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Comments to the California Air Resources Board

On Whitepaper Outlines Discussed During the June 30th & July 1st Advisory Panel Meeting

July 15, 2011

The Biotechnology Industry Organization (BIO) appreciates the opportunity to submit comments on the draft outlines discussed during the most recent California Air Resources Board (CARB) Low Carbon Fuel Standard (LCFS) Review Advisory Panel meeting, which took place in Sacramento, California on June 30, 2011 and July 1, 2011. As described in its comments below, BIO and its members believe that there are policy elements of certain federal programs that are effective to achieve the policy goal of supporting investment in renewable low carbon fuels. BIO urges CARB to consider the beneficial elements of these policies as it evaluates how to best strengthen the LCFS as a driver of investment in low carbon fuels.

BIO is the world's largest biotechnology organization with more than 1,100 member companies worldwide. Among its membership, BIO represents over 85 leading technology companies in the production of conventional and advanced biofuels and other sustainable solutions to energy and climate change challenges. BIO also represents the leaders in developing new crop technologies for food, feed, fiber, and fuel.

Supply and Availability Outline

This outline and the discussion of it included debate about the effectiveness of the federal Renewable Fuel Standard (RFS) as a driver of investment in biofuels—especially cellulosic biofuels—which will lead to increased production and availability of biofuels to help meet the LCFS. BIO has recently published a white paper on this very topic (see attached). As presented in its white paper, BIO has concluded that the federal RFS and the U.S. Environmental Protection Agency's (EPA) consistent implementation of the policy is the fundamental policy driver of investment in and production of U.S. biofuels because it provides the long-term stable policy signal demanded by biofuels producers and investors.

The technology for advanced and cellulosic biofuels is ready and has been demonstrated at pilot and demonstration scales by numerous companies representing multiple technologies. However, commercialization has been slowed by the economic downturn and its accompanying lack of financing. Stability of policy, therefore, is crucial for the industry's pathway to commercialization. In fact, the RFS law passed by Congress anticipated a potential shortfall in commercialization of cellulosic biofuels and accordingly set up an appropriate waiver system in the event an economic downturn or some other factor delayed commercial timelines.

The Cellulosic Waiver Credit (CWC) is calculated under a clear, transparent statutory formula, and EPA announces every November the CWC price for the following compliance year, which in turn provides market certainty. The CWC provides obligated parties several calculable ways to comply with the overall RFS. In keeping with market realities, obligated parties are expected to choose the lowest cost option for compliance. Importantly, because the price of the CWC will be announced prior to the compliance year, biofuel producers, investors, and obligated parties can calculate the price point cellulosic biofuels will have to meet to be competitive.

As the BIO RFS white paper explains, the price of cellulosic biofuel is the price of the lowest cost advanced biofuel plus the price of the CWC. If cellulosic biofuel producers can meet the optimum price point—which will fall somewhere between the high cost of oil and the relatively low cost of conventional biofuels—then cellulosic biofuels are expected to be attractive to obligated parties to comply with the RFS. The compliance value for cellulosic biofuels is a calculable premium, inversely related to oil prices.

With regard to annual Renewable Volume Obligations (RVOs) under the RFS, the EPA has kept annual levels of both conventional and advanced biofuels at the levels mandated under the RFS law. EPA has clarified that the CWC will not eliminate the obligation to blend advanced biofuels, which means any waived cellulosic biofuel volumes are re-designated as "other advanced." ***Thus, the shortfall in cellulosic biofuel production has not impacted the overall mandated level of advanced biofuels.***

As mentioned above, EPA's consistent maintenance of the levels of advanced biofuels mandated under the RFS law provides the fundamental signal to the financial markets of a growing market for advanced and cellulosic biofuels. BIO has conducted its own research and has concluded that sufficient advanced biofuels will be available on the market to meet the advanced biofuels volumes mandated under the RFS.

Technology Assessment Outline

This outline covers the ultralow carbon fuels topic. BIO Member companies are developing ultralow carbon fuel technologies such as cellulosic and advanced biofuels. LCFS policies aim to encourage the technologies that BIO member companies are commercializing today. BIO agrees with some of the panelists who made the point that the LCFS has not sent a clear market signal to encourage investors in these emerging technologies. Further, the policy has not provided obligated parties certainty that they will be able to meet their obligations especially in later years of the program as the requirements increase.

Inherent complexities of the LCFS system make it difficult to interpret the market (supply or demand) for LCFS credits or forecast future value of LCFS credits and relative value of carbon intensity (CI) differentials among various fuel options. As a result, carbon premiums from the LCFS are much less likely to be included in investment decisions currently being made. Investors making decisions right now on projects that could supply California with ultralow carbon fuels in the next several years need assurance that LCFS compliance will provide quantifiable value to their investments. BIO believes policy measures—like the RFS discussed

above—that send more direct and simple signals to the market would help spur investment in renewable fuels in California.

