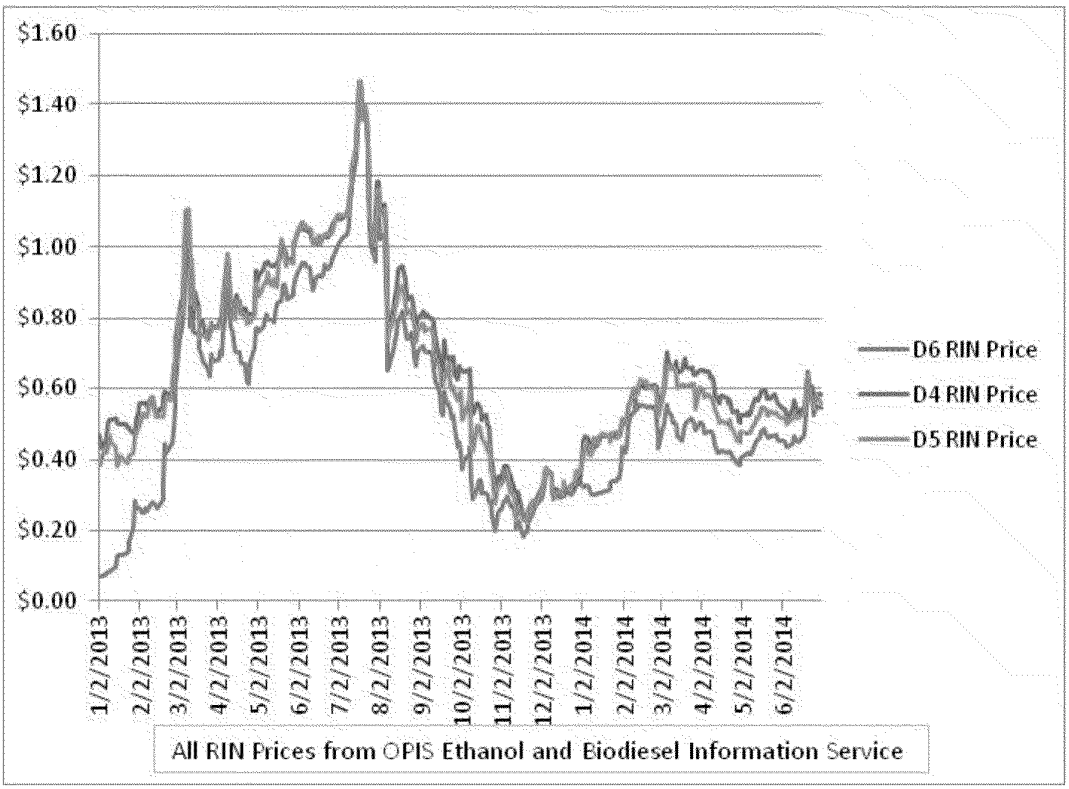
Background

On March 26, 2010 EPA published changes to the RFS program regulations, as required by the Energy Independence and Security Act of 2007 (EISA), to ensure that transportation fuel sold in the United States contains volumes of renewable fuel that are either specified in the statute or set by EPA pursuant to specified waiver authorities. The EISA amendments increased the volume of renewable fuel required to be blended into transportation fuel to 36 billion gallons by 2022. As a part of the RFS regulations, EPA implemented a system for tracking the production and use of qualifying renewable fuel using Renewable Identification Numbers or RINs. These RINs are generated by renewable fuel producers or importers and are bought and sold "attached" to the renewable fuel until the fuel is purchased by an "obligated party" (a refiner or importer of gasoline or diesel fuel) or blended with a petroleum-based transportation fuel. At that point the RIN is "separated" from the fuel and may thereafter be independently bought or sold until it is retired to meet an obligated party's renewable volume obligation or for some other reason.

By providing an opportunity for obligated parties to fulfill their obligations under the RFS program by purchasing RINs, the RIN market allows obligated parties the flexibility to choose whether or not to be directly involved in the blending of renewable fuels. Obligated parties may choose to acquire RINs by directly blending renewable fuels, by purchasing renewable fuel, separating the RINs, and selling the renewable fuel without RINs, or by purchasing separated RINs on the spot market or through other contract arrangements. While most RINs are used for compliance in the year they are generated, up to 20% of an obligated party's renewable volume obligation (RVO) may be satisfied with RINs generated in the previous year. This allows excess RINs to function as an inventory in the RIN trading market and provides compliance flexibility to the obligated parties as excess (or "carry over") RINs can act as a buffer for obligated parties to protect themselves against unforeseen changes in the RIN market. Obligated parties may also defer their RFS obligation, in whole or in part, to the following year, provided that the RIN obligation is satisfied together with the party's next year's RVO.

In 2013 the price for Renewable Fuel RINs (D6) increased substantially, from an average of a few cents per RIN in previous years to over $1.00 per RIN in the summer of 2013 (see Figure 1 below). The swift run up in the RIN price led a variety of stakeholders to conduct analyses looking into the causes and impacts of the increase. This memo presents EPA's assessment of the cause of the high RIN prices, the expected impacts on retail fuel prices of high RIN payments, and the impact of high RIN prices on obligated parties. Throughout, this memo focuses on D6 RINs; references to RIN prices are to D6 RINs unless otherwise noted.

Figure 1
RIN Prices



RIN Market Overview

In attempting to describe and explain the many factors that affect RIN prices or the effect of RIN prices on fuel prices and market participants, it is helpful to begin with a look at the roles different RIN market participants play. RINs are generated by renewable fuel producers.[7] RINs may be generated any time after the fuel is produced but before the fuel leaves the custody of the renewable fuel producer. Each RIN is "attached" to a gallon of renewable fuel and must be sold with that gallon of renewable fuel for which it was generated.

[7] Renewable fuel must be made from "renewable biomass" in accordance with a "pathway" determined by EPA to satisfy lifecycle greenhouse gas reduction requirements (or be grandfathered from such requirements) and be produced for use as transportation fuel, jet fuel or home heating oil. Pathways are a combination of feedstock, finished fuel type, and production process. For a list of currently approved pathways see CFR 40.1426

After a gallon of renewable fuel is sold, it is generally blended with a petroleum based fuel to produce a transportation fuel such as E10, E85, or B5. When a gallon of renewable fuel with an attached RIN is purchased by an obligated party[8] or blended to create a transportation fuel the owner of the fuel may separate the RIN from the renewable fuel. The RIN can then be used by the obligated party to demonstrate compliance with their RFS obligation, or it can be sold to another obligated party seeking RINs to fulfill their renewable volume obligation. Figure 2 presents a basic schematic of the RIN/renewable fuel market.

Figure 2
Product Transfers in the Renewable Fuel and RIN Market[9]

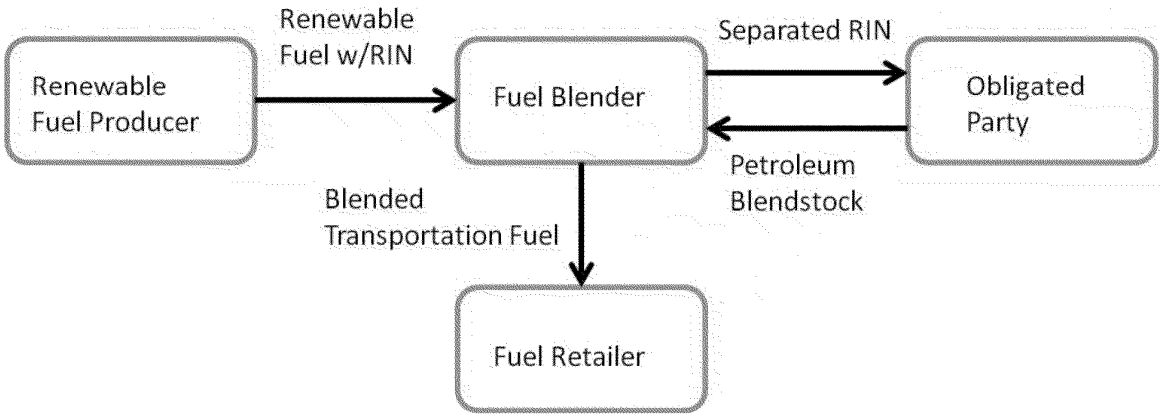


Figure 2 greatly simplifies the reality of a complex marketplace. For example, many obligated parties also own fuel blending operations, and others may purchase renewable fuel with an attached RIN, retain the RIN, and then sell the renewable fuel without the RIN. In practice several parties may take ownership of a renewable fuel before it is blended with a petroleum blendstock to produce a transportation fuel. Similarly separated RINs may be sold to brokers or aggregators before being sold to obligated parties. Where there are additional parties participating in the marketplace not shown in the graphic above, the commodity price received by one of the depicted parties will not be equal to the purchase price paid by the party who ultimately receives the commodity as the intermediate parties will require a fee for their services. We do not expect these fees to be significant, as the RIN and transportation fuel marketplaces are generally competitive.

There are also cases where a single company may be active in multiple areas of the transportation fuel market place. Examples include an ethanol production facility that blends finished transportation fuel, or a refiner who owns fuel blending terminals. In these cases certain

[8] In the RFS program an obligated party is defined as any refiner that produces gasoline or diesel fuel in the 48 contiguous states or Hawaii, or any importer that imports gasoline or diesel fuel, into the 48 contiguous states or Hawaii

[9] In the graphics in this memo we have depicted the renewable fuel producer, fuel blender, obligated party, and fuel retailer as independent entities. In reality two or more of these functions may be conducted by the same company. Traditionally many obligated parties have also functioned as fuel blenders, and increasingly renewable fuel producers are also producing and marketing renewable fuel blends.

transactions may take place within a single company rather than between two companies. The same fundamental transactions, however, still take place, whether they are internal to one company or external and involve different entities.

Factors Affecting the RIN Price

EPA designed the RIN program with the intention of providing a market-based compliance mechanism that would cause minimal disruption in the transportation fuel marketplace, while also providing EPA with the necessary assurance that the required volumes of renewable fuel would be used in the transportation sector. EPA sought to provide flexibility to refiners, importers, and other producers of petroleum-based transportation fuel by allowing obligated parties to purchase RINs and rely on the existing renewable fuel production, distribution, and blending marketplace rather than requiring each obligated party to directly blend a quantity of renewable fuel equal to their renewable volume obligation. If the RIN market is functioning efficiently the RIN price should be approximately equal to the difference between a renewable fuel's supply price and its demand price (the price the market is willing to pay for the renewable fuel as a transportation fuel). The RIN price provides the incentive for fuel blenders to purchase renewable fuels, and ultimately for renewable fuel producers to continue to produce renewable fuel up to the required volume, even if the demand price for the fuel would not otherwise cover the cost of production of the renewable fuel.

With this in mind, EPA examined available price data to determine if changes in the supply and demand price for renewable fuels explained the rising and variable D6 RIN prices observed in 2013. Determining a supply price was straightforward: EPA used ethanol[10] price data reported weekly by USDA.[11]

Determining the demand price for ethanol, however, is more complicated. Ethanol, in its unblended form, cannot be used as a transportation fuel by vehicles in the United States. It must be blended with gasoline to produce transportation fuels such as E10 (containing 10% ethanol) or higher level blends such as E85 (containing between 51% and 83% ethanol with a national average ethanol content of 74% as reported by the Energy Information Administration (EIA)).

We posit that the demand price for ethanol in a blended transportation fuel varies significantly depending on the ethanol blend level. The vast majority of ethanol sold as transportation fuel in the United States is sold as E10. When ethanol is sold in an E10 blend we argue that the demand price is equal to the price of the gasoline fuel into which it is blended on a volumetric basis, despite the fact that ethanol contains approximately 33% less energy per gallon than gasoline.

