Written Testimony of:

Mr. Brooke Coleman
Executive Director, Advanced Biofuels Business Council

Subcommittee on Environment and Subcommittee on Oversight
Committee on Science, Space, and Technology
U.S. House of Representatives

Renewable Fuel Standard: A Ten Year Review of Costs and Benefits

November 3, 2015

Good morning Chairman Bridenstine, Chairman Loudermilk, Ranking Members Bonamici and Beyer and members of the subcommittees. My name is Brooke Coleman and I am the Executive Director of the Advanced Biofuels Business Council (ABBC).

The Advanced Biofuels Business Council represents worldwide leaders in the effort to develop and commercialize next generation, advanced and cellulosic biofuels, ranging from cellulosic ethanol made from switchgrass, wood chips and agricultural waste to advanced biofuels made from sustainable energy crops, municipal solid waste and algae. Our members include those operating production facilities, those augmenting conventional biofuel plants with "bolt on" or efficiency technologies, and those developing and deploying the technologies necessary to make advanced biofuel production a commercial reality.

We are honored to be here today to help accurately assess the impacts of the federal Renewable Fuel Standard (RFS) now ten years into the program. My primary role today is to talk about the continued development of the advanced biofuels industry. However, we would also like to provide context for the ongoing discourse about the rationale for, and efficacy of, ongoing federal policy support for biofuels.

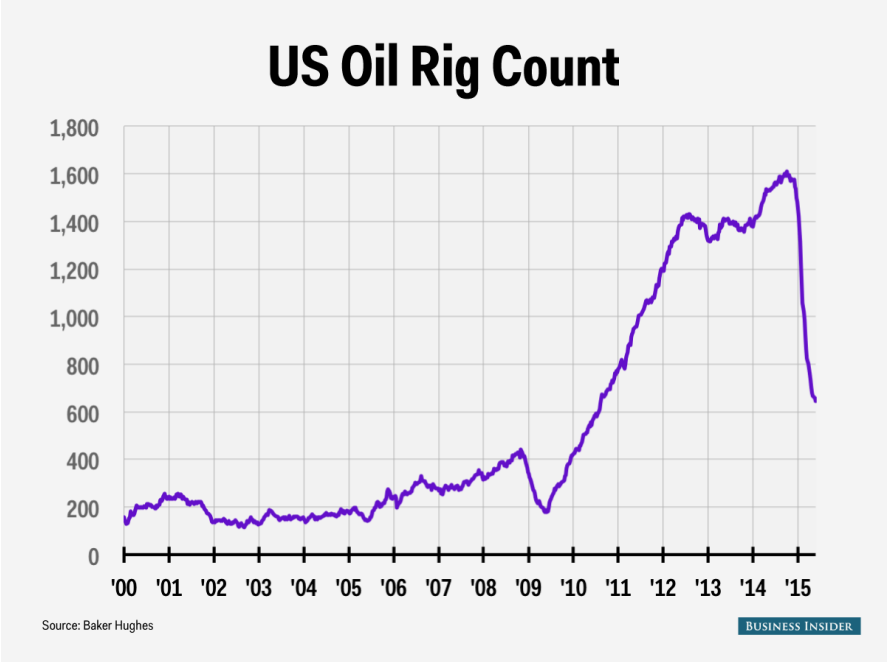
1. Oil dependence is still a problem, and recent trends are not changing the big picture

If there was a central underpinning of Congressional support for the RFS ten years ago – and again when it was amended in 2007 – it was bipartisan support for reducing U.S. dependence on foreign oil. Between 2000 and 2012, the cumulative total of U.S. spending on imports of goods and services exceeded U.S. export earnings by $7.1 trillion dollars – U.S. trade deficits in crude oil and refined petroleum products were $2.87 trillion during this period, or 40.5 percent of the cumulative deficit in all goods and services (petroleum accounted for 55 percent of the trade deficit in 2012).[1]

[11] U.S. Department of Commerce, Bureau of Economic Analysis, International Data, pulled October 2015. See http://www.bea.gov/international/index.htm.