The ultralow carbon fuels topic whitepaper should evaluate mechanisms for ensuring direct market signal to both strategic and financial investors. The following are two examples of potential mechanisms:

(A) Buy-out mechanism for alternate compliance (like the CWC under the federal RFS) to set a quantifiable target or range for the value of compliance (e.g. a price floor and/or price ceiling for CI improvements). Such a mechanism could provide a measure of certainty to investors in these innovative technologies; and,

(B) Allow investors in ultralow carbon fuel projects to earn compliance credits directly with their investments in projects that produce fuel that will ultimately earn compliance. For example, every dollar invested in a qualifying project that will produce an ultralow carbon fuel could earn compliance credit when it is invested rather than when that fuel is used for compliance. Such a system has the potential to encourage investment in ultralow carbon fuels while at the same time providing a more certain mechanism for compliance for obligated parties.

Conclusion

Thank you for the opportunity to submit these comments on the draft whitepaper outlines discussed during the most recent CARB LCFS Review Advisory Panel meeting. This work is very important to the future of the biofuels industry in California and throughout the country, and BIO would like to serve as a resource as the whitepapers—particularly those on the topics of Supply and Availability and Technology Assessment—are drafted.

Sincerely,

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The Value Proposition for Cellulosic and Advanced Biofuels Under the Federal Renewable Fuel Standard

Executive Summary

This paper demonstrates that the federal Renewable Fuel Standard ("RFS")—established under the Energy Policy Act of 2005, enhanced pursuant to the Energy Independence and Security Act of 2007 ("EISA"), and enforced by the Environmental Protection Agency ("EPA")— provides considerable market motivation to drive investment in cellulosic and advanced biofuels.

The RFS forms the basis for U.S. low carbon fuels policy at the federal level, requiring the blending of up to 36 billion gallons of biofuels by 2022– more than twice current biofuel use. Recognizing that deployment of cellulosic and other advanced biofuels is essential to meeting the nation's energy security, economic development, and greenhouse gas reduction objectives, the RFS provides a transparent program to speed the deployment of these innovative products into U.S. fuel markets.

Renewable volume obligations ("RVOs") under the RFS ensure that all renewable fuels produced up to annually prescribed volumes will have a market. EPA has demonstrated in its 2010 and 2011 rulemaking its intention to fully enforce both advanced and overall volumes under the RFS. For cellulosic biofuels, EPA has adjusted cellulosic RVOs annually, as required, to reflect current market supply realities. In so doing, EPA does not dilute RFS obligations, but simply provides notice of the projected achievable volume of cellulosic biofuels – all of which must be blended into the fuel supply. This mechanism ensures that there will be a market for all cellulosic biofuel produced up to the volumes prescribed in statute.

To accommodate uncertainty in the timeline of deployment for cellulosic biofuels, the RFS provided obligated parties with flexibility in complying with cellulosic volume requirements. To satisfy their compliance obligations, obligated parties can either buy a gallon of cellulosic biofuel or purchase some combination of fuels—including advanced biofuels— and EPA waiver credits. The cellulosic waiver credit mechanism establishes a counter-cyclical compliance value for cellulosic biofuels that increases as petroleum price decreases, providing a significant degree of price certainty and, thus, considerable market motivation for investment in cellulosic biofuels. To the extent each option is dependent on the other, or can draw upon long-term pricing models for commercial fuels markets and supplies, the relative value and return on investment of physical gallons of cellulosic biofuels over the life of the RFS can be reasonably quantified.

This paper finds the RFS to be an effective mechanism in providing market motivation for investment in advanced and cellulosic biofuels. Continued federal investment in the construction of first-of-a-kind commercial advanced and cellulosic biorefineries is needed to overcome initial

scale-up risk. Thereafter, the RFS will rapidly accelerate deployment of advanced and cellulosic volumes, significantly reducing U.S. dependence on imported petroleum.

The Value Proposition for Cellulosic and Advanced Biofuels Under the Federal Renewable Fuel Standard

The enactment of the Renewable Fuel Standard ("RFS") in 2005 and its extension in 2007 ("RFS2") are critical elements in the demand for biofuels and play an important role in determining the value of renewable fuels. The value of cellulosic and advanced biofuels under the RFS2 is determined by both the price of the commodity fuel and its value in meeting the RFS2 requirements for obligated parties. This paper discusses the compliance mechanisms under RFS2 and their impact in determining the value of—and thus future demand for—cellulosic and advanced biofuels.