There are several reasons we believe this to be the case. Due to the relatively low level of ethanol in E10 the fuel economy reduction of E10 as compared to E0 (gasoline without ethanol) is fairly small (approximately 3%) and not noticeable by most consumers. Customers therefore

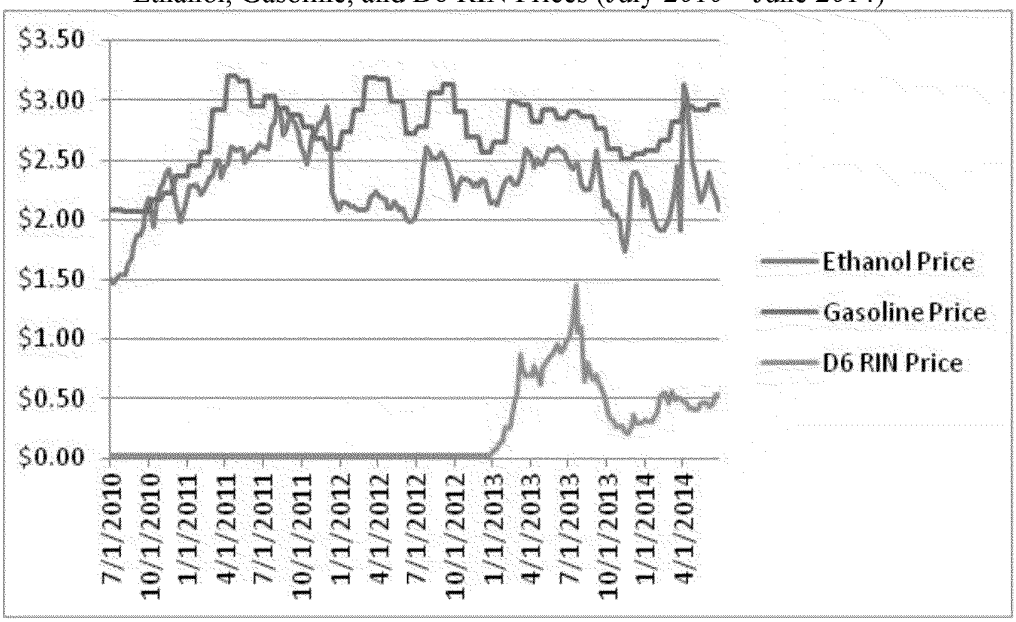
[10] Throughout this memo all references to ethanol are to denatured ethanol

[11] Data recorded by Agricultural Marketing Resource Center. These prices are for ethanol with attached RINs. Accessed online April 10, 2014 <http://www.agmrc.org/renewable_energy/ethanol/midwest-ethanol-cash-prices-basis-data-and-charts-for-selected-states/>

generally do not seek price discounts for E10 v. E0. Furthermore, for the relatively few consumers who are aware of the slightly lower energy content (and therefore lower fuel economy) of E10 as compared to E0, options to purchase E0 are very limited as virtually all gasoline sold in the United States now contains 10% ethanol. Where E0 is available, it is generally priced at a significant premium relative to E10, thus negating any potential value it may have offered due to its higher energy content. For a further discussion of the pricing of ethanol as E10 see the 2012 Notice of Decision Regarding Requests for a Waiver of the Renewable Fuel Standard.[12]

If the demand price for ethanol as transportation fuel when blended as E10 is approximately equal to the price of gasoline on a volumetric basis, rather than an energy-equivalent basis, we would expect D6 RIN prices to be very low whenever the ethanol price is below the gasoline price. This is because fuel blenders can generate profit by purchasing ethanol for a lower price than gasoline and sell the blended E10 at a price approximately equal to that of the gasoline blendstock on a per gallon basis despite the lower energy content of the fuel. No RIN value is necessary for the blending of ethanol to be profitable under these conditions. This was the case throughout the history of the RFS program until the early months of 2013. As shown in the graph below, from July 2010, the effective date of the updated RFS regulations, through the end of 2012 ethanol was generally priced below gasoline *on a volumetric basis*, and D6 RIN prices were only a few cents, likely attributable to RIN transaction costs. In 2013 the price of ethanol generally remained below the price of gasoline on a volumetric basis, yet the price of D6 RINs increased substantially. We argue a significant factor in this change in RIN price was a saturation of the E10 pool requiring that any additional volumes of ethanol be blended as E85.

Figure 3
Ethanol, Gasoline, and D6 RIN Prices (July 2010 – June 2014)



[12] FRL-9754-4

Note: The ethanol blenders tax credit expired in December 31, 2011, likely resulting in the decline in ethanol price in January 2012. The price spike in March/April 2014 was primarily the result of extremely cold winter temperatures leading to rail congestion[13]

When ethanol is sold as an E85 blend we argue that the ethanol has a significantly different consumer demand price. E85 blends contain significantly less energy per gallon than E10 (approximately 22% less energy per gallon assuming E85 contains 74% ethanol). This lower energy content results in a decrease in fuel economy of approximately 22% when owners of flexible fuel vehicles (FFVs) operate their vehicles on E85 rather than E10. Not only is the decrease in fuel economy more noticeable to fuel customers, but the fuel customers also have the ability to choose between purchasing E85 or E10, as E10 is available everywhere that E85 is. For E85 to appeal to most customers, therefore, it would need to be priced in a manner that accounts for the fuel economy penalty, as well as any "inconvenience factor" associated with its lack of availability relative to E10 and the need to refuel more frequently.

We argue that the more noticeable decrease in fuel economy and the greater availability of alternative fuel choices has a significant impact on consumer decisions regarding purchases of E85. While some FFV owners, primarily motivated by factors other than minimizing fuel costs[14], may purchase E85 at prices above energy parity, the majority of potential E85 customers will likely only purchase E85 if it is priced at a per gallon discount equal to or greater than the difference in energy content between E85 and E10.[15] If this is the case, the demand price for ethanol as a transportation fuel in an E85 blend is proportional to gasoline on an energy-equivalent, rather than a volumetric basis. This means that we would expect the true demand price for ethanol blended as E85 to be approximately 67% of the price of gasoline.[16] We would further expect that in a competitive market the D6 RIN price would be approximately equal to the difference between the price of ethanol relative to the price of gasoline on a volumetric basis (or near zero if ethanol were cheaper) when ethanol was primarily sold as E10, as it was until the end of 2012, and approximately equal to the difference on an energy-equivalent basis (67% of the price of gasoline) when the E10 market is effectively saturated and additional ethanol must be blended as E85, as in 2013. The prices of ethanol, gasoline, and an ethanol-equivalent gallon of gasoline (67% of a gallon) for 2012 and 2013 are shown below (Figure 4), followed by a graph that compares the difference between these prices and the observed D6 RIN price in 2012 and 2013 (Figure 5).

Figure 4

[13] For further information on this issue see "Rail congestion, cold weather raise ethanol spot prices." *Today in Energy*. U.S. Energy Information Administration, April 3, 2014. Web. September 25, 2014 <http://www.eia.gov/todayinenergy/detail.cfm?id=15691>.

[14] Consumers may purchase E85 when priced above energy parity for reasons such as supporting the rural economy, a desire to buy a domestically sourced fuel, E85's environmental attributes, or government fleet mandates. Alternatively some customers may avoid purchasing E85 even when it is available and priced below energy parity due to concerns about fuel quality, a desire to avoid more frequent refueling, or a lack of knowledge that the fuel is compatible with their vehicle.

[15] Informed customer decisions are often complicated by a lack of information on the precise ethanol content of E85. E85 may contain anywhere from 51% to 83% ethanol. Uncertainty regarding the ethanol content of E85 may hinder a customers ability to effectively choose the lower cost fuel on an energy-equivalent basis.

[16] The energy content of ethanol (77,000 BTU/gallon) is approximately 67% of the energy content of gasoline or E0 (115,000 BTU/gallon).

Ethanol Price, Gasoline Price and Energy-Equivalent Gasoline Price

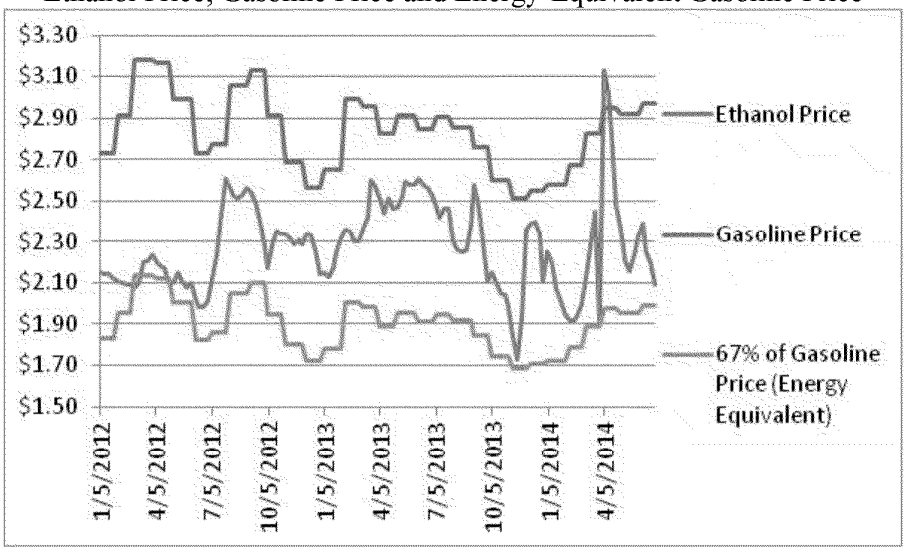
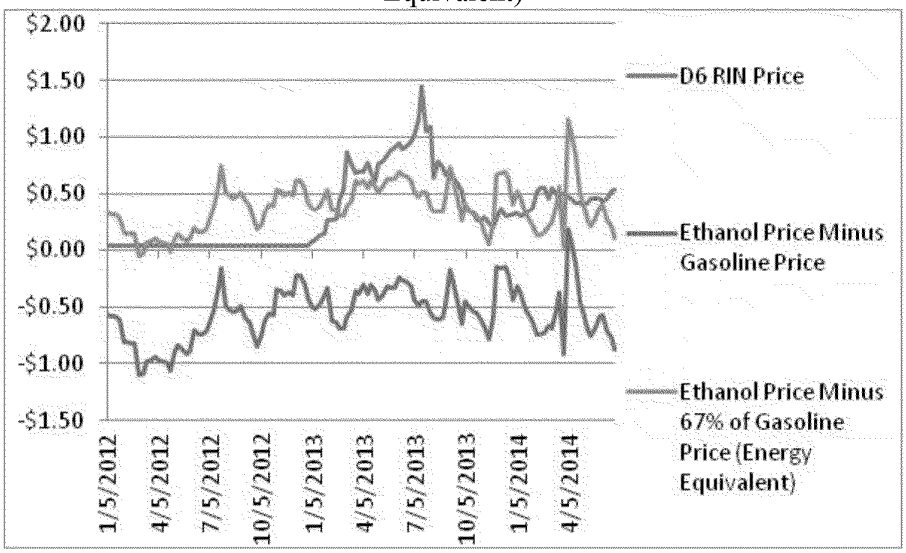


Figure 5
D6 RIN Price and Difference Between Ethanol and Gasoline Price (Volumetric and Energy-Equivalent)

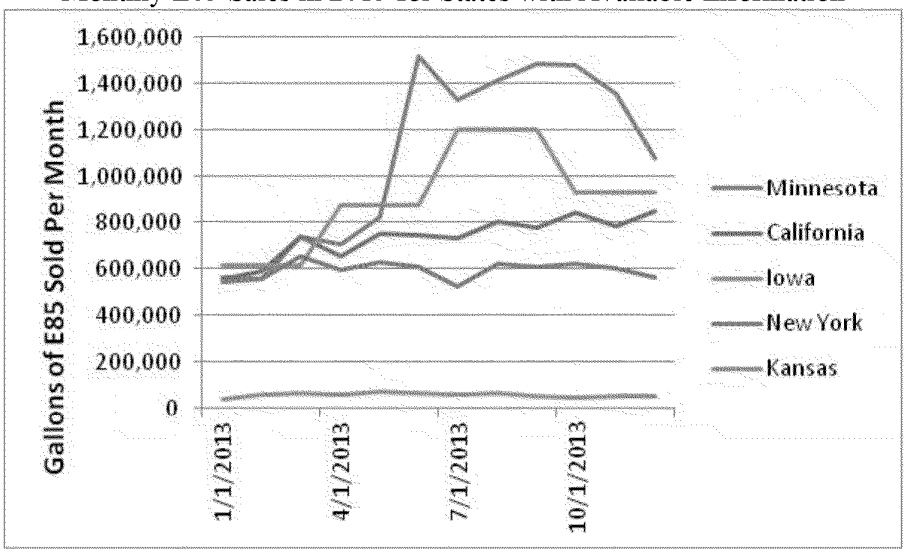


For the first time in 2013, the portion of obligated parties' total renewable volume obligations that could be satisfied with D6 RINs (the total volume obligation for non-advanced biofuels) exceeded the quantity of RINs that could be obtained by blending ethanol with gasoline to create E10. Because the amount of ethanol that could be blended as E10 was effectively capped, obligated parties looked to alternative sources of RINs, such as increased blending of ethanol as E85, the blending of additional non-ethanol biofuels, or the use of carry over RINs (RINs generated in 2012 available to satisfy 2013 obligations). In the ethanol market, we argue that the customer demand price shifted from a price based in part on gasoline on a volumetric basis (as it had been when increased blending of ethanol as E10 had represented the marginal gallon of

ethanol), to one based in part on gasoline on an energy-equivalent basis, as increased ethanol blending of ethanol as E85 now represented the marginal gallon of ethanol. This higher D6 RIN value also provided an increased opportunity for the increased blending of non-ethanol fuels, which may not have been profitable to blend into transportation fuel with low D6 RIN prices. In each of these cases, increased blending of ethanol as E85, increased use of non-ethanol biofuels, and the use of carry over RINs, the supply price exceeded the demand price for these renewable fuels when used as a transportation fuel. As a result, RIN prices increased in 2013 as shown in Figure 1. The increasing D6 RIN price provided an incentive not only for increased blending of ethanol as E85, but also for the increased production and import of non-ethanol fuels such as biodiesel and for a draw-down in the bank of carry over RINs.

