Statement of James C. Collins, Jr.
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Regarding Domestic Renewable Fuels
before the
Committee on Environment and Public Works
United States Senate
December 11, 2013

Good morning Chairman Boxer, Ranking Member Vitter and Members of the Committee. My name is Jim Collins and I am the Senior Vice President for DuPont's Polymers and Industrial Biosciences businesses. I am pleased to be here today to discuss our progress on renewable fuels. My testimony will cover the significant investment that DuPont has made in biofuels and how these investments have made transformative contributions to our nation's energy security, reduced greenhouse gas emissions and strengthened rural economies. This technology represents a tremendous shift in how we energize our planet. It is real, it is happening today and it is due in large part to the Renewable Fuels Standard (RFS), visionary legislation enacted by Congress a few short years ago and a critical policy that must endure.

DuPont Biofuels

Our deep commitment to biofuels stretches across the country from our laboratories in California, to the corn fields of Iowa and reaching our headquarters in Delaware. Through our seed business, DuPont Pioneer, our scientists work with farmers every day to optimize corn production. As breeding continues to advance, we are able to produce more and more corn on the same acreage. This additional feedstock, coupled with more efficient corn ethanol plants and optimized enzymes, means we're doing more with less in first generation ethanol.

To increase ethanol output per unit of grain, DuPont transforms feedstock and production. First, and most importantly, we continue to improve harvestable yield per unit of inputs. We also select certain seeds for ethanol yield potential and offer over 180 High Total Fermentables hybrids. Drought tolerant corn seeds are a reality and DuPont Pioneer has great success in drought tolerance breeding. While last year's drought was terrible, grain production would have been much lower but for superior genetics produced by companies like ours. DuPont also produces enzymes to further improve digestability of the valuable feed byproduct from corn ethanol production. All these advances combined enable more predictable corn production to deliver increasingly more food, more feed and more fuel per acre.

In addition to our per acre advancements to add more food, feed, and fuel there is another important point that should not be missed. The Renewable Fuels Standard has successfully brought on line conventional ethanol refining capacity that fulfills the volumes expected under the statute. We strongly support these volumes being included in total blended fuel offered to American consumers but current law does not anticipate any further conventional ethanol capacity being built. This means that, to whatever extent biofuels policies have influenced grain

prices, with yield increases and improving refining efficiencies, the standard will have a diminishing impact on grain prices.

But that is only half the story. With more corn, comes more corn residue: more leaves and stalks and cobs that DuPont and others are harvesting and with which we are building the infrastructure necessary to commercialize cellulosic biofuels at scale.

DuPont began its research into cellulosic technology a decade ago. What started as a lab scouting project grew into a full scale commercialization effort. In2009 DuPont opened a demonstration facility in eastern Tennessee producing cellulosic ethanol from both corn stover and switchgrass. For the past four years in Iowa, we worked closely with farmers, equipment makers and academia on corn stover harvest trials to build and manage a cost effective cellulose supply chain. All this work culminated in the groundbreaking of a 30 million gallon per year facility one year ago in central Iowa, approximately 40 miles north of Des Moines. I am happy to report that the construction is progressing on track and the facility is scheduled to begin producing its first gallons of cellulosic ethanol in the second half of 2014. When you look at the complex challenge before us – this has actually gone incredibly fast. . We had to unlock the sugars trapped in cellulose, biochemically convert them into advanced liquid fuel and create an entirely new supply chain to deliver this raw material with the economics capable of competing with fossil fuels. DuPont has over 200 years of bringing scientific innovation to market. We've never delivered this type of disruptive innovation so fast.

And fortunately for the industry, we are not alone. In addition to the cellulosic volumes that DuPont will bring to market, a number of other companies will do the same. Multiple companies are constructing, starting up or operating facilities producing renewable fuels from a wide variety of cellulosic feedstocks, including corn stover, switchgrass, wheat straw, municipal solid waste and wood fiber. Many of these are large, well-capitalized, sophisticated companies with long track records in designing, constructing and operating manufacturing facilities. This diversity of operations virtually guarantees multiple technologies succeeding at commercial scale. As was seen for grain ethanol, we anticipate that cellulosic renewable fuel production will expand quite rapidly once technologies have been proven at commercial scale.

In addition to cellulosic ethanol, DuPont is pursuing the commercialization of another advanced renewable fuel with our partner BP in a 50/50 joint venture called Butamax™. The joint venture has developed and extensively tested biobutanol, a higher alcohol fuel produced much like ethanol. Biobutanol has excellent fuel properties and gives higher mileage than ethanol. It also reduces the volatility of fuel blends, and so can be used where summer air quality concerns persist. It can be distributed by existing gasoline infrastructure, including pipelines. Lastly, biobutanol is more compatible with existing equipment, including small engines and marine engines. Butamax is constructing the first phase of a retrofit of an ethanol plant in Lamberton, Minnesota which after a two phase construction process will be producing commercial scale biobutanol by 2015.

Biobutanol's properties create totally new opportunity in the entire fuel system. It can improve refining economics as butanol requires a fossil blendstock that is easier to make.

It overcomes what oil companies call "the blendwall": Simply put, a butanol gasoline blend meets E10 fuel specifications and is compatible with existing vehicles and infrastructure, but has twice the renewable energy content of E10. This can be achieved by retrofitting existing ethanol plants into biobutanol facilities.

Indeed, these are both tremendously exciting technologies coming online that will squarely put the U.S. in a leadership position in the global biofuels market. But Members of the Committee, if we stay the course, this technology is just the beginning. Here is where it gets truly exciting. Let me explain.

We start with biofuels. The technology to unlock the sugars in cellulose and the supply chains being developed to deliver those sugars at scale are enabling the commercial deployment of cellulosic ethanol today. Tomorrow, these same sugars and supply chains will be enabling a whole new world of bio-chemicals and materials, delivering on the promise of a truly bio-based economy.

Background on the RFS

Six years ago, the RFS set us on a path toward cheaper, more diverse and cleaner fuels. In the years since, the RFS has made homegrown renewable fuel 10 percent of our nation's gasoline supply, lowered greenhouse gas emissions by 33.4 million metric tons, added $500 billion in value to America's farmlands, lowered gas prices by $1.09 per gallon and created a real choice for consumers at the pump. DuPont, along with others, has led in that transition, investing hundreds of millions of dollars in reliable, environmentally responsible and homegrown feedstocks for fuel production. No other policy or technology has driven a more dramatic shift toward cleaner transportation than the RFS.

First generation biofuels have had a significant impact on an improved agriculture economy and also has increased farmer spending power. This translates into jobs – including additions at DuPont Pioneer, an improved tax base, and increased energy security. With the construction of our cellulosic plant, we are about to unleash a new round of biofuels expansion resulting in all of the benefits that accrue to rural economies.

When enacted, the objectives of the RFS were to reduce dependence on foreign sources of crude oil, reduce greenhouse gases and promote domestic rural economies. Over the past few years, the RFS has done all of that and done it exceedingly well.

The fuels of the future are here today, and we can thank Congress for enacting the bi-partisan 2007 energy bill containing the RFS2. This policy has brought us to the point where the first commercial facilities producing cellulosic renewable fuels are up and running, and several more are under construction. As a result of this innovative policy, the U.S. is the world leader in biofuels and is attracting billions of dollars of private-sector investment from all over the world.

The first chapter of the RFS has seen renewable fuels grow to play a substantial role in our fuel supply. The next chapter of the RFS will bring advanced and especially cellulosic renewable

fuels made from residues such as agricultural and wood waste and trash. That commercialization is under way but only if Congress stands strong with its commitment made to the private sector under the RFS.