RFS Compliance Value

For the first time in U.S. history, the RFS created a federal program requiring the use of 7.5 billion gallons of biofuels by 2012. In 2007, Congress passed the Energy Independence and Security Act (EISA), which extended and increased the RFS requirement to 36 billion gallons by 2022, and included specific, nested requirements for cellulosic and advanced biofuels. Given uncertainty around the availability of cellulosic biofuels, Congress required EPA annually to adjust volume targets for cellulosic biofuels to reflect achievable production. The law also set a pricing mechanism for compliance with the cellulosic biofuels requirement. In 2010, EPA released its final administrative rules for implementation of the RFS2 program ("EPA's final rules"), which defined eligible renewable fuels and compliance values based on greenhouse gas ("GHG") emissions. It further clarified the treatment of the nested requirements. Figures 1 and 2 below outline the specific volume requirements in the RFS2 as well as qualifying fuels.

Figure 1 – RFS2 Volume Requirements

	Total Renewable Fuel =	Total Advanced +				Conventional Renewable Fuels
		Total Advanced =	Cellulosic +	Biomass-based Diesel +	Other Advanced	
		Advanced biofuel nested standards				
Year	Total Renewable Fuel	Advanced biofuel	Cellulosic biofuel	Biomass-based diesel	Other advanced	Conventional biofuel (maximum)
2009	11.1	0.6	0	0.5	0.1	10.5
2010	12.95	0.95	0.1	0.65	0.2	12
2011	13.95	1.35	0.25	0.8	0.3	12.6
2012	15.2	2	0.5	1	0.5	13.2
2013	16.55	2.75	1	1	0.75	13.8
2014	18.15	3.75	1.75	1	1	14.4
2015	20.5	5.5	3	1	1.5	15
2016	22.25	7.25	4.25	1	2	15
2017	24	9	5.5	1	2.5	15
2018	26	11	7	1	3	15
2019	28	13	8.5	1	3.5	15
2020	30	15	10.5	1	3.5	15
2021	33	18	13.5	1	3.5	15
2022	36	21	16	1	4	15

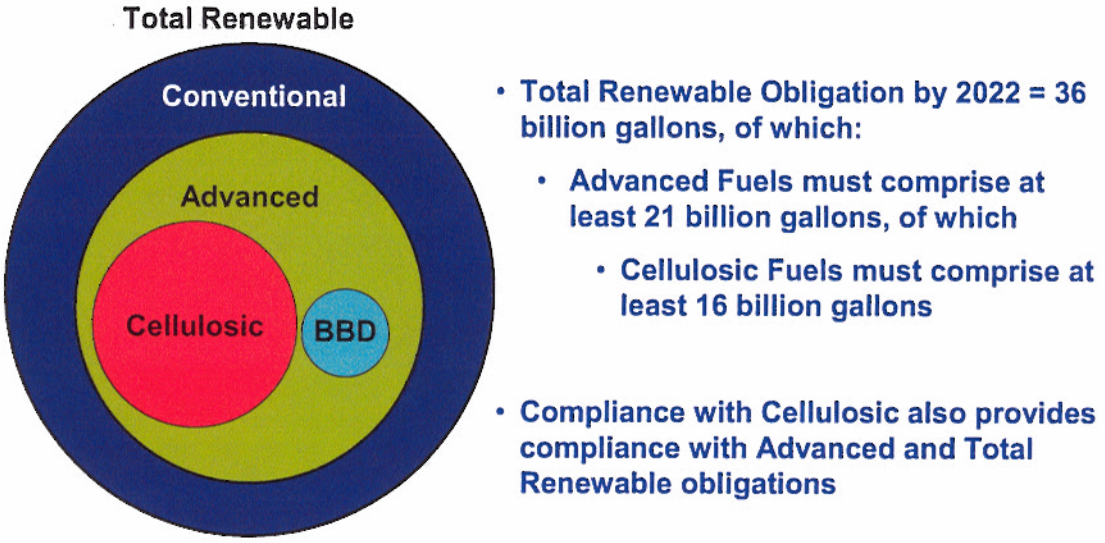
Figure 2 – Eligible Biofuels for RFS2

RFS2 designation	GHG reduction	Qualifying renewable fuel
Advanced	50%	Any renewable biofuel, other than corn starch ethanol, that meets 50% GHG reduction (includes sugarcane-based ethanol)
Cellulosic	60%	Biofuel, including diesel, derived from cellulosic biomass
Biomass-based Diesel	50%	Fatty methyl ester or hydrogenated biodiesel from any fat or oil, including algal oils
Conventional	20%*	Corn starch based ethanol

*Facilities where construction began before Dec. 2007 and is completed by June 2011 do not have to meet this GHG reduction threshold.

Figure 3 below depicts the nested nature of the RFS2 requirements. Compliance with the Cellulosic requirement also provides compliance with the Advanced and the Total requirements. Similarly, compliance with the Biomass-Based Diesel requirement also provides compliance with the Advanced and Total requirements. These categories therefore will have the highest value from a compliance standpoint. In fact, cellulosic diesel, which can qualify for either the Cellulosic or the Biomass-Based Diesel ("BBD") requirements, should have the highest compliance value since it satisfies all requirements.