During the period of high RIN prices in the middle of 2013 some parts of the United States saw growth in E85 sales. This growth was most notable in states, such as Minnesota and Iowa, where the RIN value was most likely to be passed on to the consumer due to competition at both the wholesale and retail level in the E85 market.[17] However, consumption of E85 remained limited despite the high RIN prices due to a variety of factors including a lack of infrastructure for the blending, sale, and consumption of E85, and the lack of competitive markets leading to RIN value pass through to consumers in many markets.[18]

Figure 6
Monthly E85 Sales in 2013 for States with Available Information



High D6 RIN prices incentivized a limited increase in E85 consumption, to an estimated 134 million gallons in 2013[19], but had an even more significant impact on the production and consumption of non-ethanol biofuels such as biodiesel and renewable diesel, which did not face

[17] According to data from DOE's Alternative Fuels Data Center approximately 20% of all E85 stations in the United States in 2013 were located in Minnesota or Iowa

[18] See Section IV.C.1.b of the preamble for a larger discussion of E85 sales in 2013 and the limited impact of RIN prices on E85 retail prices, and ultimately E85 consumption in 2013. In much of the United States the retail price for E85 remained high despite the potential for lower prices enabled by higher D6 RIN prices.

[19] See Section IV.C.1.b.i of the preamble for our estimation of E85 consumption in 2013

the same infrastructure challenges as ethanol blended as E85. Generation of D6 RINs for biodiesel and renewable diesel increased from approximately 6 million and 1 million in 2011 and 2012 respectively to over 250 million in 2013.[20] Generation of D4 (biomass-based diesel) RINs were also at the highest levels achieved under the RFS program. The increased availability of these fuels, combined with the availability of carry over RINs from excess production in 2012 helped to moderate the price of D6 RINs in 2013 despite the limited ability of RIN prices or volume mandates to increase the consumption of ethanol as E85.

On the basis of the data available to EPA, we believe much of the increase in 2013 D6 RIN can be explained by required volume of D6 RINs exceeding the amount that could be blended as E10 in 2013 and the resulting change in demand price for ethanol. These factors alone, however, do not provide a complete explanation of the observed D6 RIN prices. From May 2013 through August 2013, spot D6 RIN prices were substantially higher than would have been expected based solely on the prices of ethanol and gasoline. This may have been due to a variety of factors, including: limited blending and retail infrastructure for E85, limited ability for RIN prices to affect the retail price of E85, the RIN price needed to incentivize increasing the production or import of non-ethanol fuels, and uncertainty about the final RFS standards for 2013 and 2014. It may also be the case that the reported prices for D6 RINs reflect the price of a relatively small number of RINs traded on the spot market rather than the D6 RINs purchased through long term contracts and are therefore more volatile and not necessarily reflective of the average D6 RIN price. Regardless, these elevated D6 RIN prices increased the incentive for the production, import, and consumption of non-ethanol fuels, notably biodiesel produced from grandfathered facilities,[21] which was eligible to generate D6 RINs and could now compete in the domestic fuels market as a result of its significantly increased RIN value. In other words, renewable fuels that were uneconomic to produce or import to satisfy the D6 RIN obligations when RIN prices were only a few cents became economic to produce or import with substantially increased D6 RIN prices.

It is highly speculative and difficult to predict the future price of D6 RINs, as they are influenced by multiple factors, including the supply and demand prices for ethanol, the price of petroleum, the cost of production of non-ethanol renewable fuels, consumer behavior in the E85 market, and availability of alternative compliance mechanisms. However, given the fact that the required total renewable fuel volume will likely exceed the volume of ethanol that can be blended as E10 in the future, we would not expect D6 RIN prices to return to the prices seen from 2010 to 2012.[22]

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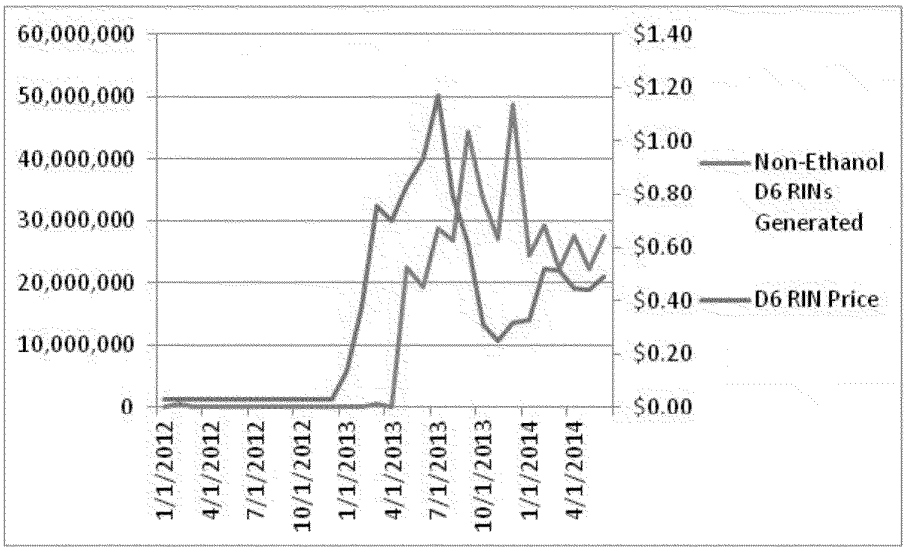
[20] All RIN production numbers from EMTS

[21] Grandfathered facilities are those that commenced construction on or before December 17, 2007, or any ethanol plant fired by natural gas, biomass, or a combination thereof that commenced construction before December 31, 2009. These facilities are exempt from the 20% GHG reduction requirement for the generation of D6 RINs, however they still must use a feedstock that meets the renewable biomass definition and meet all other reporting and recordkeeping requirements.

[22] RIN prices could return to historic low levels of a few cents if the price of ethanol or other renewable fuels fell sufficiently below the cost of gasoline on an energy equivalent basis

Figure 7
Generation of Non-Ethanol D6 RINs and D6 RIN Price



*RIN Prices from OPIS Ethanol and Biodiesel Information Services

RIN Price Impact on Transportation Fuel Prices

The high RIN prices observed in 2013 prompted questions not only regarding the cause of the increase, but also to questions about the impact the RIN prices would have on the retail price of transportation fuel. Some have suggested that higher RIN prices necessarily lead to higher retail prices for all transportation fuels.[23] Our analysis, however, indicates that this is not likely to be the case. In short, this is due to the fact that, rather than being an additional cost, RINs can be viewed as transfer payments from obligated parties to renewable fuel blenders to incentivize the blending of renewable fuels and the sale of fuel blends with higher renewable content. These payments, while having no net impact on the overall cost of transportation fuel, can reduce the price of fuels with high renewable content, such as E85, at the expense of fuels such as diesel that generally contain a small percentage of renewable fuel. This can ultimately increase the demand for renewable fuels by giving the fuel blenders a greater incentive to increase the renewable content of the fuel blends they sell.

If the cost of producing ethanol and gasoline blendstocks (or biodiesel and diesel fuel) remains unchanged, then the overall cost of the blended fuels should not be impacted by RIN prices.[24] This does not mean that there is no cost to increasing the volume of renewable fuels required to be blended into the transportation fuel pool. If renewable fuels cost more on an energy-equivalent basis than the petroleum fuels they displace there is a cost to using these renewable fuels; and the higher the required volume of these fuels, the higher the cost will be. As can be seen in examining the available data, however, the sharp rise in D6 RIN prices did not have a

[23] For example see "Gasoline Price Inflated by Ethanol in Oil Boom: Energy Markets" by Mario Parker, published by Bloomberg on March 21, 2013. Available online < http://www.bloomberg.com/news/2013-03-21/gasoline-price-inflated-by-ethanol-in-oil-boom-energy-markets.html>

[24] As stated in the previous paragraph, however, varying RIN prices are expected to impact the relative prices of different fuel types such as E85, E10, E0, B20, B5, etc.

measurable impact on the prices of ethanol with attached RINs (see Figure 8). Renewable fuel blenders acquire RINs by purchasing renewable fuels with attached RINs.[25] They sell these RINs to obligated parties, who look to recover the cost of these RINs in the price of the blendstocks they sell to the fuel blenders. Higher blendstock prices are in turn offset by the RIN value captured by blenders when they blend renewable fuels. We expect that higher RIN prices may increase the magnitude of these payments between obligated parties and renewable fuel blenders, as well as the relative pricing of fuel blends containing higher volumes of renewable fuels versus those containing little or no renewable fuel (see Figures 9 and 10 below), but that the net impact of these transfers on the cost of transportation fuel would be minimal.

Figure 8
Ethanol (with attached RIN) and D6 RIN

Prices

To illustrate this we examined the expected price of fuel supplied to the retailer for both E10 and E85. We did this first assuming a relatively low average RIN price and then again using the average RIN prices in 2013. The prices used for this example are shown in Table 1 below. The RIN obligation percentages are based on the 2013 volume requirements and standards. We note that because the standards are nested, the D6 RIN obligation percentage is equal to the total renewable fuel percentage standard minus the advanced biofuel percentage standard. Similarly, the D5 RIN obligation percentage is equal to the advanced biofuel percentage standard minus the biomass-based diesel percentage standard. For this example we have ignored the very small cellulosic biofuel requirement.

The total RIN cost is calculated by summing the product of the RIN obligation percentages by the corresponding RIN price for each of the RIN types.[26] The structure of the RFS program is

[25] As noted previously, renewable fuels with attached RINs can be purchased directly by obligated parties, and many obligated parties also blend renewable fuels to produce transportation fuel

[26] Per Gallon RIN Cost = D6 RIN Obligation * D6 RIN Price + D5 RIN Obligation * D5 RIN Price + D4 RIN Obligation * D4 RIN Price. This is the RFS "compliance cost" for each gallon of gasoline and diesel produce or imported by an obligated party.

such that every gallon of gasoline or diesel fuel produced or imported in the United States has an equal RIN obligation, including cellulosic, biomass-based diesel, advanced, and total renewable RINs. This means that the RIN cost for a gallon of gasoline is impacted by the price of the biomass-based diesel RIN, even though biodiesel cannot be blended into gasoline. Our examples reflect this structure, with identical RIN costs for gasoline and diesel that vary with different RIN prices. For these examples we have ignored transportation, overhead, and profit-taking[27] to simplify our analysis. While these are all factors that will impact the cost paid by retailers for blended fuels, we would not expect them to vary with RIN prices and have therefore not explicitly considered them in our example.

Table 1
Illustrative Commodity Prices for Exploring RIN Price Impacts on Retail Fuel Prices

	Low RIN Prices	High RIN Prices (2013 Average for RIN Prices)
Ethanol (with attached RIN)[28]	$2.25/gallon	$2.25/gallon
Gasoline blendstock (without RIN costs)	$2.75/gallon	$2.75/gallon
Biodiesel (with attached RIN)	$4.00/gallon	$4.00/gallon
Diesel blendstock (without RIN costs)	$3.25/gallon	$3.25/gallon
D6 RIN Price	$0.05	$0.60
D4 RIN Price	$0.50	$0.73
D5 RIN Price	$0.25	$0.71
D6 RIN Obligation	8.12%	8.12%
D4 RIN Obligation	1.13%	1.13%
D5 RIN Obligation	0.49%	0.49%
Total RIN Cost per gallon(All RIN obligations)	$0.01	$0.06

Using these assumptions for commodity prices, and based on our schematic of the RIN and fuel market shown in Figure 2 above, we can follow each of the fuel types through the RIN and fuel market to estimate the impacts on the price paid by retailers for both E10 and E85.