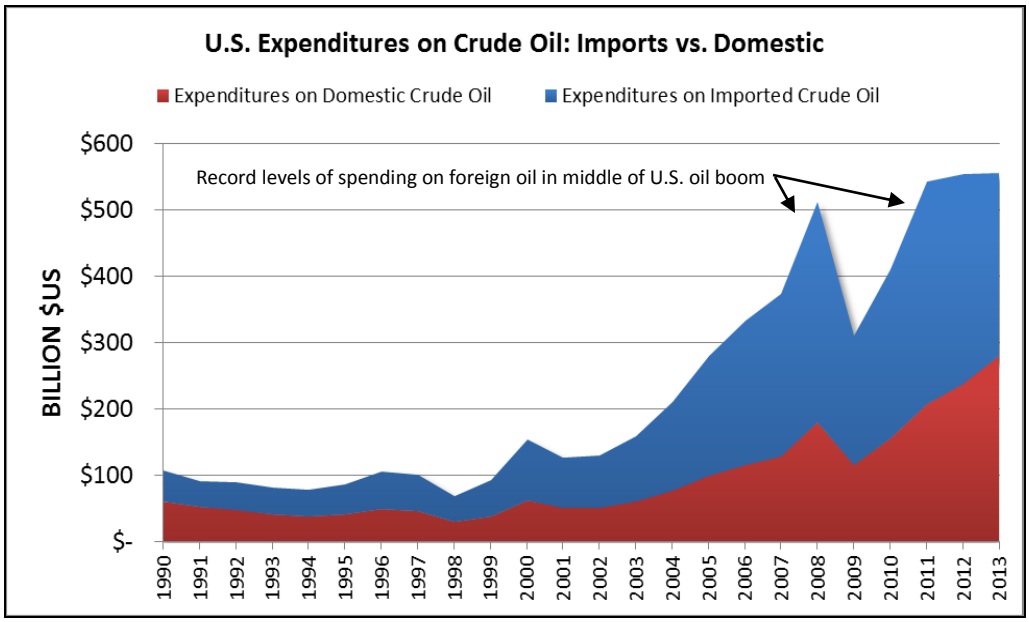
One argument made against the RFS is the United States no longer has a serious issue with foreign oil dependence due to recent trends in U.S. and global oil markets. However, it would be a mistake to confuse the short-term economic benefits of recent increases in U.S. oil production and decreases in gasoline prices with long-term energy security for the following reasons:

- **Low gasoline prices are occurring primarily because controlling interests in the Organization of the Petroleum Exporting Countries (OPEC) are using their market power to snuff out the U.S. oil boom.** Certain members of OPEC decided in late 2014 to allow global crude oil prices to slip in part to snuff out competition and reclaim market control. In simple terms, colluding to lower the price of oil changes the economics on U.S. oil production, which cannot compete with today's oil prices. A recent Bloomberg report entitled "OPEC Is About to Crush the U.S. Oil Boom" notes that the strategy is working.[2] In just 12 months, OPEC has knocked U.S. oil production back significantly. OPEC's September report openly acknowledges the effort and its effects: ""In North America there are signs that US production has started to respond to reduced investment and activity. Indeed, all eyes are on how quickly US production falls."[3] In essence, policymakers would be unwise to be lulled into a false sense of security by low gasoline prices and a U.S. oil boom now paralyzed by OPEC.