Figure 3 – RFS2 Nested Requirements



The following are defined terms under EPA's final rules clarifying key elements in the process to achieve compliance with the renewable fuel volume requirements under the RFS:

- Obligated Parties – Gasoline and diesel fuel producers and importers in the United States.
- Renewable Volume Obligation ("RVO") - Annually defined as the number of Renewable Identification Numbers each Obligated Party must possess to meet the volumetric requirements of RFS (calculated as percentages of conventional and advanced renewable fuels required to be included in each Obligated Party's sales).
- Renewable Identification Number ("RIN") – EPA tracking mechanism for RVO compliance.
    - The RIN is created and attached to each gallon of renewable fuel produced. It follows the gallon through blending, unless separated prior to blending by an Obligated Party.
    - RINs are reported to EPA annually for compliance and can be tracked daily through the EPA Moderated Tracking System (EMTS).
    - To help Obligated Parties achieve their RVOs, RINs may be separated from physical gallons and sold after blending (or by Obligated Parties prior to blending).

- Cellulosic Waiver Credit (CWC) – Credits available for purchase from the EPA to satisfy a shortfall in RINs needed for the cellulosic RVO.
    - The CWC price is set annually at the higher of $3.00 less the average wholesale price of gasoline for the preceding 12 months or $0.25 per gallon adjusted for inflation (2008 base per EISA).
    - Can only be used to satisfy current year cellulosic RVO; cannot be banked for future use, cannot satisfy compliance obligation carried over from previous year, cannot be sold or transferred.
    - Number of credits issued by EPA for the marketplace is equal to total cellulosic RVOs for current year.
- Equivalence Values (EVs) – Adjustments to account for differing energy content and efficiency of different biofuels; determines number of RINs per gallon of production.
    - Ethanol = 1
    - Butanol = 1.3
    - Biodiesel = 1.5 or 1.7 (depending on production method).

Cellulosic Requirement

The cellulosic compliance mechanism in RFS2 constitutes a true and enforceable requirement on Obligated Parties to blend all available cellulosic biofuels, up to the volumes prescribed in Figure 1 above. As required by EISA's cellulosic waiver mechanism, EPA annually has adjusted prospective year cellulosic volumes to the projected production level, determined by surveying producers prior to each compliance year. In so doing, EPA does not dilute RFS2 obligations. It simply provides notice to Obligated Parties of the projected achievable volume of cellulosic biofuels – all of which **must** be blended into the fuel supply. **This volume requirement ensures that there will be a market for all cellulosic biofuel produced up to the prescribed volumes.**

EPA Enforcement Is Key

EPA's continued enforcement of the RFS2 is crucial to compliance with the volume requirements. While EISA obliges EPA to waive the cellulosic requirement to achievable production levels, *EPA does not have a waiver obligation for the advanced or total renewable fuel requirements.* EPA has asserted that it has the authority to waive the advanced and overall requirements by the same amount as the waiver of the cellulosic portion, but will not do so as long as it envisions sufficient supply of advanced biofuels. Furthermore, since 2005 EPA has been consistent in its commitment to enforcing the renewable fuels requirements set by Congress.

EPA has continued that tradition in its rule making. In setting annual volumes, EPA has explicitly stated its intention to provide an incentive for industry growth. In EPA's final rules for the 2011 RFS2 volumes, the Agency specifically noted:

> "We believe that the cellulosic biofuel standard should provide an incentive for the industry to grow according to the goals that Congress established through EISA. However, we also believe that the cellulosic biofuel standard that we set should be within the range of what can be attained based on projected domestic production and import potential. Any estimate we use to set the cellulosic biofuel standard for 2011 will have some uncertainty in terms of actual attainment, and the level of such uncertainty generally rises with the volume mandate. Our intention is to balance such uncertainty with the objective of providing an incentive for growth in the industry."[1]

In addition to EPA's commitment to enforcement, the effectiveness of the cellulosic and advanced requirements is further reinforced by several important considerations:

- The cellulosic requirement EPA sets is unlikely to fall below actual production levels for two main reasons: (1) Cellulosic producers will report their expected production volumes; and, (2) EPA thus far has taken great care to fully account for all potentially available cellulosic volumes and has signaled its intent to provide a market incentive. Furthermore, given that cellulosic biorefineries have long construction schedules, it is highly unlikely that any unanticipated production will come online in any given compliance year. So, even if EPA does adjust the cellulosic requirement, cellulosic biofuels are more likely to be in short supply than oversupply.

- EPA is unlikely to waive the advanced or total RFS2 requirements for at least the next few years. Sufficient biodiesel, sugarcane ethanol and other advanced biofuels are likely to remain available to satisfy the advanced volumes in the RFS2 schedule for the next several years given existing capacity in those industries. EPA has demonstrated in its 2010 and 2011 rulemakings that it is committed to enforcing these volumes. This means the total and advanced EISA volumetric requirements are likely to be maintained at congressionally directed levels. **Under this scenario, waived cellulosic volumes are re-designated into the "other advanced" category, expanding the requirement and opportunity for "other advanced" biofuels.**

- EPA will allow the purchase of a CWC to be used only for compliance with the current year's cellulosic requirement. This means a purchased CWC does not eliminate the obligation to blend a gallon of advanced biofuel, or purchase an advanced biofuel RIN (A-RIN).