Across the United States and around the world, innovative companies are investing heavily — to the tune of over a billion dollars of private capital — to build the first wave of commercial scale facilities. These facilities will bring the technology to market to help enable fossil fuel independence. Farmers are preparing to supply these plants with the cellulosic materials they will convert to fuel. Steel is in the ground, and construction workers and farmers are on the job. These plants hold the promise clean, renewable fuel at large scale and improving energy and economic security while achieving significant environmental benefits. Over the next several years, cellulosic renewable fuel can grow into a sizable American commercial industry with over 400 million gallons per year projected globally by 2020.

Defending the Renewable Fuel Standard

The RFS works well. Reversing course on the RFS would deny the country of a true alternative fuel with real climate benefits and economic upside for consumers and producers across the U.S. It would be a mistake to in any way alter the RFS which would certainly result in the United States losing its lead in the development of advanced renewable fuels. A change in this bedrock policy will assure that investors and entrepreneurs step back and wait to see how a new policy will develop, while they take their investments and resources elsewhere. Without the RFS, America can be all but certain that investment in advanced renewable fuels like cellulosic and biobutanol will halt for at least a generation.

That is why DuPont is particularly concerned with the EPA's recent proposed rule on the 2014 Renewable Volume Obligations (RVOs), which would move us backward through setting production targets lower than what the U.S. has currently been blending and lower than the amount of renewable fuel that can be produced on both the cellulosic side and the traditional corn ethanol side. We believe that as this Committee conducts oversight on the administration of the RFS, it must encourage that RVOs be set annually in a way that drives higher blend use rates into the future. DuPont believes that the EPA should set the RVOs to sustain demand for Renewable Identification Numbers (RINs) in order to create the right incentives for bringing higher blends of fuel to the marketplace. Ethanol blends of E-15 and E-85 are coming on-line, particularly in the Midwest, and the USDA and Secretary Vilsack have put a grant program in place to assist station owners with installing blender pumps. Initiated in 2011, the goal was to install 10,000 new blender pumps by 2016. Since the program's inception, we believe that refiners have resisted the movement to higher blends of ethanol. In August, Senators Grassley and Klobuchar sent a letter to Attorney General Eric Holder and FTC Chairwoman Edith Ramirez requesting an investigation because of allegations that oil companies are "blocking the use of the current retail infrastructure to sell renewable fuels." The RFS, if maintained as an increasing standard, will generate the RINs to give innovative refiners the right reward for developing efficient routes to market for renewable fuels. There is factual evidence that this approach is works. A recent Reuters news article quotes Steve Walk of Protec Fuel on the impact of the Administration's RVO proposal. "It was just starting to get to the point where oil

companies were saying, 'We'll start putting in alternative fuels,'" says Walk, who went on to say that the deal with two large oil refiners was put on hold.

Other analysis showed that in Minnesota this past summer, as RIN values began to rise, E-85 sales volumes increased significantly in a very short amount of time based on price. This did not require additional vehicle sales as many people already own flexible fuel vehicles and was also not related to other policy changes. I have included further analysis on the impact of RIN's on higher renewable fuel blends for the record.

More renewable fuel and higher RIN prices do not result in higher retail gas prices, but in fact lower retail gas prices. RINs are free for those that blend renewable fuel. Purchasing RINs is optional and only required for those that don't want to blend renewables. There is plenty of ethanol capacity in the market, it is less expensive than gasoline, and studies have shown that renewable fuel reduces gas prices overall by more than $1.00 a gallon.

If the RFS is administered in a way that keeps RINs cheap, then there will not be an incentive to create an efficient route to market for renewable fuel.

Greenhouse gas emissions, Sustainability and Efficiency Improvements

The RFS is the only existing climate policy contributing significantly to reducing our greenhouse gas footprint, and making our transportation fuel supply more sustainable. Both President Obama and Bush committed to greenhouse gas reduction goals. The RFS is making significant strides in lowering emissions and will help meet these goals –while other means of reducing CO2 remain stalled in Congress or stuck in the courts. The cellulosic plant DuPont is currently building in Iowa will be GHG neutral – or in other words: our supply chain meets a standard that the oil industry cannot meet. It is fully sustainable and has zero net CO2 emissions.

A peer reviewed life cycle assessment from field to wheel of the DuPont cellulosic biorefinery and supply chain indicates a potential greater than 100 percent reduction in greenhouse gas emissions compared to gasoline. This is because cellulosic co-products are also a source of renewable energy. The DuPont biorefinery co-product can displace coal in facilities currently burning this fossil fuel. Regional businesses and academic institutions have already indicated interest in exploring the potential use of the renewable co-products to replace portions of their coal fired operations.

Another benefit to DuPont's involvement in the entire biofuels supply chain is that sustainability and efficiency improvements are not limited to greenhouse gas emissions. Equally as important, are the contributions that our enzymes business makes to reducing animal feed costs on the order of $5 to $20 per ton, improving nutrient digestibility of animal feed and animal gut health. This improved digestibility results in both a reduction in the amount of manure and a better balance of nutrients in the manure which minimize the environmental impact. DuPont scientists continue to research ways to further maximize the contribution of every corn kernel with the goal of using all the nutrients as efficiently as possible and returning any unused portion back to the nutrient cycle. Dry and wet distiller's grains are recycled to animal feed and DuPont enzymes are added to optimize the nutritional value to the animal. For example, DuPont's phytase enzyme improves

the nutritional value of feed by unlocking the phosphorus tied up by phytic acids in plants. This enzyme also reduces the need to add organic phosphate to feed which is an added cost to the farmer and results in higher phosphorous levels in manure and run-off. Other DuPont enzymes, xylanase, amylase and protease, help digest other nutrients in feed further reducing feed costs and improving animal performance. These are just a few examples of how DuPont is optimizing animal feed through science and research to maximize the use and benefit in every kernel.

DuPont and USDA Memorandum of Understanding

A bio-based economy depends on the gifts of Mother Nature being around for the long haul. This past March, I had the pleasure of joining U.S. Department of Agriculture Secretary Tom Vilsack in Iowa as we announced a Memorandum of Understanding (MOU) between DuPont and the USDA to work towards voluntary standards for the sustainable harvesting of agricultural residues for renewable fuel. DuPont's comprehensive, sustainable farm to fuels approach for corn stover set the stage for this agreement with the USDA's Natural Resource Conservation Service. The agreement will facilitate conservation planning assistance for farmers who supply bio-based feedstocks to biorefineries as the industry begins to commercialize. A conservation plan is voluntary, developed in cooperation with farmers, and helps protect natural resources while promoting a farm's sustainability.

Through the MOU, DuPont will develop a process to work with cooperating farms to execute sustainable harvest practices that will keep soil and nutrients in the field and out of rivers, streams and lakes. This work will promote a healthier soil which reduces flooding through increased infiltration rates, and provide for the efficient use of nutrients preventing the need for additional fertilizer.

This is a critical step forward in the development of the cellulosic biofuels industry as numerous players rally with farmers to undertake these novel feedstock supply chains. Harvesting stover residue sustainably is not just the right thing to do for the stewardship of our fertile heartlands – it is also a business critical imperative if we hope to maintain the renewable raw materials to supply biorefineries for decades to come.

Conclusion

In 2007, Congress reaffirmed a policy commitment originally made in 2005 to include energy options broader than petroleum in our nation's transportation sector. Congress made these bold commitments for a host of reasons including energy security, environmental improvements and economic development among others. These objectives still stand, even as our nation is increasing energy production on many fronts, as a growing world population and energy consumption will increasingly stress traditional energy sources. Congress was wise to invest in a broad portfolio of energy options now to guard against economic impacts of the future.