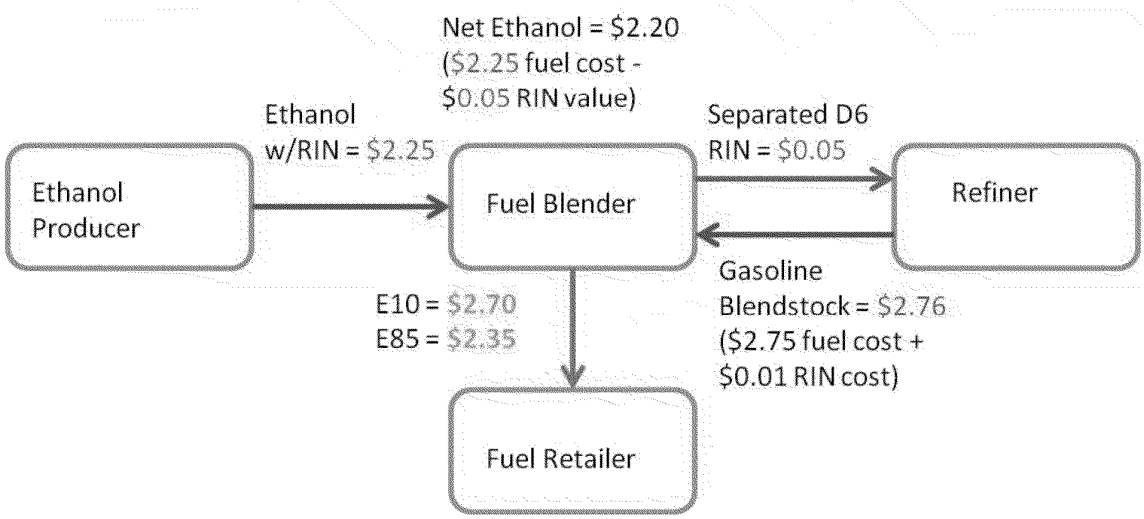
For the low RIN price scenario, we begin with the purchase of ethanol by the fuel blender from the renewable fuel producer. In this transaction the fuel blender receives one gallon of ethanol and the corresponding D6 RIN from an ethanol fuel producer for $2.25. After receiving the ethanol from the ethanol producer the fuel blender separates the D6 RIN and sells it to an obligated party for $0.05. The net purchase price for the ethanol without the RIN is therefore $2.20. The fuel blender next purchases gasoline blendstock from a refiner. The price the refiner would charge for one gallon of gasoline blendstock in the absence of the RFS program in this example is assumed to be $2.75 per gallon. Anticipating the need to purchase RINs to satisfy the RIN obligation associated with selling the gallon of gasoline blendstock, the refiner instead

[27] The opportunity for profit taking as a result of high RIN prices is discussed in further detail in Section IV.C.1.b of the preamble. EPA has examined some data that suggests increased profit taking during times of high RIN prices in the E85 market, but believe this will decrease as competition in the E85 marketplace increases.

[28] As shown in Figure 8, data from 2013 strongly suggests that the price of ethanol with an attached RIN is not a function of the RIN price

charges the fuel blender $2.76 per gallon ($2.75 for the cost of the gasoline blendstock and $0.01 to cover the per gallon cost of the RIN obligations). The fuel blender has effectively paid $2.20 per gallon of ethanol ($2.25 per gallon with attached RIN - $0.05 cost recovered in the sale of the RIN) and $2.76 per gallon of gasoline blendstock ($2.75 for the blendstock + $0.01 RIN recovery cost). The cost of producing blended fuels can be calculated by taking the average of these two fuel component costs weighted by the proportion of each component in the finished fuel blend.[29] The resulting blended fuel costs are $2.70 per gallon for E10 and $2.35 per gallon of E85. The prices and flows of the various commodities are shown in Figure 9 below.

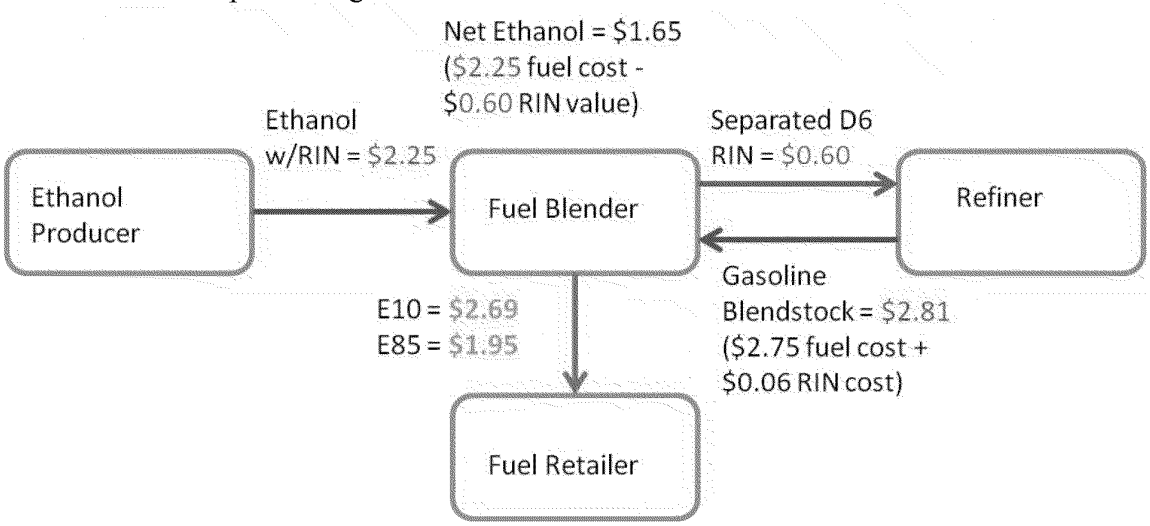
Figure 9
Impact of Low RIN Prices on the Cost of Gasoline to Retailers



A similar scenario can be examined with high RIN prices, such as those observed in 2013. For this scenario, we begin in the same place, with the purchase of ethanol by the fuel blender from the renewable fuel producer. As in the previous scenario, the fuel blender receives one gallon of ethanol and the corresponding D6 RIN from an ethanol fuel producer for $2.25. In this case, however, after being separated from the gallon of ethanol the RIN is sold to an obligated party for $0.60. The net purchase price for the ethanol without the RIN is therefore $1.65 rather than $2.20 in the previous scenario. In response to the higher RIN prices, the refiner must charge more for each gallon of gasoline blendstock sold to cover the cost of purchasing RINs to fulfill their RVO. The refiner now charges the fuel blender $2.81 per gallon of gasoline blendstock ($2.75 for the cost of the gasoline blendstock and $0.06 to cover the cost of the RIN obligations). In this high RIN price scenario, the fuel blender has effectively paid $1.65 per gallon of ethanol ($2.25 per gallon with attached RIN - $0.60 cost recovered in the sale of the RIN) and $2.81 per gallon of gasoline blendstock ($2.75 for the blendstock + $0.06 RIN recovery cost). The resulting blended fuel costs are $2.69 per gallon for E10 and $1.95 per gallon of E85. The prices and flows of the various commodities are shown in Figure 10 below.

[29] For this example we have assumed E10 contains 10% ethanol and 90% gasoline blendstock and E85 contains 74% ethanol and 26% gasoline blendstock. The equations to calculate the cost are therefore E10 = 0.1*[net ethanol cost] + 0.9*[net gasoline blendstock cost] and E85 = 0.74*[net ethanol cost] + 0.26*[net gasoline blendstock cost]

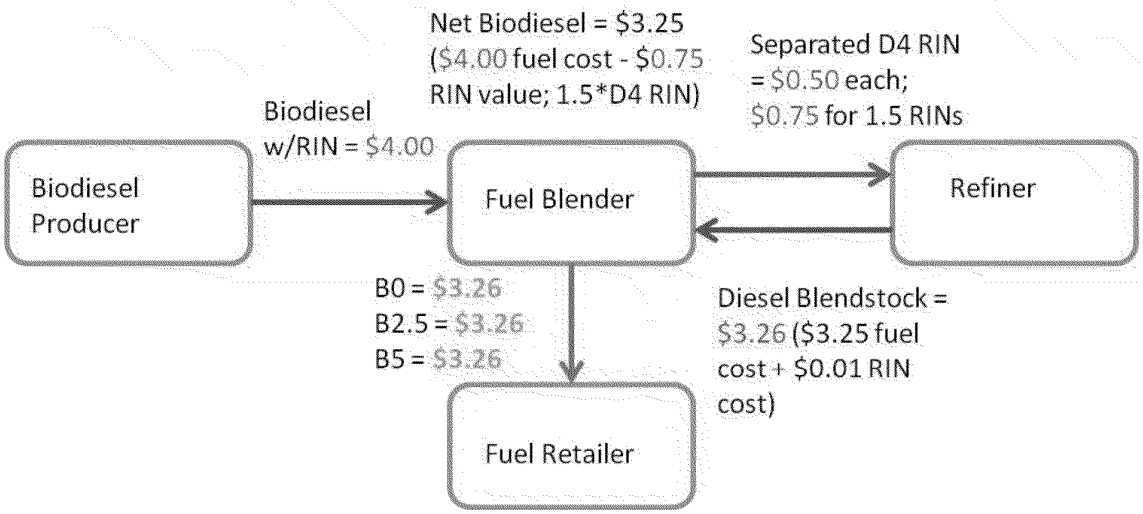
Figure 10
Impact of High RIN Prices on the Cost of Gasoline to Retailers



As these two scenarios demonstrate, rising RIN prices alone are not expected to increase the price of transportation fuel to retail station owners, however they have a significant impact on the relative prices of fuels with a relatively high renewable content (E85) as compared to those with a relatively low renewable content (E10). As the cost of acquiring RINs rises, refiners and other obligated parties are expected to respond to this cost by increasing the price of the gasoline blendstock they are selling to recover their increasing RIN costs. While this does increase the market price for the gasoline blendstock, this increase is generally offset by the lower net price paid for the ethanol with which the gasoline blendstock is blended.

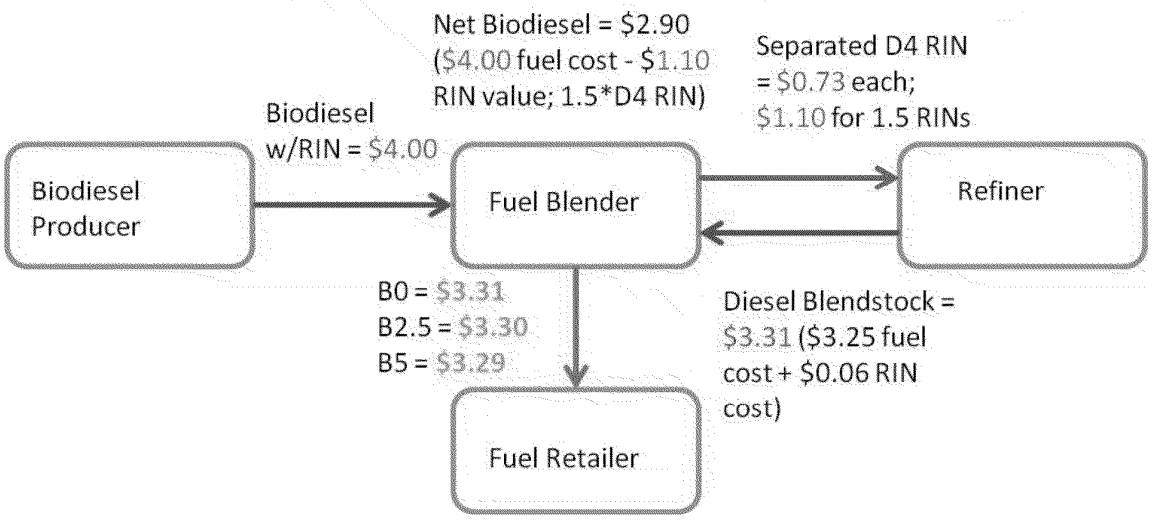
The same market dynamics are at work in the diesel fuel marketplace. When considering the impact of RIN prices on cost of fuel to the retailer, we begin with the purchase of biodiesel by the fuel blender from the renewable fuel producer. The fuel blender receives one gallon of biodiesel and 1.5 D4 RINs from a biodiesel producer for $4.00. Each gallon of biodiesel generates 1.5 RINs due to the higher energy content of biodiesel relative to ethanol. After being separated from the gallon of biodiesel, the RINs are sold to an obligated party for $0.50 each (the blender receives the total RIN value associated with a gallon of biodiesel; $0.75 in the low RIN price scenario). The net purchase price for the biodiesel without the RIN is therefore $3.25. For the purposes of this example we are not considering the impact of any blenders tax credit on the cost of biodiesel blends to retail stations. To cover the anticipated cost of their RIN obligation, the refiner charges the fuel blender $3.26 per gallon of diesel blendstock ($3.25 for the cost of the diesel blendstock and $0.01 to cover the cost of the RIN obligations). In this scenario, the fuel blender has effectively paid $3.25 per gallon of biodiesel ($4.00 per gallon with attached RIN - $0.75 cost recovered in the sale of the RINs) and $3.26 per gallon of gasoline blendstock ($3.25 for the blendstock + $0.01 RIN recovery cost). The resulting blended fuel costs are an identical $3.26 per gallon for B0, B5 and B2.5 (the average blend rate if every gallon of diesel fuel sold contained biodiesel). The prices and flows of the various commodities are shown in Figure 11 below.