[2] See: http://www.bloomberg.com/news/articles/2015-10-20/after-year-of-pain-opec-close-to-halting-u-s-oil-in-its-tracks.
[3] See: http://www.opec.org/opec_web/static_files_project/media/downloads/publications/MOMR_September_2015.pdf

- **Even if a significant percentage of "new" U.S. oil production survives OPEC's predatory strategy, the vulnerability of the U.S. economy to foreign oil dependence is all about price.** Even if U.S. oil production stabilizes, OPEC will reduce output at some point and crude oil prices will increase sharply. If the U.S. continues to consume far more oil than it produces (inevitable) and oil prices increase (inevitable), consumers will continue to spend enormous sums of money on foreign oil and the U.S. economy will continue to suffer at the hands of its dependence on foreign oil. The problem was evident from 2007-2013. U.S. consumers were spending more and more money buying oil from U.S. producers as U.S. production increased, but consumers were also spending more a more money on foreign oil because oil prices were so high and increasing at the same time. The magnitude of the economic drain can be staggering. Americans transferred nearly $1 trillion to OPEC members during the oil price spike of 2008, in just 6-8 months. The figure below demonstrates how increasing U.S. oil production does not necessarily protect the U.S. economy and consumers from unsustainable and dangerous levels spending on foreign oil.



- **Recent headlines notwithstanding, the federal government cannot assess accurately the energy security and economic risks of oil depletion.** When assessing energy security risk as associated with oil, Congress should be aware that: (1) there is virtually no transparency when it comes to "source data" for the myriad of claims about future oil markets made on an everyday basis by analysts in the sector; and, (2) the oil industry and its analysts have a long history of seriously overestimating the vastness of its claimed reserves.

    - With regard to transparency, Russia (one of the world's largest conventional oil producers) declared all oil data a state secret in 2004. Neither Saudi Arabia nor Venezuela share data publicly when they make claims about future capacity. This is a concern in part because "there are political and financial pressures to misreport figures."[4] OPEC member quotas are based on reported reserves; the higher the reserve, the higher the quota relative to other members. OPEC members also face the challenge of attracting investment, from both government and outside sources. As reported in a recent peer-reviewed article in *Science*, "there are fears that Saudi oil reserves (and others) may have been over-estimated by at least 40%," and, "[a]t best Saudi reserves are seen as near maturity," given that 7 million barrels of sea water are being injected in the main field on a daily basis to increase flow.[5] The oil industry and OPEC also has the incentive of exaggerating reserves to weaken political and market interest in developing alternatives. OPEC first admitted its focus on

[4] Chapman, I., *The end of Peak Oil? Why this topic is still relevant despite recent denials*, Energy Policy (2013). http://dx.doi.org/10.1016/j.enpol.2013.05.010 at p. 3.
[5] See Chapman, I., *The end of Peak Oil? Why this topic is still relevant despite recent denials*, Energy Policy (2013). http://dx.doi.org/10.1016/j.enpol.2013.05.010 at p. 4.

alternative fuels in 2006, when it openly admitted that its price setting is designed partially to deter their use.[6]

- With regard to overestimation, recent statements about game changing oil reserves should be regarded carefully because we have heard similar claims in the past about Alaska and the Gulf of Mexico. In 2002, the U.S. Geological Survey estimated that the National Petroleum Reserve-Alaska contained 10.6 billion barrels (mean estimate) of oil. In late 2010, USGS revised their estimate to 896 million barrels – a downward adjustment of roughly 90 percent.[7] When BP discovered the Thunder Horse field in the Gulf of Mexico in 1999, they estimated that the reserve contained more than a billion barrels of oil. The discovery fundamentally changed projections about U.S. oil capacity and was credited with changing the global price of oil. BP and partners built the largest oil platform in the Gulf. However, oil extraction was delayed by more than 3 years due to technical difficulties, and according to a consultant for oil exploration, "Thunder Horse hasn't reached anywhere near its expected potential."[8] Tight oil plays (e.g. the Bakken) face similar challenges. As noted in an April 2013 article in *Science*, "data on reserves of many unconventional sources are now regarded as optimistic, compounded by thermodynamic inefficiencies in the processes, often relying on high energy inputs, will ultimately limit the net gain to provide fuel quantities well below predicted figures."[9] As a point of reference, the 4.3 billion barrels of technically recoverable tight oil from the Bakken (as estimated by the U.S. Geological Survey) is less than one year's worth of crude oil consumption by U.S. refineries. And investors are running away from tight oil in the current marketplace, due to the aforementioned market conditions imposed by OPEC.