- EPA will calculate the CWC price under a clear, statutory formula and will announce the price prior to each compliance year. This EPA CWC pricing structure provides for RIN market certainty and transparency for a cellulosic premium.

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[1] EPA, Preamble to 2011 Final Rule, November 23, 2010, page 13

- EPA has added transparency and efficiency to the various ways in which an Obligated Party may comply with the RFS ("compliance mechanisms") by instituting the EMTS (defined above), an electronic reporting system, to provide real-time information and tracking. This information and tracking thus provides Obligated Parties—and all industry participants—real-time views into the RIN supply/demand situation in the compliance markets.

Compliance Options

The compliance mechanisms available under the RFS2 afford Obligated Parties several options for compliance with the cellulosic requirement, as depicted in the example shown in Figure 4, below.

Figure 4 – Compliance Options for Cellulosic Requirement – Ethanol Example

	Advanced biofuel nested standards			Conventional biofuel	Alternative compliance from EPA
	Advanced biofuel	Cellulosic biofuel	Biomass-based diesel		
RIN type	A-RIN	C-RIN	B-RIN*	R-RIN	CWC
Compliance options:	Gallon purchased (✓); RINs obtained (X)				
1 - Buy cellulosic ethanol gallons		✓ X			
2 - Buy advanced ethanol gallons & CWC	✓ X				X
3 - Buy biodiesel gallons & CWC*			✓ X		X
4 - Buy corn ethanol gallon; sell R-RIN & buy A-RIN and buy a CWC	X			✓	X

* Per Equivalence Values, biodiesel is worth 1.5 or 1.7 RINs. An average of 1.6 is assumed. This implies only 0.6 gallons of biodiesel provide an ethanol equivalent RIN. It also implies that a B-RIN/gal=1.6 A-RINs/gal.

In the case of cellulosic ethanol, to comply with the cellulosic requirement under RFS2, an Obligated Party has four options:[2]

1. Buy cellulosic ethanol (CE) gallons, which provides the fuel and cellulosic biofuel RINs (C-RINs);
2. Buy advanced biofuel (AE) gallons (which provides the fuel and A-RINs) ***and*** purchase a CWC from EPA;

[2] Technically, an obligated party has a fifth option which is to carry over the obligation for one year. However, CWCs cannot be used to meet carry over obligations, only C-RINs. This would increase the demand and price of C-RINs in future years. Since this is a higher cost option, and is complicated by inter-temporal elements, it has been omitted from the above example.

3. Buy biodiesel (BD) gallons (which provides the fuel and biodiesel RINs [B-RINs]) over the Biomass-Based Diesel requirement ***and*** purchase a CWC from EPA; or
4. Buy conventional (RE) biofuel gallons (which provides the fuel and renewable fuel RINs [R-RINs]) ***and*** sell the R-RINs and purchase A-RINs ***and*** purchase a CWC from EPA.

Note that since a gallon of biodiesel includes 1.6 RINs (average of 1.5 and 1.7 equivalence values assumed), the value of a B-RIN per gallon must be 1.6 ethanol A-RINs per gallon, and therefore *a B-RIN per gallon will always be higher than an A-RIN per gallon*. This fact means that an Obligated Party could obtain the required RINs with fewer gallons of biodiesel. Other fuels such as butanol also receive more RINs than ethanol due to their higher energy content. *Butanol's compliance value per gallon will be similarly higher in value than ethanol.*

Obligated Parties will seek to minimize their cost of compliance. Producers may therefore set their price up to the level at which Obligated Parties are indifferent between purchasing cellulosic fuel and complying with a CWC. Thus, the purchase price of cellulosic ethanol (option 1) must be equal to the least-cost option from among options 2-4[3]. As a result:

C-RIN = A-RIN + CWC

This relationship between the compliance values is important because it (1) establishes a known compliance premium for cellulosic biofuels in the form of the CWC formula price, and (2) allows an estimation of the value of cellulosic biofuels, inclusive of its C-RIN, by estimating the value of the marginal advanced biofuel equivalents. If we add the fuel value of ethanol to each side of this equation, for example, we come to a full value for cellulosic ethanol:

CE Value = AE Value + CWC

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[3] The price of each compliance option is outlined below:
Option 1: Cellulosic Ethanol (CE) = Naked Fuel (Fuel) + C-RIN
Option 2: Advanced Ethanol (AE) + CWC = Fuel + A-RIN + CWC
Option 3: Biodiesel (BD) + CWC = Fuel + B-RIN + CWC
Option 4: Renewable Ethanol (RE) + A-RIN – R-RIN + CWC = Fuel + R-RIN+A-RIN –R-RIN + CWC