Figure 11
Impact of Low RIN Prices on the Cost of Diesel to Retailers



For the high RIN price scenario, the cost of the biodiesel with attached RINs to the fuel blender is the same $4.00 per gallon. The net purchase price for the biodiesel without the RINs is now reduced to $2.90 per gallon ($4.00 per gallon of biodiesel – 1.5 RINs * $0.73 per RIN). In response to the higher RIN prices, the refiner must charge an additional $0.06 for each gallon of diesel blendstock sold, resulting in a per gallon price of $3.31 per gallon for diesel blendstock. In this high RIN price scenario, the fuel blender has effectively paid $2.90 per gallon of biodiesel ($4.00 per gallon with attached RIN - $1.10 cost recovered in the sale of the RINs) and $3.31 per gallon of diesel blendstock ($3.25 for the blendstock + $0.06 RIN recovery cost). The resulting blended fuel costs are $3.31 per gallon for B0, $3.19 per gallon of B5, and $3.30 per gallon of B2.5. The prices and flows of the various commodities are shown in Figure 12 below.

Figure 12
Impact of High RIN Prices on the Cost of Diesel to Retailers



When comparing the impact of high versus low RIN prices on the cost of gasoline and diesel fuel blends to retailers we note two key differences. The first is that the price of gasoline and ethanol fuel blends are much more sensitive to high RIN prices than the price of diesel and biodiesel fuel blends (see Table 2 below). This is due to the fact that the renewable content of gasoline is generally much higher than for diesel fuel (almost all gasoline sold in the United States contains 10% ethanol, with limited availability of blends containing up to 85% ethanol; biodiesel is generally sold at blends containing 5% biodiesel or less, with few blends offered that contain more than 20% biodiesel).

Table 2
Impact of High RIN Prices on Retail Fuel Prices

	No RIN Price (No RFS)	Low RIN Prices	High RIN Prices
E0	$2.75	$2.76	$2.81
E10	$2.70	$2.70	$2.69
E85	$2.38	$2.35	$1.95
B0	$3.25	$3.26	$3.31
B2.5	$3.27	$3.26	$3.30
B5	$3.29	$3.26	$3.29

The second difference that can be observed is that increasing D6 RIN prices are expected to cause a slight decrease in gasoline prices and an increase in diesel prices. In the example above, which is designed to be reflective of a perfectly competitive market, any cost decreases that result from lower prices of gasoline-ethanol blends are offset by cost increases resulting from higher diesel fuel prices. The per gallon pricing changes for diesel fuel are high relative to the pricing changes in E10 and low relative to the pricing changes in E85 primarily due to the

relative renewable fuel content of these three fuel blends.

While not shown in the examples above, increasing D4 RIN price while holding the D6 RIN price constant would be expected to result in a slight increase in blended gasoline prices and a decrease in diesel prices. This is a result of the structure of the RFS program. Both gasoline and diesel blendstocks are subject to the same renewable volume obligations, and therefore the same costs associated with acquiring the necessary RINs. As shown in Table 1, this cost is $0.01 per gallon under the low D6 RIN price scenario and $0.06 per gallon under the high D6 RIN price scenario. In the scenarios presented above, the high D6 RIN prices can be used to reduce the net purchase price of fuels that generate D6 RINs, which in the majority of cases is corn ethanol. Gasoline-ethanol blends, such as E10 and E85, benefit from the lower net ethanol costs enabled by the higher D6 RIN prices, while diesel and biodiesel blends do not benefit as ethanol cannot be added to these fuels. The reverse scenario would also be true. If D4 RIN prices increased while D6 RIN prices were relatively unchanged the RIN cost for producing petroleum-based gasoline and diesel blendstocks would increase by the same amount. This would be expected to decrease the price of biodiesel blends (as the D4 RIN price reduced the net price of biodiesel) and cause slight increases in the price of gasoline-ethanol blends (which cannot be blended with biodiesel and therefore experience only a RIN cost). The magnitude of this impact, however, would likely be smaller as the D4 RVO is significantly lower than the D6 RVO.

Finally, we note that the price for unblended gasoline and diesel fuel increases in both the high and low RIN price scenarios as compared to a scenario where there are no RIN prices (no RFS). For E10, the most common fuel type sold for use in gasoline vehicles, this cost increase is offset by the effective cost reduction in the price of ethanol, resulting in little or no net change to the price of E10. For diesel-biodiesel fuel blends, however, this is not the case. The lowest price diesel fuel across the three scenarios is for unblended diesel in the no RIN price case. While it is true that in low and high RIN cases biodiesel blends are the same price as, or cheaper than unblended diesel fuel all of these products are more expensive than unblended diesel in the scenario where there is no RIN price.

Observing RIN Price Impacts in the Marketplace

After considering these simplified examples of how increasing RIN prices might impact the price of blended fuel to retailers, EPA examined available price information to determine if the expected price impacts (higher costs for petroleum blendstocks and lower net costs for renewable fuels) could be observed in the data. Due to the many independent factors that impact the cost of transportation fuels, this is not a straight-forward exercise. For example, it is not enough simply to observe the retail price of transportation fuel as the RIN prices fluctuate. If changes in RIN prices corresponded with changes in the price of crude oil (the primary cost of producing gasoline blendstocks), simply observing the relationship between RIN prices and retail fuel prices may give the false impression that increasing RIN prices have a direct impact on the retail pricing of blended fuels. Conversely, decreasing crude oil prices might mask the impact that changing RIN prices have on the price of gasoline blendstocks at the wholesale level or the retail price of blended fuels.

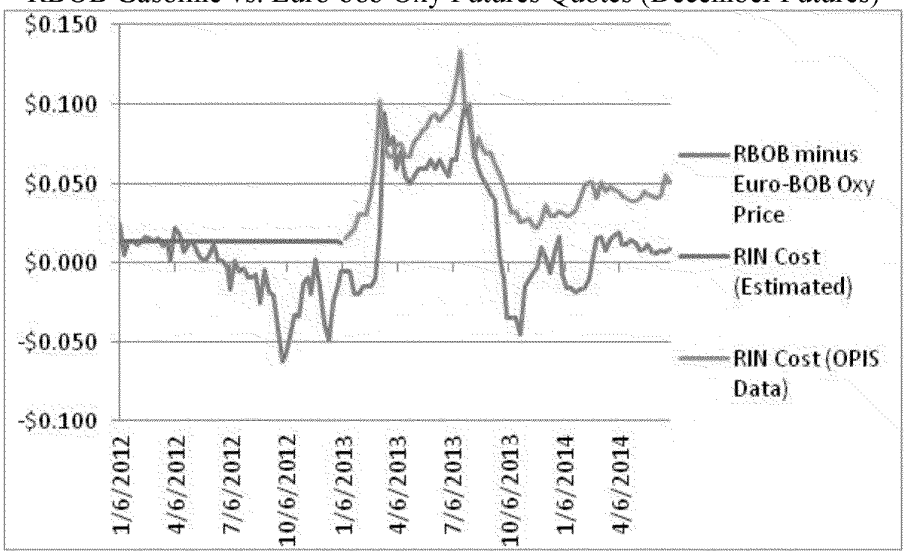
If the market is reacting to changes in RIN prices in the way that the scenarios presented in the

previous section suggest, there are two places we expect we would be able to observe the impacts of the changing RIN prices in the market. The first is in the wholesale pricing of similar types of fuel with and without a RIN obligation. The scenarios presented above suggest that if RIN prices increase, obligated parties will respond by increasing the price they charge for petroleum based fuels to recover the cost of purchasing RINs to satisfy the RVO associated with the sale of these fuels. We would not, however, expect to see an increase in the price of similar fuels that are not subject to a RIN obligation. If we observed a sustained price delta between similar types of fuels with and without a RIN obligation, and if this price delta was approximately equal to the RIN cost associated with producing a gallon of petroleum based fuel transportation fuel, it would provide support for our argument that obligated parties are able to increase the cost of their petroleum blendstocks in order to recover the cost of their RIN obligations.

In the current market there exist several pairs of similar types of fuels wherein one of the pair carries a RIN obligation while the other does not. This allows us to examine the impact of RIN prices on the wholesale price of petroleum fuels. One such pair of fuels consists of gasoline produced for the domestic market (which is subject to an RVO) and gasoline sold for export to the European market (which carries no RIN obligation). A second pair is diesel based: diesel fuel is very similar to jet fuel and heating oil sold in the United States, but diesel fuel produced or imported into the U.S. has a RIN obligation while heating oil and jet fuel do not. EPA examined available pricing data for these three pairs of fuels (gasoline sold in the domestic v. foreign markets, diesel v. jet fuel, and diesel v. heating oil). Figure 13 shows the future quotes for RBOB Gasoline vs. Euro-bob Oxy for the December futures (the price difference between gasoline grades sold for the United States and European markets) and the RIN obligation cost for gasoline produced or imported into the United States. Figures 14 and 15 show the price differentials between diesel and heating oil and diesel and jet fuel and the RIN obligation costs associated with diesel fuel. The correlation between the price differences of these similar fuels and the RIN obligation costs suggests that obligated parties were generally able to increase the price they charge for the RIN obligated petroleum products they sell for use as transportation fuel in the US to help recover their compliance costs under the RFS program.[30]

[30] Or alternatively, that the market price adjusted to reflect the RIN cost

Figure 13
RBOB Gasoline vs. Euro-bob Oxy Futures Quotes (December Futures)



RIN Prices from OPISEthanol and Biodiesel Information Services
RBOB Gasoline vs. Euro-bob Oxy Futurer prices from CME Group

Figure 14
ULSD Price Minus Heating Oil Price (New York Harbor) and Per Gallon RIN Cost

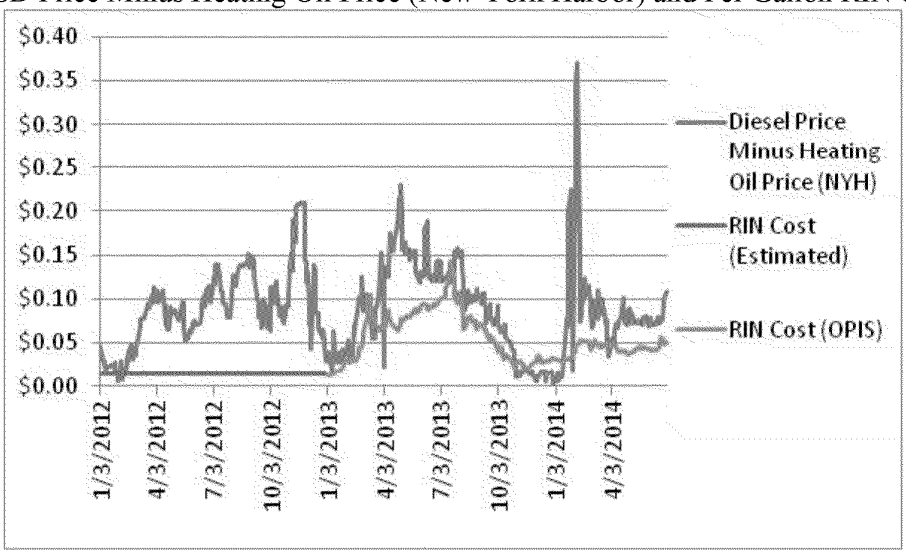
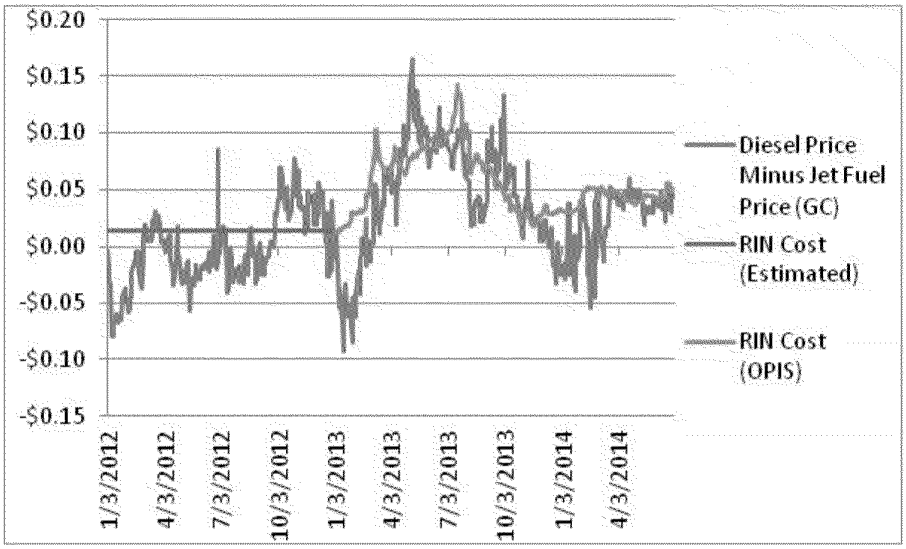