In making these policy choices, Congress also set a course for business investment. DuPont has invested significant capital and is on track to meet the demands of the RFS. Changes in renewable fuels policy may put these investments at considerable risk and inject uncertainty into an improving economy. While some members of this committee may view biofuels with

skepticism, I hope that you would agree that DuPont and other businesses investing in a policy set forth by Congress should not have the rules changed mid-course.

The biofuels industry has met the Congressional call for conventional biofuels ahead of schedule. As we move to advanced biofuels, the technologies for converting cellulose to fuel exist today and other renewable fuel choices are around the corner. The plants that harness these transformative technologies are being constructed. We sit at a critical juncture as farmers are harvesting feedstock now for commercial cellulosic ethanol production next year, based on the RFS. Without policy stability, growth of the advanced biofuel industry, as Congress intended, will not happen. That means lost jobs, lost economic development, lost energy security and lost environmental advantages.

We firmly believe that Congress has the responsibility to examine policies, and when appropriate, correct unforeseen consequences of previous decisions. While we appreciate the opportunity to participate in this oversight process, DuPont respectfully asserts that the Renewable Fuels Standard works, and importantly, the industry is at a critical juncture where advanced commercial production is under construction and policy decisions will significantly impact investments.

Specifically, DuPont commits to continue to inform and respond to this committee regarding the progress of our investments in biofuels, and invite each member of this committee to join us at our sites associated with biofuel production. However, we request that this committee also acknowledge the commitment made by Congress and the importance of policy certainty to investment in the technology we, and other companies, are deploying. In addition, in an oversight capacity, we ask this committee to work to make certain the RFS is administered in a way that ensures the Congressional goals of higher biofuels blends, advanced biofuels investments, and the realization of greater energy security through diversity of options.

Thank you, again, for this opportunity to address this committee. I would like to also take this opportunity to invite each of you to visit our biofuel production facilities to more thoroughly understand the importance of the Renewable Fuels Standard to achieving our national goals.

October 2013

HOW THE RFS ACTUALLY DELIVERS RENEWABLE ENERGY POLICY OBJECTIVES

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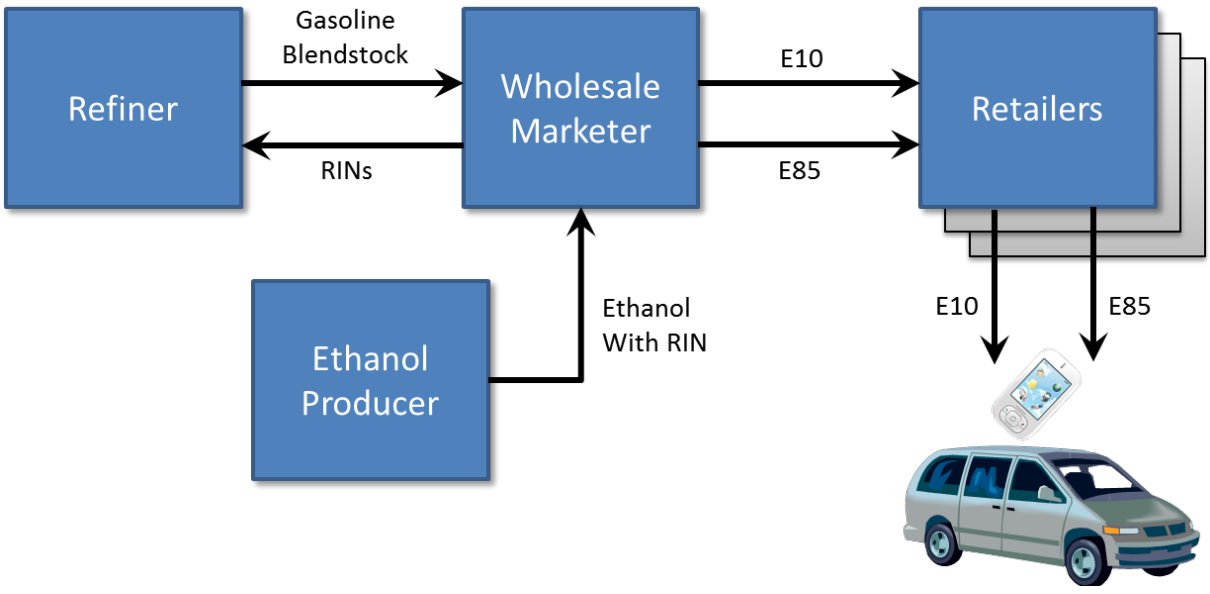
HOW THE RFS ACTUALLY DELIVERS RENEWABLE ENERGY POLICY OBJECTIVES

Jane Q. Public drives her flex fuel vehicle (FFV) in to her local gas station, checks the prices, enters them into a smart phone app and is advised that she should purchase E85 today. Many of her fill-ups lately are with E85. She chooses E85 for one basic reason, cost. Aside from cost, her vehicle works exactly the same on E85 or E10. This simple act, multiplied by millions of FFV owners and thousands of gas stations offering E85 are the key to how the biofuel targets of the Renewable Fuels Standard 2 (RFS) can be met. They can be met with vehicle types already on the road, retail equipment already available and under current law as written.

A number of critics have suggested that the RFS is flawed, broken or infeasible and therefore must be either substantially re-written or simply abolished. We emphatically disagree. In fact, we assert the RFS is working as designed and the goals of the RFS are being realized. Recent proposals to reduce biofuel blending targets are fundamentally at odds with the objectives of the RFS and must be reconsidered. This paper provides a detailed explanation of how the mechanisms within this legislation are successfully working as intended.

THE FUEL VALUE CHAIN AND RFS REQUIREMENTS

An understanding of the RFS first requires an understanding of the roles of the different entities in the fuel supply system and how their activities are interconnected. The accompanying figure provides a simplified illustration to support this discussion.



The system shown above provides incentives for all players in value chain to allow RFS2 compliance to be achieved. For a refiner, as their renewable volume obligation (RVO) increases, they will need to acquire renewable identification numbers (RINs) generated from blending in order to be able to supply gasoline blendstock. The cost of these RINs will be reflected in the price of gasoline blendstock offered to wholesale marketers, since it is part of the "license" to supply gasoline. For wholesale marketers, generation of RINs will be a core requirement for them to be able to source gasoline from refiners. Once the E10 blend wall is reached, the immediate option for wholesale marketers to increase supply of RINs (beyond that which is possible with E10 alone) is to blend and sell E85 to retailers. Wholesale marketers will be incentivized to do this because of the value of the RINs generated, and retailers will be incentivized to offer E85 because of the opportunity to sell a growth product which offsets declining gasoline sales. Retailers will need to install appropriate dispensing equipment to allow them to do this and will need to price it attractively to consumers to generate demand. RINs are the mechanism that allows this to happen; the price of a RIN will rise to the level needed for the wholesale marketer to price E85 attractively to the retailer and for retailers to price E85 attractively to consumers. These factors work together to incentivize generation of the number of RINs required by refiners. As will be discussed throughout this document, all of this can be achieved without significant impact on retail gasoline prices.

While some commentators have suggested the recent increase in the price of RINs is indicative of fundamental problems with the RFS, in fact the complete reverse is true. It is clear evidence that the mechanism designed to stimulate compliance with RFS targets works in exactly the way that was intended. RINs create the required incentives throughout the value chain to cause unrelated parties to work in concert to deliver the legislated targets. More detail on the roles of each of these parties is provided in the Appendix.