2. The United States is not going to "free market" its way out of its foreign oil dependence problem or emerge as the global leader in advanced biofuel development without aggressive policies to attract investment

In a competitive marketplace, the increasing cost and scarcity of crude oil would play to the benefit of alternatives such as advanced biofuels. That is, the declining production cost of biofuels would attract investment over the increasing cost and scarcity of petroleum, and new alternative fuel products would emerge to replace petroleum. In essence, free markets reward innovation. However, U.S. and global liquid fuel markets are not free markets. As discussed, they are distorted by the price-controlling behavior of OPEC, driven by policy as opposed to price, and are dominated by highly-

[6] See http://www.foxnews.com/story/0,2933,222840,00.html
[7] See http://www.newsminer.com/news/alaska_news/oil-estimates-slashed-for-national-petroleum-reserve-alaska/article_999d982e-5823-59c2-82f7-8b6bb65d8fd6.html.
[8] See http://www.theoildrum.com/node/6415.
[9] Chapman, I., *The end of Peak Oil? Why this topic is still relevant despite recent denials*, Energy Policy (2013). http://dx.doi.org/10.1016/j.enpol.2013.05.010.

consolidated and vertically integrated incumbent oil companies that continue to receive the large majority of federal subsidies to the U.S. fuel energy sector. While many of these policies lie outside of the jurisdiction of these committees, the RFS must be assessed in its proper context – as a fuel energy policy designed to address problems in motor fuel markets – to be properly understood.

For example, the largest leaseholder in the Bakken told the Senate Finance Committee in 2012 that "[w]ithout the current capital [federal tax] provisions in place … that let us keep our own money … we would not have been able to fail over and over again, which is what it took to advance the technology needed to produce the Bakken and numerous other [tight oil/fracking] resource plays across America."[10] It is critical to point out that cellulosic biofuel producers and "tight oil" producers have something in common; they are both endeavoring to supply the country and world markets with what the Energy Information Administration (EIA) terms "unconventional fuel." While facing similar technology risk, the cellulosic biofuels industry does not receive the same tax treatment as companies like Continental Resources (from the perspective of value or duration).

More broadly, the fossil fuels industry enjoys the benefit of a number of unique federal tax allowances – unavailable to renewable fuels – that de-risk and lower the cost of the ongoing development of oil and gas resources relative to other sources of liquid fuel. For example, a recent study estimates that fossil fuels received 70 percent of U.S. federal energy subsidies between 2002 and 2008, to the tune of more than $70 billion during this time period. [11] This number does not include the loopholes in oil and gas laws that, according to the Government Accountability Office (GAO), allowed petroleum companies to forego paying $53 billion in royalty payments, over just four years, for extracting natural resources from lands owned by the American taxpayer. The federal government also helps incumbent industries develop new technologies. According to a recent Congressional Research Service report, [f]or the period from 1948 through 2012, 11.6% of Department of Energy R&D spending went to renewables, 9.7 % to efficiency, 25% to fossil energy, and 49.3% to nuclear.[12] According to a recent report, "energy innovation has driven America's growth since before the 13 colonies came together to form the United States, and government support has driven that innovation for nearly as long."[13] Governmental support drove investment in coal, timber, engine innovations, land settlement for resource extraction and other forms of innovation in the 19th and 20th centuries, and domestic energy consumption and GDP have tracked closely for at least 200 years.[14] Given the importance of energy security, we believe that the federal government's engagement in domestic energy development is appropriate, and there is a clear case for making advanced biofuels a focal point of that effort going forward.