Figure 15
ULSD Price Minus Jet Fuel Price (Gulf Coast) and Per Gallon RIN Cost



The second area EPA examined to corroborate the results of our example scenarios was the pricing of ethanol, unblended gasoline, and blended fuels (such as E10 or E85) at the wholesale level. Examining this data should indicate whether or not the value of the RIN, which can be separated by the fuel blender when the ethanol is blended to produce a transportation fuel, is reflected in the wholesale price of the blended fuels. If the wholesale price for blended fuels, such as E10 and E85, is equal to or slightly greater than the volume weighted average price of neat ethanol (E100) and clear gasoline (E0) it would indicate that the RIN value is not reflected in the wholesale price of the blended fuels.[31] In this scenario, the fuel blender would retain any value associated with the separation and sale of the RIN. If, however, the price for the blended fuels was lower than the volume weighted average of neat ethanol and clear gasoline, it would indicate that the RIN value was at least partially reflected in the price of the blended fuels at the wholesale level.

The fuel blender can only profitably sell a blended fuel for less than the component costs of that fuel if they are realizing value elsewhere. Fuel blenders are able to separate and sell a RIN every time they blend a gallon of renewable fuel, and the RIN value can be used to discount the price of the blended fuel and offer it at a competitive price. Alternatively, the fuel blenders may attempt to retain some or all of the RIN value, especially in less competitive markets. As in the case where we examined the price delta between similar fuels with and without RIN obligations, if the difference between the blended fuel price and the volume weighted average price of neat ethanol and clear gasoline was approximately equal to the RIN value for each of these fuels, this would provide support for the argument that the RIN value is the basis for this difference.

For this analysis we used terminal pricing information from Des Moines, Iowa. We chose to use Des Moines for two reasons. First, unlike many terminals in other states, clear gasoline (E0) is

[31] This is true when RIN prices are relatively high. When D6 RIN prices are only a few cents any blended fuel discount due to the sale of the RIN may be masked by a mark-up of the fuel price at the fuel blender

readily available in Iowa at the wholesale level. Knowing the price of clear gasoline allows us to see RIN price impacts on petroleum blendstocks before they are blended with ethanol. Second, Iowa contains a relatively high number of ethanol plants that currently market E85 fuel blends, making it more likely to represent a competitive marketplace for E85. This increase in the competition in the E85 wholesale market increases the likelihood that the RIN value will be reflected in the price of E85 at the wholesale level (see Figure 6, where E85 sales in Iowa increased when RIN prices were high). In other markets, where blenders of E85 face less competition, they may be able to retain more of the RIN value for these higher level ethanol blends rather than reflecting them in the wholesale pricing of these blends.[32] Figure 16 shows the pricing of neat ethanol (E100), clear gasoline (E0), and E10 at the Des Moines terminal, as well as the average price for E85 available at the terminal and direct from ethanol production facilities.[33] Figure 17 compares the difference between the reported price of E10 and the calculated price using a volume weighted average of the component fuels (E100 and E0)[34] to the RIN value associated with E10.[35] Figure 18 compares the difference between the reported price of E85 and the calculated prices using a volume weighted average of the component fuels (E100 and E0)[36] to the RIN value associated with E85.[37]

[32] Over time, however, we would expect markets that are currently relatively uncompetitive to see increased competition and a decreasing opportunity to withhold RIN value from fuel costomers

[33] Prices for E0, E10, and E100 are Des Moines rack average prices, provided to EPA by Iowa RFA. Price for E85 is the average of all prices listed on the Iowa RFA Wholesale E85 Price Listing website (http://www.iowarfa.org/E85PastPriceProgram.php)

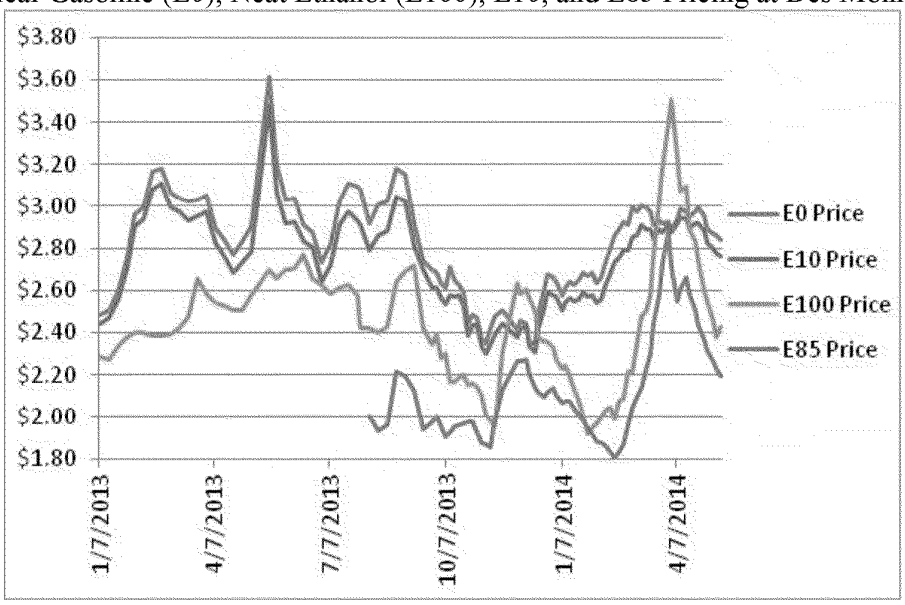
[34] Component E10 price = 0.9 * E0 price + 0.1 * E100 price

[35] E10 RIN value = 0.1 * D6 RIN price (RIN price information from OPIS Ethanol and Biodiesel Information Service

[36] Component E85 price = [1 – Ethanol Content] * E0 price + [Ethanol Content] * E100 price; Ethanol content is calculated based on the weekly average of all E85 offerings reported by Iowa RFA

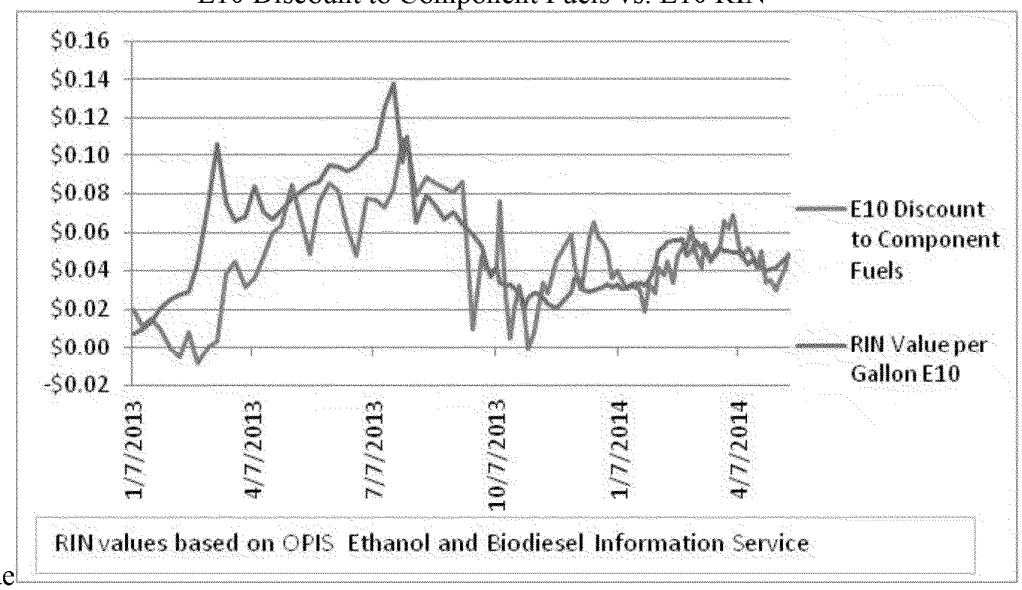
[37] E85 RIN value = [Ethanol content of E85] * D6 RIN price (Ethanol content is calculated based on the weekly average of all E85 offerings reported by Iowa RFA ; RIN price information from OPIS Ethanol and Biodiesel Information Service

Figure 16
Clear Gasoline (E0), Neat Ethanol (E100), E10, and E85 Pricing at Des Moines



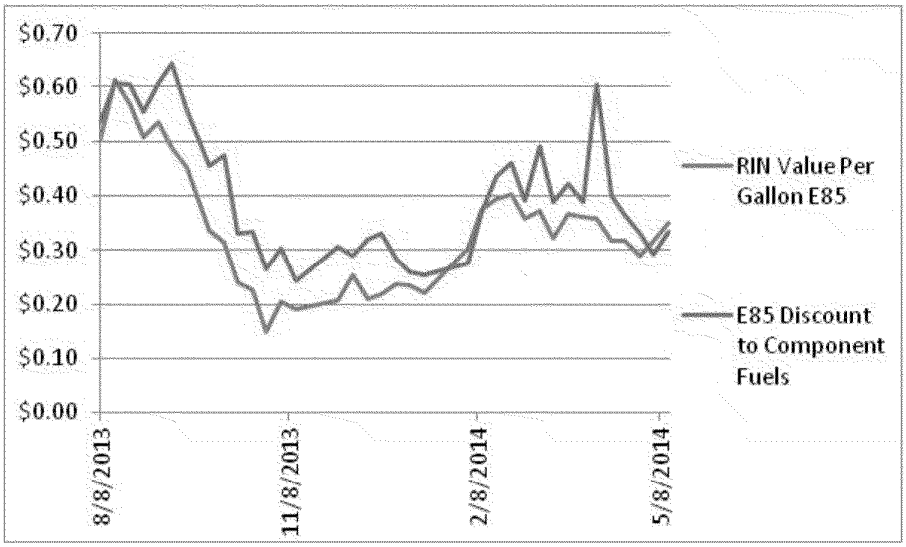
Fuel Prices from Iowa RFA (E85 Prices only available after August 8, 2014)

Figure 17
E10 Discount to Component Fuels vs. E10 RIN



Value

Figure 18
E85 Discount to Component Fuels vs. E85 RIN Value; August 2013 – May 2014



In reviewing the available data, it appears that, as predicted by scenarios in the previous section, the blended fuel prices at the wholesale level generally reflect the changing RIN prices. To state this another way, when determining the price at which to offer blended fuels, the data suggests the fuel blenders are taking into account the value received in the sale of the RIN. This further supports EPA's argument that, if all else remains equal, rising RIN prices may impact the relative pricing of fuel blends containing differing amounts of renewable fuel, but should not result in overall increases to blended fuel prices. We expect that these dynamics will hold when there are generally competitive markets for blended fuels at the wholesale and retail level. This is currently the case for much of the United States for E10 blends, however in most of the United States there is limited competition for E85 at both the wholesale and retail level. In their efforts to maximize profit, E85 wholesalers and retailers who face less competition may choose to withhold some or all or the RIN value if they believe that any increased sales volumes that result from lower priced E85 will be insufficient to overcome the lower per gallon profit margin. These high per-gallon profit margins may over time result in new parties entering the E85 wholesale or retail marketplace, and ultimately greater competition and lower E85 fuel prices for customers.[38]

While EPA has examined the available data in the marketplace to answer these two questions (Are obligated parties increasing the price of their RIN obligated fuels to recover RIN costs? And are fuel wholesalers reflecting the price of the RIN in their blended fuels?) we have not conducted a comprehensive analysis to address the question of whether or not a causal relationship between RIN prices and retail gasoline prices could be observed. EPA is aware, however, of others who have directly explored this issue, including an analysis released by the Renewable Fuels Association conducted by Informa Economics[39] and Scott Irwin and Darrel

[38] See Section IV.C.1.b of the preamble for a larger discussion of E85 sales in 2013 and the limited impact of RIN prices on E85 retail prices, and ultimately E85 consumption in 2013.