ACTIONS REQUIRED TO DELIVER RFS

Much of what has been written about the RFS focuses on the refiner (who, as the obligated party, has a very large stake) or the ethanol producer (generally seen as the principle beneficiary of this law). The role of the retailer is often ignored, yet they are the key – the goals of the RFS will only be realized if retailers offer and consumers purchase the mix of fuels necessary for refiners to achieve compliance. The RFS, between the statutes and the implementing regulations, is prescriptive on the requirements placed on refiners as well as the qualifications and actions of biofuel producers. The RFS is deliberately non-prescriptive in terms of fuel types and formulations. The intent of this structure is to avoid picking winners and losers in an area characterized by technology that is evolving rapidly. Butamax has been leading this innovation with the development of technology to produce biobutanol and introduce it to the fuels value chain. Making this mix of

prescriptive and non-prescriptive elements work requires a focus on the fuel needs of the consumer.

For the scenario envisaged at the start of this paper to be realized, E85 will need to be increasingly available at retail and offered at prices which make it economically attractive for FFV owners. We focus on E85 because it is matched with the designed capabilities of the existing FFV fleet and its high ethanol concentration enables RFS requirements to be achieved with a smaller and more gradual deployment of new E85 installations and FFVs than would be possible with mid-level ethanol blends (e.g. E30). Other types of biofuels (sometimes referred to as "drop in fuels"), such as biobutanol, which do not require new retail infrastructure are expected to be an important and growing part of the market. While it could ultimately become material in the market, E15 alone will not be sufficient to meet the intent of the RFS. E85, on the other hand, represents a cost-effective fuel blend, immediately available for market deployment, with potential to underpin the full objectives of the RFS. Accordingly, E85 should be considered as a core component of any RFS compliance strategy. E85 also has the added benefit that it is complementary to new drop-in biofuel technologies, enabling them to develop in the market as their cost performance improves.

Building increased retail availability of E85 at attractive prices requires several factors:

- **GROWING THE NUMBER OF E85 INSTALLATIONS** – Currently, there are about 3000 gas stations in the US offering E85[1]. It is estimated that 80% of FFV owners live within 10 miles of an E85 station. Nonetheless, in order for E85 to have the necessary impact on fuel markets, the availability will need to grow. These 3000 stations demonstrate that retailers will invest if they see market demand. With store sales being an increasingly important driver of station profitability and declining fuel volumes retailers may find that they need to offer new fuels if they are to retain the store traffic required for station profitability. With refiners needing growth in E85 sales volumes to supply a growing RIN obligation, they are incentivized to make commercial arrangements with blenders and retailers which will facilitate a growing retail E85 presence.

- **ATTRACTIVE E85 PRICING TO CONSUMERS** – E85 has only recently started to draw mainstream consumer interest in the US because it has not previously been priced at a level which reflects its reduced fuel economy compared to E10. Market data from Brazil, where FFVs are widely available (90+% of new car sales for the past decade have been flex fuel vehicles) and high ethanol content fuel is universally

[1] Babcock, B.A., and S. Pouliot. "Price It and They Will Buy: How E85 Can Break the Blend Wall." Policy Briefing Paper 13 PB-11. Center for Agricultural and Rural Development, Iowa State University.

available at retail, shows that FFV owners will buy this fuel if it is readily available and priced appropriately relative to gasoline. The same result can be expected in the US once consumers are familiar with the benefits of E85 and it is priced consistently with the fuel economy delivered.

Retailers can only offer an attractive E85 price to consumers if they are able to purchase E85 at a price which allows them to make that offer while earning a profit margin similar to that which they earn selling E10. As the wholesale marketer also has no RFS obligation, they will require the value of the RINs they capture (through blending of E85) to be sufficient to enable them to price E85 at the level required by the retailer. In fact, if E85 is the marginal source of RINs for the refiner, as can be expected when RVOs exceed RIN supply from E10 alone, the market value of RINs will continuously adjust[2] to enable the wholesaler to offer this pricing while earning a normal profit margin. As Jane and her fellow FFV owners will vary somewhat in how they assess E85 prices, wholesale marketers and retailers will learn to adjust their E85 price to move their sales mix as needed to balance with refiner demand for RINs.

- **MAINTAINING AND GROWING THE NUMBER OF FFV'S** – The current FFV fleet in the US is estimated at about 14 million vehicles. Historically, automobile companies have produced these vehicles in the general absence of material consumer demand because they earned the manufacturer credits towards their compliance with fuel economy (CAFÉ) standards. With the opportunity for CAFÉ credits being reduced, there is a risk that automobile companies will begin to scale back their FFV offerings unless consumer demand or other incentives make this attractive.

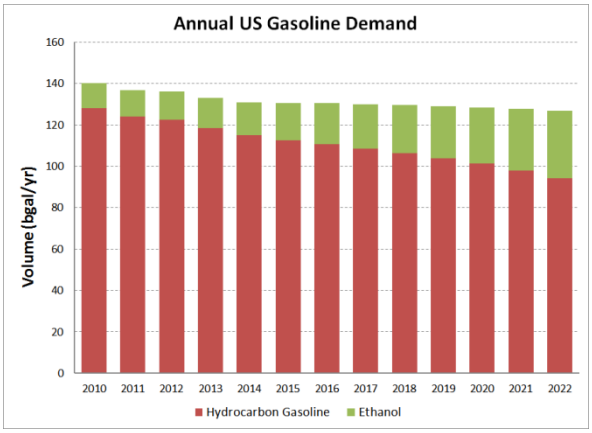
Wholesale marketers have incentive to maintain and grow their fuel sales volumes in a shrinking gasoline market and they have an opportunity to grow their RIN sales by blending increasing volumes of biofuels. Moving greater volumes of high biofuel blends, such as E85, requires them to secure demand from retailers with E85 capability and to price the E85 at levels which will enable retailers to profitably grow their E85 sales volumes. This will typically require wholesale marketers to transfer much of the RIN value to the retailer by way of a lower E85 price, so that retailers, in turn, can pass it on to the consumer. With E85 as the marginal source of RINs, market forces will drive RIN values to levels which enable the wholesale marketer to profitably price E85 at levels which incentivize retailer demand. While widespread adoption of this strategy may take some time, there is already evidence of the market responding to the incentive created by the market need for additional RINs.

[2] RIN values are expected to decrease when gasoline prices rise relative to ethanol and decrease when gasoline prices fall relative to ethanol.

In summary, E85 must be viewed as the core mechanism for delivery of the RFS in the near term. It plays this role because it is an existing product with a substantial base of compatible vehicles and retail infrastructure. Accordingly, it offers the most immediate opportunity to greatly expand the RIN supply to the market. Growth of E85 demand has historically been impeded by retail pricing at levels above its value to most consumers. The RIN mechanism of RFS changes this by providing economic incentive for all parties in the value chain to align in a manner which grows E85 availability and supports retail pricing that can stimulate the required levels of consumer demand. The RIN mechanism also serves to incentivize commercialization of drop-in biofuels such as biobutanol. These fuels will serve to enable deeper penetration of biofuels through their enhanced RIN delivery and full compatibility with existing, non-FFV, vehicles and retail infrastructure. Conversely, modifications to RFS which reduce RIN prices will reduce costs to refiners but will also eliminate incentives for wholesale marketers, retailers and consumers to grow E85 markets or deploy drop-in biofuels.