Setting Option 1 to the minimum of options 2-4 leads to:
Fuel + C-RIN = Min (
Fuel + A-RIN + CWC
Fuel + B-RIN + CWC
Fuel + A-RIN +CWC)

Since B-RIN> A-RIN, and cancelling like terms from each side of the equation, we derive:
C-RIN = A-RIN + CWC

Adding fuel value ("Fuel") to each side of this equation we get:
Fuel + C-RIN = Fuel + A-RIN +CWC
CE = AE + CWC

The key to valuing cellulosic ethanol is in understanding the value of advanced ethanol, since the CWC price will be determined by a stated formula, and it will be announced ahead of the compliance year. Similar methodology may be applied to other fuel molecules, such as biobutanol. For the purposes of the following discussion, we will consider ethanol as a case study.

Advanced Biofuel Value

As is typical of commodities, biofuel prices are bound by the consumer's substitution value and the marginal cost to producers. Within these bounds, *the price of ethanol at any given point in time is determined by ethanol's relative supply/demand balance*. If there is excess supply, the price will tend to be closer to the marginal cost. If there is excess demand, the price will tend to be closer to the substitution value. The difference between the substitution value and the marginal cost represents the total margin that can be distributed between producers and consumers.

Gasoline Blend Value

The substitution value of biofuel is the price at which a blender becomes indifferent to using biofuel and is referred to as the Gasoline Blend Value ("GBV"). Since ethanol can be a substitute for gasoline, the GBV is determined by the price of gasoline, adjusted for mileage and blending properties such as octane value, the incentives that blenders obtain for using ethanol and the compliance value for meeting the RFS.

Ethanol can currently be utilized in vehicles in either a 10 percent blend in regular vehicles ("E10"), 15 percent blend in newer vehicles ("E15")[4], or up to an 85 percent blend ("E85") in flex fuel vehicles ("FFVs"). At E10 and E15, there is effectively no distinguishable mileage loss (compared to using 100 percent gasoline) and no corresponding impact on price. However E85 blends suffer a 25 percent mileage loss in the final blended fuel in typical flex fuel vehicles available today.[5] *An outlook on the prevailing blend of ethanol is important in determining the GBV*. Other biofuels, such as butanol, can be blended at higher percentages without a mileage loss.

Blenders of ethanol also receive the Volumetric Ethanol Excise Tax Credit ("VEETC")—also known as the "blender's credit"—established under the American Jobs Creation Act of 2004. This blender's credit replaced the Federal Ethanol Excise Tax Credit that had been in place since the 1970s and provides oil companies with an additional economic incentive to blend ethanol

[4] Note that this is not yet legal in commerce. Testing is done, approval for 2001 and newer light duty vehicles is authorized but commercial use is not legal until the fuel has passed EPA registration requirements and all conditions of the waiver have been met.

[5] The mileage loss is due to ethanol's lower energy content compared to gasoline. However, despite a 33 percent lower energy content, empirical mileage tests show average mileage for E85 vehicles to be only 20-25 percent lower than similar models with non-flex fuel engines.

with gasoline. As of January 1, 2009, the original blender's tax credit totaling 51 cents per gallon on pure ethanol was reduced to 45 cents per gallon pursuant to the Food, Conservation and Energy Act of 2008. VEETC is currently authorized through Dec. 31, 2011.

As discussed above, there is a compliance value that blenders also derive from using ethanol. In the past, when RFS volume requirements and demand for a replacement for methyl tertiary butyl ether ("MTBE") as an oxygenate exceeded industry production, a significant compliance premium was also associated for conventional ethanol. Given the corn ethanol industry's ability to quickly ramp up production, however, that compliance premium was short-lived. Today, conventional R-RINs are worth a few cents per gallon. In the case of advanced biofuels, the value of an A-RIN will be determined by similar market forces such that when advanced biofuels, including biodiesel, are plentiful A-RINs will have a lower value than when these fuels are scarce. If required volume demand is greater than available supply, then the A-RIN value will rise to incent additional supply of advanced biofuels. Since Brazilian sugarcane ethanol is also expected to earn compliance credits with California's Low Carbon Fuel Standard ("LCFS"), the A-RIN is likely to reflect the value of that compliance credit as well.

The value of advanced ethanol to a blender, or the GBV, therefore is the wholesale price of gasoline, adjusted for ethanol mileage loss, plus the blender's credit and A-RIN. This determines the expected ceiling for the advanced ethanol price.

Marginal Cost

The marginal cost ("MC") of ethanol is the cost of the marginal supplier, which for the advanced category is assumed to be imported sugarcane ethanol from Brazil. This cost will include production costs at expected exchange rates, reflective of prevailing sugar prices (which show correlation to crude oil prices), and an expectation for the cost of tariff and transport. This cost reflects the floor value for advanced ethanol prices.