[39] "Analysis of Whether Higher Prices of Renewable Fuel Standard RINs Affected Gasoline Prices in 2013." Informa Economics. January 2014. In examining the available information, Informa Economics concluded that RIN prices did not have a causal relationship with gasoline prices. Other factors, notably the refiner crude oil

Good of FarmDoc Daily,[40] and concluded that RIN prices in 2013 did not cause higher gasoline retail prices.

RIN Price Impacts on Merchant and Integrated Refiners

After RIN prices surged in 2013, several parties argued that high RIN prices would put merchant refiners (refiners that do not blend the petroleum blendstocks they produced with renewable fuels) at a competitive disadvantage relative to integrated refiners (refiners who do own fuel blending operations). EPA maintains that this conclusion is based on a flawed analysis of the RIN and transportation fuel markets. Specifically, this argument rests on the assumption that parties who blended renewable fuels with petroleum-based fuels to produce transportation fuel were able to separate RINs from renewable fuel and obtain them at a lower cost, while merchant refiners were forced to buy RINs at the market price. Those who raised this concern argued that while this dynamic existed even when RIN prices were low, the high RIN prices in 2013, specifically the high D6 RIN prices, put them at a significant competitive disadvantage.

The misunderstanding at the heart of this flawed conclusion concerns the manner in which merchant refiners acquire RINs, which may differ from the method generally used by integrated refiners. Because merchant refiners do not own fuel blending infrastructure, they generally purchase RINs from fuel blenders who do not have RIN obligations, or other parties who have RINs in excess of their obligations. For these merchant refiners there is a direct and obvious cost of purchasing RINs to satisfy their obligations. Integrated refiners generally obtain RINs by purchasing renewable fuels with attached RINs. As a result, integrated refiners are not paying a separate price for the RINs they acquire, but rather simultaneously purchasing both the renewable fuel and the associated RINs. At the same time, the increased value merchant refiners receive for their petroleum fuel is hidden in the market pricing of the fuels. Several merchant refiners have claimed that they cannot increase the price of their petroleum products, as the price they receive is determined by market listings such as NYMEX. However, even if true, the higher NYMEX price for gasoline sold in the United States relative to the price of gasoline in foreign markets shown in Figure 13 suggests that the NYMEX prices reflect the RIN cost incurred by refiners who sell petroleum products into the U.S. market. While these merchant refiners may simply be receiving prices for their products based on market listings, the data we have reviewed suggests that the market has adjusted to increased D6 RIN prices and they are nevertheless receiving a higher price for their products that generally reflects their RIN costs. If this is the case, exempting merchant refiners (or any other obligated party) from their RIN obligation while maintaining RIN obligations for other obligated parties would allow the exempted parties to benefit from higher petroleum prices that reflect RIN costs while incurring no RIN costs themselves. This would allow the exempted parties to benefit from increased profit margins relative to other obligated parties as a direct result of the RFS program.

composite acquisition cost, were found to have a causal relationship with gasoline prices in 2013. While this paper does not explore the mechanics of the RIN and transportation fuels market, and therefore cannot be used to verify EPA's understanding of the RIN market dynamics, it nevertheless supports our conclusion that high RIN prices did not cause higher gasoline prices in 2013.

[40] Irain, Scott, and Darrel Good. "High Gasoline and Ethanol RIN Prices: Is There a Connection?" FarmDoc Daily. Department of Agriculture and Consumer Economics, University of Illinois Urbana-Champaign, 27 Mar. 2013. Web. 10 Sept. 2014.

The data EPA has analyzed also indicates that parties that blended renewable fuels were not able to retain the full RIN value. Rather, the price received for a RIN was effectively used to subsidize the price of the renewable from which it was separated, and the price of blended fuels generally reflected this lower renewable fuel price. As discussed in the preceding section and shown in Figures 17 and 18 above, the data EPA has reviewed for Iowa shows that the price of blended fuels at the wholesale level in 2013 was generally less than the weighted average prices of the component fuels. This difference was related to the RIN value associated with the renewable fuel content in these blended fuels. This suggests that fuel blenders who purchased renewable fuels with attached RINs, whether independent or owned and operated by integrated refiners, were selling the renewable fuels for significantly less than the purchase price after the renewable fuels had been blended to produce transportation fuel and the RINs had been separated. Whether the integrated refiners attribute this cost to their renewable fuel acquisition operations, blending operations, or refining operations, they are subject to a cost for acquiring RINs just like the merchant refiners as long as they are selling renewable fuels at a price lower than the purchase price. If the integrated refiners were to attempt to recover the full purchase price of the renewable fuels in the price of the blended fuel they would likely not be competitive with the independent fuel blenders as the available data suggests blended fuel prices generally reflect discounted renewable fuel prices (net the RIN value).

We further believe that the obligated parties were generally able to recover this increase in the cost of meeting their RIN obligations in the price they received for their petroleum-based products in 2013. We do not argue the fact that higher RIN prices lead to higher compliance costs for obligated parties. We do believe, however, that these higher costs have a similar impact on all obligated parties. This includes not only merchant and integrated refiners, but also fuel importers who may import only a single product, such as gasoline or diesel fuel, as the primary mechanism for recovering the RIN cost is through the sales price of the petroleum based blendstocks. There are a number of factors that may impact an individual obligated party's RIN costs, including their RIN purchasing strategy (contract v. spot purchases, separated RINs v. RINs attached to renewable fuels), investments in renewable fuel production and blending infrastructure, and many others unique to each obligated party's business. While changing RIN prices may result in profit or costs for one obligated party relative to another, these impacts are largely due to individual business decisions rather than the systematic design of the RFS program. In this way the increasing RIN prices are similar to an increase in the price of crude oil. A rise in the price of crude oil has a significant impact on a refiners cost to produce gasoline blendstocks, but it will likely not impact their competitiveness, as all refiners are similarly impacted. The impacts on individual refiners may have slight variations due to crude oil purchase contracts or crude supply options, but these differences are indicative of market positions taken by individual refineries rather than a systematic competitive disadvantage.[41]

In the preceding section we examined available data on the price obligated parties received for

[41] There are significant similarities between the RIN markets and how refiners make their crude oil purchasing decisions. Integrated refiners may process their own crude or procure it from the open market, while independent refiners must purchase all of their crude oil. Refiners, both integrated and independent, are differently situated to process or option different crudes. They have differing business strategies for making these decisions that may impact their relative profitability.

similar fuel types with and without RIN obligations. In demonstrating that there was a difference in the prices for these fuels, this data, shown in Figures 13 and 16, suggests that obligated parties are generally able to recover the cost of meeting their RIN obligations in the price of their petroleum blendstocks. If this were not the case, we would expect that merchant refiners would have an incentive to export the gasoline and diesel fuel they produce or to increase production of heating oil or jet fuel, as these fuels do not incur a RIN obligation. If a significant volume of fuel was exported to foreign markets this would create a shortage of supply in the U.S., prices in the U.S. would rise. These higher domestic prices would provide a price signal to increase domestic production, increase fuel imports, or reduce exports to meet the demand, despite this fuel being subject to an RVO.

Finally, claims that high RIN prices put merchant refiners at a competitive disadvantage relative to integrated refiners ignore the compliance flexibility built into the RIN system. Obligated parties, including independent refiners, may acquire RINs by purchasing renewable fuel with attached RINs and retaining the RINs after selling or blending the renewable fuel, by purchasing separated RINs on the RIN spot market, or through contract arrangements. A merchant refiner's status does not mandate that the refiner purchase only separated RINs. Rather, all obligated parties can choose how and when to acquire RINs to comply with the RFS program. To the extent that merchant refiners choose—for economic or other reasons—to limit themselves to purchasing RINs on the market, that choice is their own, and not one required by EPA's rule. If merchant refiners believe that owning and operating blending operations would present a significant financial or strategic advantage, they may enter the marketplace in this capacity.

Conclusion

In this memo we have examined the RIN, renewable fuels, and transportation fuels marketplace. We have explored the question of the cause of elevated D6 RIN prices observed in 2013 and shown that the E10 blendwall was a significant factor in these rising RIN prices. Due to the complexity of the RIN market, we cannot precisely predict the future price of D6 RINs. We would not, however, expect the D6 RIN price to return to the prices experienced from 2010 to 2012 unless the cost of production of ethanol or other renewable fuels fell sufficiently below the cost of gasoline on an energy-equivalent basis.

We also examined data from 2013 and which suggested that rising RIN prices did not result in an increase in retail transportation fuel prices in 2013 (considering both gasoline and diesel together), due to the lower net cost of renewable fuels enabled by the high RIN prices. While higher RIN prices increase the cost of RFS compliance for obligated parties purchasing separated RINs, they are generally able to recover these costs in the price of their petroleum blendstocks. As a result, a slight decrease in the price of ethanol-gasoline blends, which contain a relatively large amount of renewable fuels, is expected to be offset by an increase in the price of diesel fuel, which generally contains lower levels of renewable fuel. This does not necessarily mean that there is no cost to increasing the volume of renewable fuels required to be blended into the transportation fuel pool. If renewable fuels cost more on an energy-equivalent basis than the petroleum fuels they displace, as they did in 2013, there is a cost to using these renewable fuels. The higher the required volume of these fuels, the higher this cost will be. As a result, blending

increasing volumes of renewable fuels likely increased the total cost of transportation fuel in the United States in 2013, relative to a scenario where there was not mandate for renewable fuels.

Finally we examined how merchant refiners and integrated refiners were impacted by high RIN prices. The available data suggests that while there may be some variation in how high RIN prices impact individual obligated parties due to differing business decisions, RIN acquisition strategies, and many other factors, the structure of the RFS program does not cause a systematic competitive advantage for one type of refiner or the other. The RIN, renewable fuel, and transportation fuel market is complex, and there are limitations to the available data. EPA will continue to monitor market prices and impacts over time in an attempt to better understand the dynamics and watch for signs of market disruption. Based on available data, however, the RIN market seems to be functioning generally as expected; providing an incentive for the continued growth of renewable fuels in the transportation fuel market without causing overall increases to the retail price of transportation fuel.

To: Tracy A. Nagelbush[tan@vnf.com]
From: Hengst, Benjamin
Sent: Mon 9/22/2014 4:55:45 PM
Subject: RE: Gilbarco Veeder-Root

Hi Tracy—we still on for today at 3?

From: Tracy A. Nagelbush [mailto:tan@vnf.com]
Sent: Friday, September 05, 2014 3:10 PM
To: Hengst, Benjamin
Subject: RE: Gilbarco Veeder-Root

I will take it! Thanks!

Tracy Nagelbush | Senior Director, Governmental Issues

VanNess

Feldman LLP

1050 Thomas Jefferson Street, NW

Washington, DC 20007

T: (202) 298-1937 | C: (202) 258-5871 | tan@vnf.com | vnf.com

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From: Hengst, Benjamin [mailto:Hengst.Benjamin@epa.gov]
Sent: Friday, September 05, 2014 3:04 PM
To: Tracy A. Nagelbush
Subject: Re: Gilbarco Veeder-Root

Sure. How about 3pm on the 22nd.

From: Tracy A. Nagelbush

Sent: Friday, September 5, 2014 1:53 PM

To: Hengst, Benjamin

Subject: RE: Gilbarco Veeder-Root

Ben,

My client has been called to Dallas on the 15th. Are you and your team available on the 22nd? We are available between 11 and 430 pm.

Apologies for the scheduling snafu!

Many thanks,

Tracy

Tracy Nagelbush | Senior Director, Governmental Issues

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From: Hengst, Benjamin [mailto:Hengst.Benjamin@epa.gov]
Sent: Friday, August 29, 2014 1:27 PM
To: Tracy A. Nagelbush
Subject: RE: Gilbarco Veeder-Root

How about the 15th at 3pm?

From: Tracy A. Nagelbush [mailto:tan@vnf.com]
Sent: Friday, August 29, 2014 11:03 AM
To: Hengst, Benjamin
Subject: RE: Gilbarco Veeder-Root

Hey Ben,

I am just checking in to see if you've had any luck with the schedule. My client is working on booking his trip and we just want to hear from you which date might be better.