IMPACT ON THE MARKET AND GASOLINE PRICES

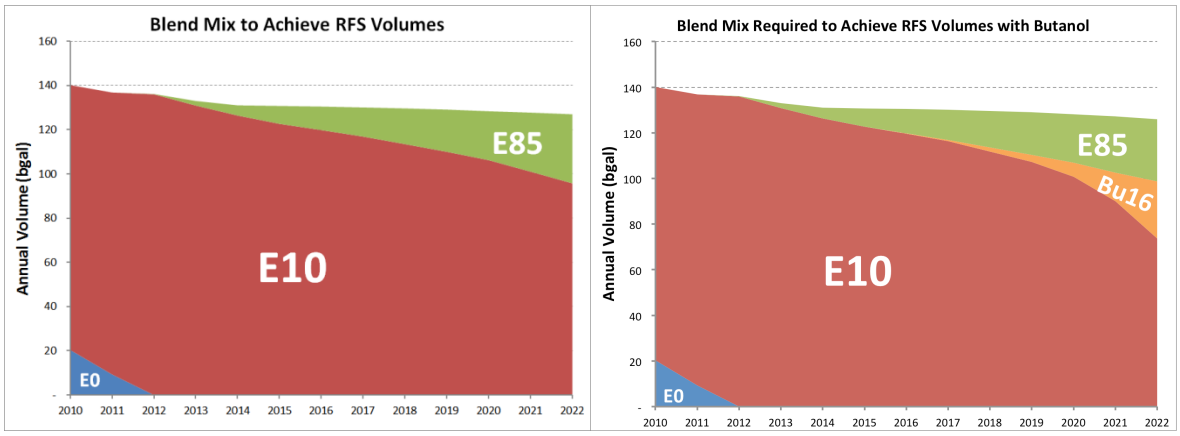
The underlying aim of the RFS is to grow the share of domestically produced renewable fuels in the US fuel market. The key benefits from this action are improvements in US energy security, improvement in air quality (both traditional pollutants and greenhouse gas emissions) and moderation of the growth in global oil demand. This is being done in a context where US gasoline demand is gradually decreasing as a result of demographic shifts, economic factors and gradual improvement in fuel economy standards for new cars. While the RFS is applicable to both the gasoline and diesel fuel markets, this paper focuses on the gasoline market as it is larger and the transition issues are more complex. In the case where ethanol is the dominant renewable gasoline component, analysis of the projected US gasoline market[3] and the gasoline portion of the RFS[4] requires that ethanol takes a growing share of a declining US gasoline market, as illustrated.



[3] Butamax analysis, based on projected US gasoline and E85 demand from the US Energy Information Agency (EIA) Annual Energy Outlook for 2013 (AEO2013) reference case.

[4] Butamax assumes that the biomass-based diesel portion of the RFS gradually increases from the 1.28bgal requirement for 2013 and subtracts this contribution from the Total Renewables requirement.

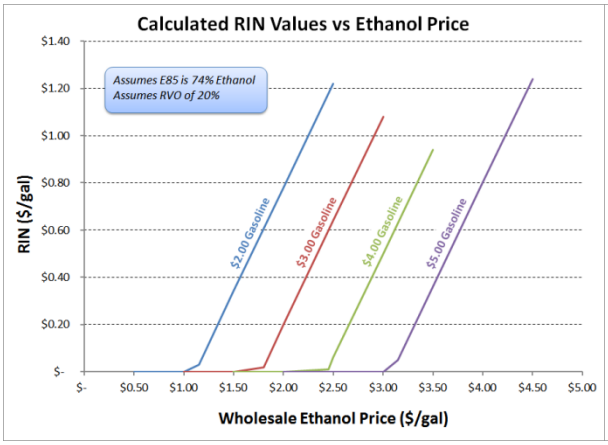
Delivery of this growing quantity of ethanol to the gasoline market requires a shift to higher ethanol blends. For simplicity, we assume that the US market first transitions away from straight gasoline (E0) to E10, a step which has already largely occurred. From there, E10 is gradually displaced by growing volumes of E85. As discussed above, delivering this result requires retail pricing which incentivizes FFV owners to regularly purchase E85, as well as growing the FFV share of the vehicle population and increasing retail availability of E85. With those enabling requirements in mind, the accompanying chart estimates the share of E0 and E85 in the market required to generate the quantity of RINs implied by full RFS implementation. (Sales of E15 or other types of biofuel would directionally reduce the amount of E85 sales required). As illustrated, the required ethanol volume share grows from about 8% in 2010 to over 25% in 2022, E0 virtually disappeared by 2012 and E85 slowly grows to 24% of fuel sales by 2022. E0, in fact, has continued in the US market at low levels as biomass-based diesel and some E85 sales have contributed to the fuel mix and generated RINs to enable RFS compliance. A slower ramp-up of the RFS obligation due to cellulosic ethanol coming to market more slowly than statute would also reduce the required rate of E85 penetration.

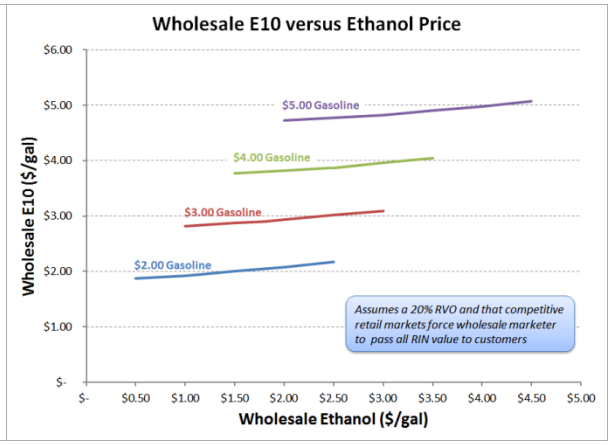


Drop in biofuels, such as biobutanol, provide an opportunity to further reduce the amount of E85 and, therefore, FFV's needed to achieve the RFS targets while staying within the capabilities of the existing vehicle fleet and infrastructure. A 16% blend of butanol in gasoline (Bu16) offers consumers the same fuel economy as E10 while generating twice the number of RINs per gallon as E10[5]. The accompanying chart uses the same fuel energy demand data as the prior chart while assuming the gradual introduction of butanol capacity (from either retrofit of existing ethanol plants or new construction of cellulosic butanol plants) of 4bgal/yr by 2022. In this scenario, required E85 volumes are reduced as butanol blends double the number of RINs which can be realized with fuel for standard vehicles.

[5] 10% ethanol X 1 RIN per gallon of ethanol generates 0.10 RIN per gallon of E10. 16% butanol X 1.3 RIN per gallon of butanol generates 0.21 RIN per gallon of Bu16.

While delays in commercialization of cellulosic ethanol technology or different levels of penetration of non-ethanol biofuels, (such as biobutanol or biomass-based diesel), may result in a shift of both the timeline and the amount of ethanol penetration required for RFS compliance, RIN prices will be set by the marginal source of compliance. We believe that, once RFS requirements exceed what can be achieved by E10, E85 will be the marginal source of compliance. The RIN will price at the level required to incentivize FFV owners to regularly purchase E85; for the large majority of such motorists that will require reducing the retail price of E85 to the level where the cost per mile is less than or equal to the cost per mile for consuming E10[6]. The RIN value necessary to achieve this retail pricing will be set by the delivered wholesale cost of ethanol and hydrocarbon gasoline respectively, as well as applicable state and local taxes in a given market[7]. The net effect of this structure is that the RIN moderates the terminal rack price of E10 (see charts below) and enables the terminal rack price for E85 to be sufficiently discounted to incentivize broad use by FFV owners. (This analysis does not assume any reduction in crude price levels due to displacement by renewables; such effect would further mitigate any price impacts on gasoline).





The manner in which these effects can be expected to appear in the marketplace is illustrated in the following examples.