Margin allocation

Historically, corn ethanol prices have fluctuated between the GBV and the MC depending on the relative supply and demand of ethanol. When the market is short ethanol, prices approach the GBV. When there is excess ethanol capacity—as there has been recently—prices approach the levels of the marginal producer's cash costs. The difference between the GBV ceiling and MC floor reflects the total margin pool available to producers and blenders. This margin pool will also cover broader supply chain costs and margins involved in the distribution of the product. The relative position of the spot price splits this margin between the blender and producer. Depending on the time period reviewed, this average margin split has fluctuated between as little as 20 percent blender share to as much as 90 percent blender share of the margin.

We expect that margins will continue to be split between blenders and producers in line with the expected supply/demand balance for ethanol. Given the growth of the advanced ethanol

requirement per the RFS2, and assuming blend wall concerns are overcome by deployment of E85 infrastructure and/or market adoption of biobutanol and other infrastructure compatible fuel molecules, we expect the sugarcane ethanol market will be in short supply beginning in 2015 . The U.S. Energy Information Administration projects that FFVs will make up more than 20 percent of U.S. auto sales by 2015 and maintain that market share through 2035, which will provide additional market for E85.[6] This additional market means that advanced ethanol is more likely to be valued closer to the GBV than the MC.

Mathematically then, the value of Advanced Ethanol is as follows:

AE value = GBV – (% Blender margin capture)*(GBV-MC)

Cellulosic Biofuel Value

Cellulosic ethanol prices can be projected by constructing a projection for Advanced Ethanol and adding to it the calculated CWC value. Advanced Ethanol prices can be projected by estimating the GBV and MC at expected oil prices per the formula discussed above, making assumptions about the relationship between crude oil, gasoline and sugar prices, as well as market factors such as blend levels and margin allocation. Similar methodology can be used for other cellulosic biofuels under development.

As discussed above, EPA will calculate the CWC based on the greater of $0.25 per gallon or $3 minus the average wholesale gasoline price for the previous 12 months, adjusted for inflation since 2008. For 2011, this CWC price was announced at $1.13/gallon.[7]

The CWC price in the future can also be projected based on an outlook for crude oil prices. A very important aspect of the CWC formula price is its inverse relationship to gasoline, and therefore crude oil prices. The figure below shows for a single year, 2014, the range of potential cellulosic ethanol values based on different crude oil prices. At low crude oil prices, the value of Advanced Ethanol is low since sugar and gasoline prices are low, however the value of the CWC approaches $3/gallon. Similarly, at high oil prices, the value of Advanced Ethanol is high, while the CWC provides a small additional premium to cellulosic ethanol. **This counter-cyclical compliance value provides a significant degree of price certainty for cellulosic ethanol and other cellulosic biofuels, substantially mitigating additional capital risk associated with commercialization of fuels from cellulosic feedstocks.**

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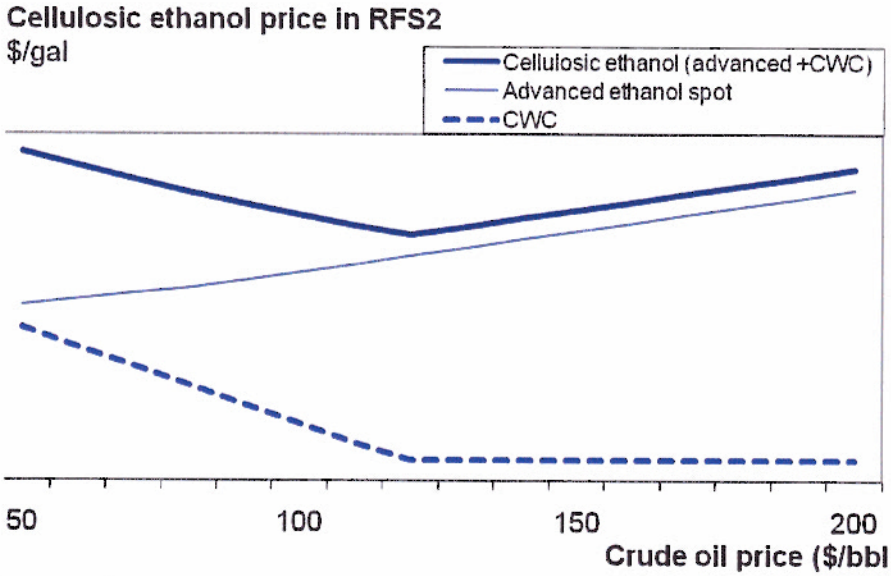
6 U.S. Energy Information Administration, "EIA projects rapid growth in unconventional vehicle sales," accessed Feb. 10, 2011. http://eia.gov/todayinenergy/detail.cfm?id=70.

[7] Per the final rule, EPA will use the trailing 12 month US Total Gasoline Bulk Sales (Price) by All Sellers reported by EIA and the latest month CPI-U index reported by BLS that is available by September 30 of the year prior to compliance.