Many thanks!
Tracy

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From: Hengst, Benjamin [mailto:Hengst.Benjamin@epa.gov]
Sent: Wednesday, August 27, 2014 9:07 PM
To: Tracy A. Nagelbush
Subject: RE: Gilbarco Veeder-Root

Hey Tracey -- let me check in with the team on timing and get back to you. Good seeing you, too. Ben

---

From: Tracy A. Nagelbush <tan@vnf.com>
Sent: Tuesday, August 26, 2014 1:52 PM
To: Hengst, Benjamin
Subject: Gilbarco Veeder-Root

Ben,

It was so nice to see you a few weeks ago with Puget. I hope you found their story not just impressive but also useful!

I have another client I would like to bring it to meet with you – this time the topic is dead center of your wheelhouse.

You may know Gilbarco Veeder-Root (GVR), a North Carolina based company that is the leading manufacturer of fuel dispensing equipment in the country. They currently hold 85% of

the market domestically and approximately 50% globally. They are fuel agnostic and have dispensers necessary for all kinds of fuels including blender pumps as well as EV, LNG and CNG systems. GVR is also the leading manufacturer of air and water quality monitoring systems in the US.

We have been making the rounds on the Hill and agencies for quite some time. We haven't really gotten into the RFS conversation but I think that now is the time.

Are you available on September 15th or 16th? Our schedule is currently wide open on those two days so let me know what works best for you.

Many thanks!

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To: Tracy A. Nagelbush[tan@vnf.com]
From: Hengst, Benjamin
Sent: Fri 9/5/2014 7:03:55 PM
Subject: Re: Gilbarco Veeder-Root

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To: bavant@tamu.edu[bavant@tamu.edu]
Cc: Sharyn Lie (Lie.Sharyn@epa.gov)[Lie.Sharyn@epa.gov]; Bunker, Byron[bunker.byron@epa.gov]; Powers, Tom[Powers.Tom@epa.gov]
From: Hengst, Benjamin
Sent: Thur 9/4/2014 7:43:18 PM
Subject: FW: RSF2 Energy Cane Revisions

Hi Bob--

Tom Powers here at EPA passed your message along to me. I, along with my colleagues Sharyn Lie and Byron Bunker, work in the Office of Transportation and Air Quality, which implements the RFS program.

The first point of contact for you on this topic is Sharyn (copied). I'll leave it to both of you from here for next steps.

Thanks,
Ben Hengst

-----Original Message-----
From: Bob Avant [mailto:bavant@tamu.edu]
Sent: Wednesday, August 27, 2014 4:48 PM
To: Powers, Tom
Subject: RSF2 Energy Cane Revisions

Tom,

It was good to see you last week at the AAQTF mtg in College Station. A bioenergy issue has been brought to my attention regarding revisions to RFS2. The new rule states that to qualify for RINS, energy cane must have a minimum composition of 75% cellulose, hemicellulose, and lignin. Texas A&M has one of the leading energycane development programs in the country under contract to both Chevron and BP. After checking with our key scientists and administrators, no one from EPA consulted us for input prior to drafting. There are a number to general concerns on the rationale for setting the 75% level, on technical concerns on how the 75% will be calculated, and on how compliance can be assured and demonstrated. (Numerous different varieties have been developed over the last seven years with different intended compositions that perform significantly depending on agronomic practices and locations.)

We are very concerned that this could significantly restrict the production on a leading lignocellulosic feedstock. We are not necessarily proposing to re-open the rule, but we think we could provide some significant assistance on implementation so there is not an unintended consequence limiting a biofuel feedstock with great potential.

Could you put me in contact with the EPA Lead in this area?

Thanks Much

Sent from my iPad

To: Fialkov, David[dfialkov@steptoe.com]
From: Hengst, Benjamin
Sent: Thur 9/4/2014 7:38:14 PM
Subject: RE: Follow up

Hi David—just left you a voicemail. Thanks, Ben

From: Fialkov, David [mailto:dfialkov@steptoe.com]
Sent: Friday, August 22, 2014 11:18 AM
To: Hengst, Benjamin
Cc: Argyropoulos, Paul
Subject: RE: Follow up

Good morning –

I saw that EPA sent the RFS rule to OMB. Do you think it would be worth our going over there to meet with them and have a similar discussion as we had a few weeks back w/ AJ from Racetrac? If so, who do you suggest we reach out to? In the past it's been Chad Whiteman but I don't know if you think there's someone better.

Also, is there still any interest on your end in meeting w/ AJ and perhaps Ms. McCabe to discuss retail sales of mid- and high-level ethanol blends?

Thanks as always for all you do.

Best,

David

From: Fialkov, David
Sent: Thursday, July 17, 2014 11:14 AM
To: 'Hengst, Benjamin'
Cc: Argyropoulos, Paul

Subject: RE: Follow up

Thank you both very much for meeting yesterday, and please extend my gratitude to Mr. Grundler as well. Regarding the Atlanta issue, I believe (though haven't spoken w/ him to confirm) that AJ was referring to RVP issues in Atlanta, not RFG (which below decision deals with).

I very much hope you found our conversation helpful and productive. Just to let you know, we are likely going to be sending a note to the Board of both NACS and SIGMA encouraging folks to inform their ethanol supplier that ethanol interests in D.C. are encouraging policymakers to change the definition of "obligated parties" to cover blenders. We will further encourage them to articulate to their supplier that such efforts are counterproductive and explain what the consequences would be in terms of how companies that currently blend would likely respond. Please let me know if you're uncomfortable with this or think it is unwise. (Along those lines I have attached to this document our letter to EPA opposing the Monroe Energy petition.)

I've also attached a letter that NACS and SIGMA sent to John Podesta last week regarding E85 sales. We have not heard back from the White House on this, but hope to be able to have this discussion with them in the near future. We also would be happy to have a similar discussion with anyone else in the Administration or @ EPA you think is appropriate.

Thanks for all you do. Let me know if I can be of any further help to you.

-David

From: Hengst, Benjamin [mailto:Hengst.Benjamin@epa.gov]
Sent: Wednesday, July 16, 2014 5:09 PM
To: Fialkov, David
Cc: Argyropoulos, Paul
Subject: Follow up

David—good talking to you today.

Here's the Atlanta decision I recalled. Not sure if this is the Atlanta rule that came up? Please pass along:

http://www.gpo.gov/fdsys/pkg/FR-2014-03-14/pdf/2014-05697.pdf

To: Tracy A. Nagelbush[tan@vnf.com]
From: Hengst, Benjamin
Sent: Fri 8/29/2014 5:26:34 PM
Subject: RE: Gilbarco Veeder-Root

How about the 15th at 3pm?

From: Tracy A. Nagelbush [mailto:tan@vnf.com]
Sent: Friday, August 29, 2014 11:03 AM
To: Hengst, Benjamin
Subject: RE: Gilbarco Veeder-Root

Hey Ben,

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From: Hengst, Benjamin [mailto:Hengst.Benjamin@epa.gov]
Sent: Wednesday, August 27, 2014 9:07 PM
To: Tracy A. Nagelbush
Subject: RE: Gilbarco Veeder-Root

Hey Tracey -- let me check in with the team on timing and get back to you. Good seeing you, too. Ben

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From: Tracy A. Nagelbush <tan@vnf.com>
Sent: Tuesday, August 26, 2014 1:52 PM
To: Hengst, Benjamin
Subject: Gilbarco Veeder-Root

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To: Tracy A. Nagelbush[tan@vnf.com]
From: Hengst, Benjamin
Sent: Thur 8/28/2014 1:07:21 AM
Subject: RE: Gilbarco Veeder-Root

Sorry I think I just misspelled your name -- I have a colleague that's Tracey with an "e" so I'm used to that!

From: Tracy A. Nagelbush <tan@vnf.com>
Sent: Tuesday, August 26, 2014 1:52 PM
To: Hengst, Benjamin
Subject: Gilbarco Veeder-Root

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To: Tracy A. Nagelbush[tan@vnf.com]
From: Hengst, Benjamin
Sent: Thur 8/28/2014 1:06:42 AM
Subject: RE: Gilbarco Veeder-Root

Hey Tracey -- let me check in with the team on timing and get back to you. Good seeing you, too. Ben

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From: Tracy A. Nagelbush <tan@vnf.com>
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Ben,

It was so nice to see you a few weeks ago with Puget. I hope you found their story not just impressive but also useful!

I have another client I would like to bring it to meet with you – this time the topic is dead center of your wheelhouse.

You may know Gilbarco Veeder-Root (GVR), a North Carolina based company that is the leading manufacturer of fuel dispensing equipment in the country. They currently hold 85% of the market domestically and approximately 50% globally. They are fuel agnostic and have dispensers necessary for all kinds of fuels including blender pumps as well as EV, LNG and CNG systems. GVR is also the leading manufacturer of air and water quality monitoring systems in the US.

We have been making the rounds on the Hill and agencies for quite some time. We haven't really gotten into the RFS conversation but I think that now is the time.

Are you available on September 15th or 16th? Our schedule is currently wide open on those two days so let me know what works best for you.

Many thanks!

Tracy Nagelbush | Senior Director, Governmental Issues

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To: Fialkov, David[dfialkov@steptoe.com]
From: Hengst, Benjamin
Sent: Tue 7/8/2014 2:30:45 AM
Subject: RE: NACS Follow-Up

Can you talk at 4pm tomorrow?

From: Fialkov, David <dfialkov@steptoe.com>
Sent: Monday, July 7, 2014 3:45 PM
To: Hengst, Benjamin
Subject: RE: NACS Follow-Up

Ben – Got your voicemail and left you one earlier today. SIGMA (a trade association with similar membership to NACS) has a fly-in next week, and I would like to schedule some agency meetings for folks. If you are able to discuss this either this afternoon or tomorrow at some point, I'd be very grateful. Thanks as always for all you do,

Dave

From: Fialkov, David
Sent: Friday, June 27, 2014 2:48 PM
To: 'hengst.benjamin@epa.gov'
Subject: NACS Follow-Up

Ben –

It was very nice meeting you on Wednesday. Thank you for taking the time to meet with me and several members of the NACS Legislative Committee. You noted during our meeting that it would be good to meet with other agencies to discuss RFS issues going forward. If it's not too much trouble, would you please pass along any contacts you have in other agencies (USTR, Department of State, DOE, AG USDA) with whom you think we should meet? I think it's a great idea and something we intend to do the next time our folks come into town.

Thanks again, hope to stay in touch. Have a great weekend,

Dave

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To: Cat Campbell[catcampbell03@gmail.com]
From: Hengst, Benjamin
Sent: Mon 6/16/2014 12:19:17 PM
Subject: Ack!!!!!

The Administrator just scheduled an RFS meeting at 5:15!!!!!!!!!!!!!!!

To: Cat Campbell[catcampbell03@gmail.com]
From: Hengst, Benjamin
Sent: Thur 5/15/2014 12:40:45 AM
Subject: Fw: Questions on small refinery exemptions from HEC majority

[redacted]

Okay, this now officially appears to be a "thing", as folks on the Senate side are asking as well. It sounds like we're going to need to do at least one phone call. Let me know who should be represented from our side, and I'll scout out times.

Thanks, Venu

Hope you are doing well. Quick question for you. I understand that there are a number (I believe 8?) applications for hardship waivers under RFS, which is for small business refineries where the impact of the ethanol mandate is a material cause of economic loss.

I have heard some concerns about the amount of time EPA is taking to provide a response to those applications. 40 CFR 80.1411(e)(2), the authority under which such applications are permitted, provides that the Administrator shall have 90 days after receipt of the petition to act.

If you have a chance, I would like to chat for a few minutes about this process – specifically, the cause of the delay beyond the 90 day period, the level of communication EPA has had with these applicants, and what the timeline is for a decision on the applications that are pending beyond the 90 day period (and for those within the 90 day period, if it is expected by EPA that a decision will not be made within the window).

I hope this makes sense! Perhaps we could chat sometime this week or next?

Thanks,

Benjamin L. Thomas
Senior Advisor and Counsel
Office of US Senator John Walsh
Senate Hart 511
202-224-2651

From: Ghanta, Venu
Sent: Wednesday, May 14, 2014 2:22 PM
To: Manners, Mary; Weihrauch, John; Bunker, Byron

Subject: Questions on small refinery exemptions from HEC majority

Ben Lieberman from the House Energy and Commerce committee left a voicemail with the following questions. I leave it to you as to whether to answer these questions in writing or via conference call.

1) What are the reasons for EPA's delays in acting on RFS small refiner hardship exemptions?

2) When do you anticipate issuing the decisions?