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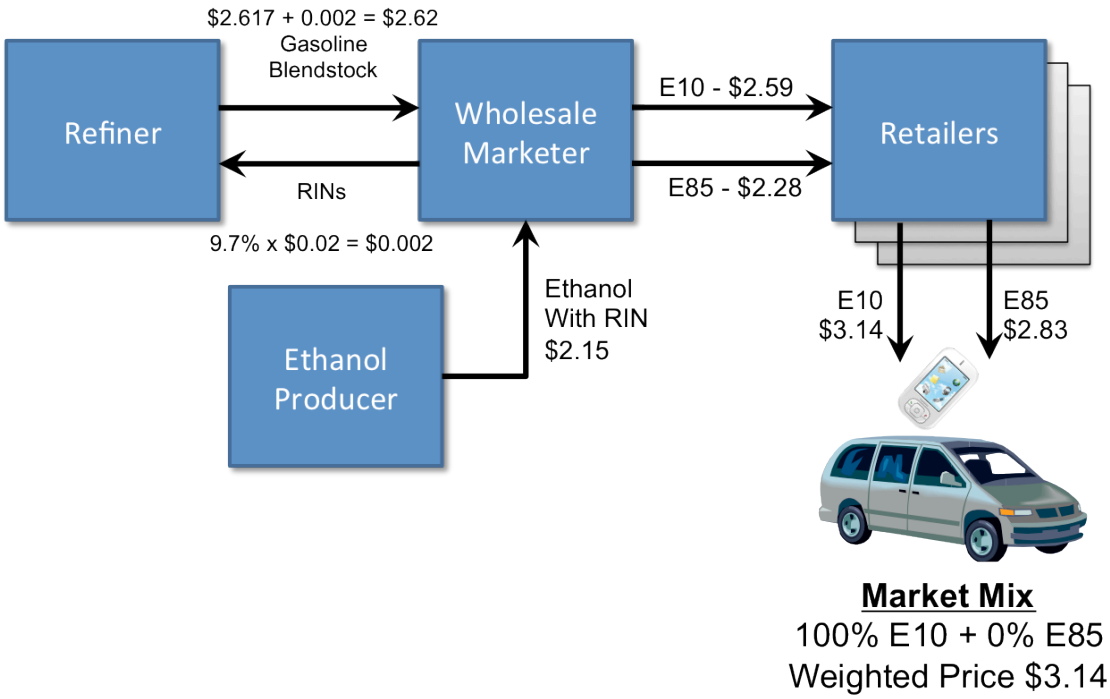
[6] Babcock (Babcock, B.A., and S. Pouliot. "Price It and They Will Buy: How E85 Can Break the Blend Wall." Policy Briefing Paper 13 PB-11. Center for Agricultural and Rural Development, Iowa State University.) Provides a more rigorous analysis which infers a demand elasticity for E85 based on consumer behavior in Brazil. The result of that analysis is that steadily larger E85 discounts, and thus increasing RIN prices, are needed to support increasing E85 market share. We agree in principle with his analysis but have chosen not to analyze to that level of detail for this paper.

[7] As RINs trade on a national market, it will actually be the highest cost market which will determine the national market value of RINs. The location of this highest cost market will be determined by local delivered bulk ethanol price relative to local delivered bulk gasoline price as well as local tax structures.

Case 1 – RVO set at 9.7% of Gasoline Production (below blend wall)

A recent[8] New York Harbor (NYH) spot price for reformulated gasoline blendstock (RBOB), the gasoline product produced by refiners for blending into E10 for the New York market, was $2.64 per gallon. Deducting any charges related to RFS obligations, this equates to $2.617.. On that same day, the spot ethanol price (which includes one RIN) was $2.15 per gallon.

Now assume that the RFS obligation is maintained at 9.7% in perpetuity, so that there is no regulatory need for E85. This would cause RIN prices to drop to historic levels, assume $0.02. If refiner's costs remain the same as current market conditions, the spot RBOB price should go to the $2.617 /gallon calculated above plus a reduced RIN cost of 9.7% X $0.02 = $0.002 /gallon, for a total of $2.62 /gallon. Using the current ethanol price ($2.15/gal) and typical values for fuel taxes, transportation costs and margins, the flow of prices through the marketing system, expressed in $/gallon, can be estimated as illustrated below –

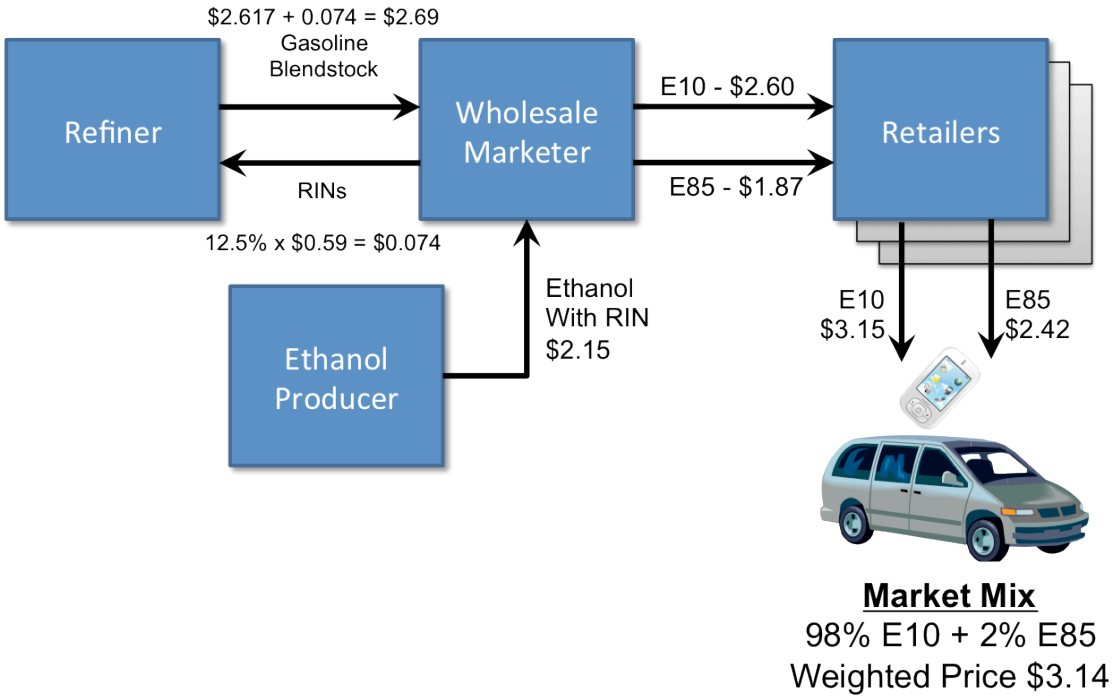


In this scenario, RIN cost has a minimal impact on refiners' cost of supplying the market and the expected retail pricing relationship between E10 and E85 (E85 at about 10% less than E10) is not likely to incentivize any significant E85 sales through existing pumps or installation of new E85 pumps.

[8] October 25th, 2013. The quoted price for a 2013 corn ethanol RIN was $0.24 and the current RIN obligation is 9.7%. Assuming that refiners are passing all of their RIN costs on to their customers, that amounts to 9.7% X $0.24 = $0.023 per gallon of RBOB. Thus, we can infer that the spot price of RBOB would be $2.640 - $0.023 = $2.617 in the absence of any RFS obligation.