Figure 5 - Cellulosic Ethanol and Crude Oil Prices



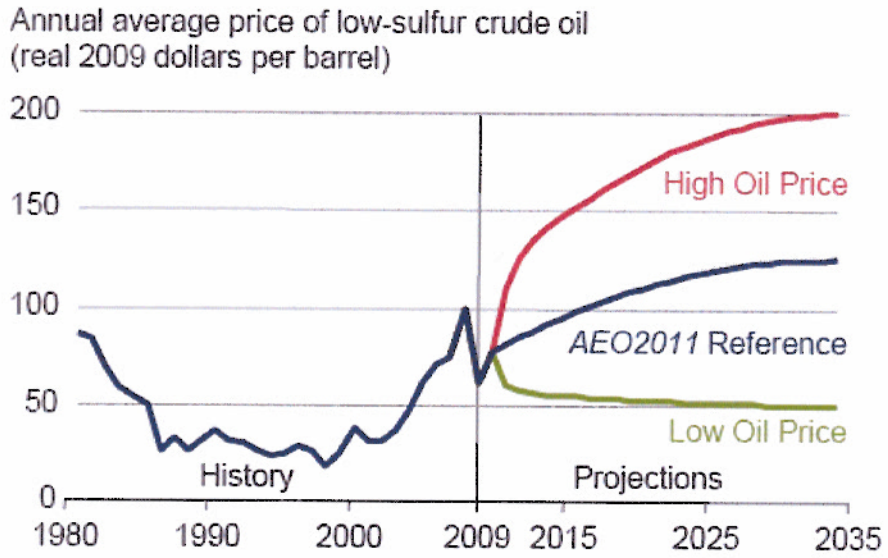
* Assumes 16 percent gasoline refining margin, A-RIN and blenders credit of $0.50/gal, a $0.54/gal tariff and 20% blender margin capture

Conclusion

The RFS2 requirement is a critical determinant of the demand for renewable fuels, providing both market assurance and value, particularly for cellulosic and advanced biofuels. For cellulosic biofuels, **the RFS2 requirements provide assurance that all cellulosic biofuel produced up to annually prescribed volumes will have a market.** The RFS2 compliance mechanisms promulgated by EPA also allow producers of innovative renewable fuels, such as advanced and cellulosic biofuels, to capture additional value for their products. **For cellulosic biofuels, RFS2 establishes a counter-cyclical compliance value that increases as petroleum price decreases, providing a significant degree of price certainty. The combination of market assurance and price certainty provides considerable market motivation for investment in cellulosic biofuels.**

Further, because of projected competition for tight supplies in worldwide oil markets, and given volatility in oil prices, cellulosic and advanced biofuels should be expected to offer a more certain return on investment. Crude oil prices are projected to continue an upward trajectory through 2035, according to the U.S. Energy Information Administration (EIA).
At the same time, progress in commercializing cellulosic and advanced biofuels and continued innovation in the industry will lead these fuels down the cost curve. Additionally, **because advanced biofuels will also be in a demand-driven market, they will also be well positioned to capture value between the high price of petroleum gasoline and low wholesale cost of conventional biofuels.**

Figure 6 – World Crude Oil Prices, 1980-2035



Source: Energy Information Administration, Annual Energy Outlook 2011 Early Release Overview, December 2010.

These findings indicate that the **RFS is an effective mechanism in providing market motivation for investment in advanced and cellulosic biofuels**. However, as the initial years of the RFS2 program have demonstrated, market requirements alone may not be sufficient to overcome initial scale-up risk associated with first-of-a-kind commercial facilities. **Continued federal investment in the construction of first-of-a-kind commercial advanced and cellulosic biorefineries is recommended to help overcome initial scale-up risk.** The U.S. Department of Energy ("DOE") Integrated Biorefinery Program at the Office of Biomass Programs, which provides grants to pilot and commercial demonstration biorefineries, and the U.S. Department of Agriculture ("USDA") Biorefinery Assistance Program, which provides loan guarantees to first-of-a-kind commercial biorefinery projects, will continue to play a critical role in overcoming initial scale-up risk. Thereafter, the RFS will rapidly accelerate deployment of advanced and cellulosic volumes, significantly reducing U.S. dependence on imported petroleum.

Further acceleration of commercial deployment of cellulosic biorefineries can be achieved through programs to speed grower adoption of purpose-grown energy crops. Continuation of establishment payments under the Biomass Crop Assistance Program is therefore also recommended.

The advanced biofuels industry, including many BIO members, is making progress in commercializing new cellulosic and advanced technologies. The RFS2 compliance options provide the type of long-term, market-based government policy mechanisms that will continue to drive innovation and cost reduction and ultimately enable the biofuels industry to achieve its promise of U.S. energy security, economic development and environmental sustainability.

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