Case 2 – RVO set at 12.5% of Gasoline Production (above blend wall)

In this case we assume the RFS obligation increases to the equivalent of ethanol at 12.5% of the refiner's gasoline production. This is roughly what would be required if the 2014 statutory obligation of 18.15 billion gallons were to be enforced with 1.28 billion gallons of biodiesel required. With this requirement and the same market environment as in Case 1, the retail market would need to sell 98.3% E10 and 1.7% E85 to generate the required number of RINs. We estimate that RIN prices would need to increase to $0.59 to enable retail E85 to be priced at levels which will incentivize this amount of consumer demand. This price level for RINs amounts to $0.074 per gallon of RBOB (12.5% X $0.59 = $0.074). This also lowers the effective cost of ethanol to the wholesale marketer to $2.15 - $0.59 = $1.56 per gallon. As a result, costs now flow through the distribution system as illustrated below –



The net result is that retail E10 prices are projected to essentially unaffected, rising from $3.14 in Case 1 to $3.15 in Case 2 while E85 price decreases from $2.83 to $2.42. This pricing relationship between E85 and E10 at retail is expected to incentivize the required consumer demand for E85. It should be noted that the market-weighted price mix remains unchanged at $3.14 per gallon. This level of E85 demand can be accommodated through the existing 3000 E85 pumps plus new pumps which retailers can be influenced to install when they see that there will be a consistent policy in place to incentivize consumer demand.

CONCLUSIONS

- The Renewable Fuels Standard is a farsighted and robust piece of legislation prompted by sound government policy. To quote the EPA "RFS2 lays the foundation for achieving significant reductions of greenhouse gas emissions from the use of renewable fuels, for reducing imported petroleum and encouraging the development and expansion of our nation's renewable fuels sector". It has successfully stimulated massive private investment in technology to create new, clean and diverse sources of renewable energy and superior fuel molecules for the US fuels market. The technology challenge has been considerable, but this investment has successfully delivered game changing technologies that put the U.S. firmly ahead of the rest of the world in the vital renewable energy sector.

- As the blend wall approaches, the market mechanisms created by this legislation have been proven to work as intended. The recent escalation of RIN prices is driven by the RFS obligations, and is precisely what is needed to incentivize growth in the share of renewable components in the fuel mix.

- E85 and Flexible Fuel Vehicles represent a readily available solution to enable the immediate blending targets of the RFS to be delivered, and should be considered a core part of any compliance strategy for meeting the RFS obligations. A clear signal to this effect from government, and maintenance of incentives for the Auto industry to maintain production of material numbers of flexible fuel vehicles, are necessary to ensure that the refuelling and vehicle infrastructure required are available to support this opportunity.

- RVO obligations beyond the level that can be achieved through E10 alone are essential to create the incentives within the value chain for renewable fuels to increase, and to create the growth envisaged by government policy.

- As such, relaxation of blend targets to levels below the so-called blend wall would immediately cause RIN prices to collapse, halt the growth in E85, and severely damage prospects of advantaged biofuel molecules (such as biobutanol) breaking into to the fuels market.

- When considering whether to diminish the aspirational objectives of the Renewable Fuels Standard, Congress and the Administration are faced with a clear choice. On the one hand, whether, to continue pursuit of energy security, reduced energy costs, rural job creation and lower greenhouse gas emissions, benefitting from new world beating technology developed in response to government leadership or, on the other hand, to forego this opportunity in favour of the status quo.

Butamax™

IMPACT OF DRAFT EPA 2014 RVO PROPOSAL

A draft proposal outlining a methodology for setting RVO's for 2014 (and beyond) was recently produced by the EPA and leaked to public. The approach outlined is to define RVO's based on the volume of ethanol required to produce essentially all US gasoline as E10, plus a small amount of additional ethanol from current E85 sales. This approach is fundamentally at odds with the objectives of the RFS, which clearly anticipated moving very substantially beyond what is possible with E10 alone. It appears that the methodology is specifically designed to collapse RIN prices in the mistaken belief that RIN prices impact gasoline prices at the street. However, as explained above, the RIN price is essential to creating incentives in the fuel value chain to drive increased levels of renewable energy in the fuel mix, but does not affect overall fuel price to consumers. If the leaked approach is implemented, the following impact can be expected:

- Conventional RIN prices will collapse to near zero, in line with historical trends.
- The reduction in RIN prices will force wholesale marketers to increase E85 prices significantly, and sales will drop to token levels. Any investment in increase E85 distribution and marketing can be expected to cease.
- Blending economics for drop-in biofuels will deteriorate substantially, since drop-in biofuels require higher RIN prices in order to remunerate the difference in production cost per gallon of higher energy content biofuels.
- Ethanol blending will revert to being driven by the economic incentive. The vast majority of gasoline will be blended with corn ethanol at 10% volume, which is readily available and for which there is a clear blend incentive.
- The gasoline price for consumers will increase over time, since the failure to implement the RFS as intended would underpin global crude oil demand and price.

RECOMMENDATIONS

Butamax is a joint venture of BP and DuPont which was established in 2009 to commercialize the biobutanol technology which they had been jointly developing since 2003. The goal of this privately funded effort, initiated prior to enactment of RFS, was to find a way to grow the benefits of biofuels while addressing many of the limitations of ethanol. The outcome is a fuel which is available to the transportation market and is not dependent upon on either government subsidy or government purchase of the product. Commercialization of a new fuel technology is necessarily time consuming as both gasoline and ethanol manufacturing processes are highly efficient, the markets in which they operate are very cost-sensitive and safety must be assured.

Specific Recommendations --

- **Maintain the existing mechanisms around RFS RINs** – The existing structure provides obligated parties with incentive to move forward towards achieving the goals of the RFS, while consumer choice creates the dynamic required to bring forward the most cost-effective solutions. While the issue of RIN fraud must, and is being addressed, the existence of RINs is vital to fuel our Nation's drive to support biofuel growth.

- **Retain clarity about the ultimate direction and scale –** While the RFS volume schedule will likely require adjustment due to the pace of commercialization of cellulosic biofuels, the demand side of the market requires long-term certainty to assure that necessary evolution of retail offerings, vehicle fleet and consumer behavior will occur as needed to achieve the policy objectives of the RFS. (It is important to note that the EPA has the authority to adjust the aspects of the advanced volume schedule to reflect the challenges of commercialising new technologies.)

- **Retain the technology neutral elements of RFS –** The RFS was specifically designed to be technology neutral. Drop-in fuels, such as biobutanol, offer the potential to greatly lower the cost of deploying a growing volume of biofuels. Loss of technical-neutrality risks these benefits.

APPENDIX – PARTICIPANTS IN THE FUEL VALUE CHAIN

Refiner –The vast majority of "gasoline" produced by US refiners today is actually not a finished gasoline product suitable for use in motor vehicles but instead is a blendstock designed to be blended with ethanol (90% gasoline, 10% ethanol) to produce E10. Different refiners have differing levels of downstream integration. Merchant refiners (i.e. Valero, PBF, HollyFrontier) typically sell large volume lots of their product at the refinery fence. Many refiners also participate in wholesale marketing (for example Exxon, BP and Shell); they blend E10 and sell it in truckload quantities out of distribution terminals to distributors or "jobbers". Only a small portion of refiners (e.g., Marathon, Northern Tier) directly supply or own retail gas stations.

- Refiners need to acquire RINs in proportion to their gasoline and diesel production in order to satisfy their RFS obligations.
- A large majority of these RINs are acquired at no cost through their integrated wholesale marketing businesses.
- When the refiner's obligations are less than the RINs they acquire through their wholesale marketing business, they are able to bank the excess RINs or sell them to others. When their obligations are greater than the RINs they acquire through their wholesale marketing activities, they can draw from any banked RINs (to a maximum of 20% of their obligation in a given year) or seek to purchase RINs from other parties.
- When the obligations of the refining industry, as a total, exceed the number of RINs which can be generated through E10 blending, market prices will increase RIN prices until they reach the level needed to incentivize blenders to produce E85 and sell it at prices which make it attractive to retailers and consumers.
- The US had recently become a net exporter of refined products and incremental exports above current levels can further reduce refiners' RFS obligations. However, attractive export markets are finite and US market demand is relatively inelastic. Accordingly, market forces can be expected to incentivize the US market to be fully supplied with various parties in the fuels market blending incremental E85 or other biofuel blends to generate the required RINs.

Ethanol Producer – An ethanol producer creates a RIN for every gallon of ethanol that they produce. This RIN is "attached" to the physical gallon of ethanol and may only be detached when that gallon of ethanol is blended into a finished fuel product for sale to an end-user in the US market. This program is managed by the EPA. Thus, the quoted wholesale price of ethanol is actually a combined price for the physical commodity and the attached RIN. Much of the ethanol used for gasoline blending in the US market is sold directly to refiners for use in their integrated wholesale blending

and marketing businesses. Some ethanol is blended into E85 directly by ethanol producers – in such cases, the ethanol producer is able to detach the RINs and sell them separately to other parties.

Ethanol producers have no obligation to produce under the RFS but refiners do have an obligation to use their product; this structure effectively assures that ethanol producers are able to recover their variable costs in the product price. RIN values effectively increase directly with ethanol price, largely shielding consumers from volatility in ethanol prices.

The potential price setting ability of ethanol producers is constrained by additional structural factors inherent in the industry and created by the RFS. Recall that the ethanol market, under RFS, effectively consists of three independent sets of producers – corn (conventional) ethanol, sugarcane (advanced) ethanol and cellulosic ethanol. While these three types of ethanol differ in the feedstocks employed and the greenhouse gas performance of their production technologies, they are producing the same ethanol molecule which must be treated the same way when blending gasoline. Further, the structure of RFS permits the refiner to use sugarcane ethanol in place of corn ethanol and cellulosic ethanol in place of both sugarcane or corn ethanol.

CORN ETHANOL – producers in this market are relatively fragmented, this industry has generally had excess capacity and there is an upper limit on the amount of corn ethanol which can be used annually for RFS compliance; this structure has generally limited the prices corn ethanol producers have been able to realize. Competition from sugarcane and cellulosic ethanol may, in the future, also serve to limit prices.

SUGARCANE ETHANOL – producers in this market are also relatively fragmented, but demand in the domestic Brazilian market and other parts of the world have generally served to limit supply to the US market. Planned production growth in Brazil, however, may make additional supply available to the US feasible in the coming years. Delivered cost to the US places an upper limit on corn ethanol prices; biodiesel and, in the future, competition from cellulosic ethanol can be expected to create a price ceiling on sugarcane ethanol. The market value of an advanced RIN can be expected to reflect the incremental cost of sugarcane ethanol over corn ethanol in the US market.

CELLULOSIC ETHANOL –Growth of the RFS significantly beyond current volumes is largely dependent upon the rate at which cellulosic production becomes available. While the first wave of cellulosic production may be more costly than existing technologies, it is expected that lower feedstock costs will ultimately overcome higher capital and operational costs to make cellulosic ethanol cost competitive with corn and sugarcane. So long as cellulosic ethanol production is projected to fall short of the statutory targets of the RFS

program, EPA is obligated to offer cellulosic waiver credits at a formula price. As refiners have the option of meeting their cellulosic obligation with either a cellulosic RIN or the combination of an advanced RIN and a cellulosic waiver credit, this sets an upper limit on cellulosic ethanol prices at the delivered cost of sugarcane ethanol plus the cost of a cellulosic waiver credit (42 cents/gal in 2013).

Wholesale Marketer – A wholesale marketer manages the combination of gasoline blendstock with ethanol to produce a finished product, such as E10 or E85 and sells those blended products to distributors (jobbers) or retailers. The blending activity generally occurs at a petroleum distribution terminal which receives and stores bulk shipments of gasoline blendstock (usually via pipeline or barge) and ethanol (usually via truck or rail). The terminal may be owned by a refiner, a wholesale marketer or an independent distribution company. In some markets, the blending is commonly done by or for jobbers. In some states, refiners are legally required to make unblended gasoline blendstock available to jobbers to do their own blending.

- Ownership of RINs detached as a result of the blending activity typically goes to the party who hired the blender. If this is not an obligated party (refiner) they will typically seek to sell the RINs in the market.

- Most terminals service more than one refiner with fungible gasoline blendstocks commingled in shared tankage and each refiner supplying their own ethanol to a community ethanol tank.

- The wholesale marketer chooses which blends to offer, typically based on input from their customers. Each marketer utilizing a shared terminal sets their own product prices.

In a market where fuel demand is declining and which is short on RINs, wholesale marketers can create value for refiners by finding a market for their fuel and supplying them with their RIN requirements. This requires that they offer successful retailers the right product blends at prices which will enable them to be competitive. The market value of the RINs generated will be set at a level which bridges from the costs of hydrocarbon gasoline and ethanol to the relative market value of E10 and E85 with a small incentive left for the wholesale marketer. The wholesale marketer's share of the RIN value will be capped by the ability of ethanol producers and jobbers to do their own blending and compete with the wholesale marketers for sales of RINs back to the refiners.

Retailer – Many retailers in the US today operate independently of refiners. While a large share of gas stations carry a refiner brand, these are generally franchisees (they agree for a period of years to exclusively source their fuel from the refiner, offer the refiner's standard set of fuel products to the refiners

quality specifications and configure the look of their site to the refiner's image standards; they do this in exchange for the refiner's marketing support and supply terms). While refiner brands retain a large share of the retail gasoline business, an increasing share is from big box retailers (Costco, Wal-Mart), grocers (Safeway, Kroger) and independent retail companies (Wawa, QuikTrip).

- Declining fuel demand and growing diversity of retailers makes retail gasoline pricing highly competitive. Fuel margins are often very small and store operations represent a major share of revenues.

- Independent companies (e.g., Propel) are entering the business of offering standalone biofuel product dispensing on existing retail sites.

- While retailers set their own product pricing and, increasingly, select their product offerings they ultimately need to price at levels which drive consumers who have multiple choices to buy. For E85 and other new biofuel blends this feeds back into the prices wholesalers must offer in order to drive volume and generate the RINs which are needed by refiners to meet their RFS obligations.

With stagnant vehicle miles travelled (VMT) and steadily increasing fuel economy, E85 has the opportunity to be a growing retail fuel product in an otherwise declining market. Retailers offering E85 will be able to maintain or grow their fuel volumes and have the best prospect for sustaining the store sales generated by fuel traffic. With retail fuel volumes declining and the mix of fuel retailers shifting away from refinery-branded dominance, successful retailers are well-placed to negotiate the best terms for supply of the range of fuels consumers are demanding; this may include being able to negotiate assistance in the installation of E85 dispensing equipment.

Consumer -- With U.S. gasoline demand steadily declining, existing market participants compete vigorously to retain volume. Retail gas sales in the U.S. are very much driven by price over all other considerations. (Branding of gas in the US does not impact consumer choice as much as it does in other countries.) Compared to non FFV users – who will still continue to enjoy price dictated by competition, consumers with FFVs will be able to make even more strategic choices where to buy their gasoline and at what price.

Consumers, particularly those who own FFV's, are the key to making the RFS succeed. They need to be incentivized to purchase E85 regularly. That incentive needs to be sufficient not only to impact current fuel purchases but also to incentivize demand for new FFV's by a growing percentage of new car buyers As E85 becomes increasingly available at attractive prices, informed consumers with FFV's can be expected to choose this product.