[10] http://www.finance.senate.gov/imo/media/doc/Hamm%20Testimony1.pdf, p. 2.
[11] See http://www.elistore.org/Data/products/d19_07.pdf.
[12] See http://www.fas.org/sgp/crs/misc/RS22858.pdf
[13] See note 2, at p. 11.
[14] *Id.*

3. <u>The RFS has a clear record of success when it comes to achieving its economic and environmental objectives in the face of a perpetually uncertain and non-competitive global oil marketplace.</u>

Any objective analysis of the RFS shows that the program has met or exceeded expectations when it comes to the primary objectives set forth by Congress in passing the law:

- ***Petroleum Dependence and Gas Prices***

While motor fuel prices are temporarily low as a result of OPEC's decision to weaken competition in the global oil marketplace, most of the last ten years have been marked by historically high oil prices. The primary reason for higher prices is the reduced availability of cheap crude oil supply relative to increased demand, and the market response (both direct and via speculation) to this dynamic. The RFS has driven the development of a new alternative fuel industry during a period of very high economic vulnerability and fuel prices in the United States. Speaking to this dynamic, energy economist Philip K. Verleger (who served as an advisor on energy issues to both the Ford and Carter administrations) recently said, "the U.S. renewable fuels program has cut annual consumer expenditures in 2013 between $700 billion and $2.6 trillion … [t]his translates to consumers paying between $0.50 and $1.50 per gallon less for gasoline."[15] Mr. Verleger notes that the RFS put the equivalent of Ecuador's world oil output on the market during a period of extreme tightness:

> <u>Had Congress not raised the renewable fuels requirement, commercial crude oil inventories at the end of August [2013] would have dropped to 5.2 million barrels, a level two hundred million barrels lower than at any time since 1990</u> … [t]he lower stocks would almost certainly have pushed prices higher. Crude oil today might easily sell at prices as high as or higher than in 2008. <u>Preliminary econometric tests suggest the price at the end of August would have been $150 per barrel</u>."

Renewable fuels reduce gas prices in two ways: (1) the predominant fuel used to date to meet the RFS is ethanol, which has been $.60 to $1.00 cheaper per gallon than wholesale gasoline for the bulk of the time that the RFS has been in place; and, (2) by adding supply to very tight oil markets, which reduces the impact of both perceived and real disruptions to supply and curtails speculative engagement by the markets. One would have to stand basic economics on its head to argue that reducing the use of renewable fuels will not exacerbate petroleum dependence and increase gas prices.

- ***Economic Development and Job Creation***

Given the inherent uncertainties with analyzing the economic impact of any industry, the most effective way to assess the job and economic development impacts of the RFS is to consider

[15] See http://www.pkverlegerllc.com/assets/documents/130923_Commentary.pdf.

multiple reports conducted by different entities. It is clear, however, that the RFS triggered the development of a robust, homegrown renewable energy industry. For example, a recent RFS footprint analysis conducted by Fuels America concluded that the RFS now creates $184.5 billion of economic output, 852,056 jobs, and $46.2 billion in wages and $14.5 billion in taxes each year in the United States.[16] A recent assessment published by the Oak Ridge National Laboratory found that the RFS is producing significant positive economic effects ("the net global economic effects of the RFS2 policy are positive with an increase of 0.8% in U.S. gross domestic product (GDP) in 2022…[well in excess of $100 billion]" stemming from the fact that the RFS is reduces crude oil prices, decreases crude oil imports, increases gross domestic product (GDP), and is having only minimal impact on global food markets and land use.[17] Roughly half of the projected economic benefits will stem from advanced biofuel production. The economic picture is even more robust in certain states. The RFS supports more than 70,000 jobs and $5 billion in wages in Iowa, 60,000 jobs and $3.7 billion in wages in California, 39,000 jobs and $3.9 billion in wages in Ohio, and more than 28,000 jobs in Kentucky (e.g.) and other states not commonly associated with the biofuels industry.[18]

While much of the economic footprint of the RFS stems from the production and use of first generation biofuels, the advanced biofuels industry is deploying commercially today. And the scale of opportunity is enormous. According to the Sandia National Laboratory, the U.S. could produce 75 billion gallons per year of cellulosic biofuels (one subset of the advanced biofuel industry, and 4.5 times the amount of cellulosic biofuel required by the RFS) without displacing food and feed crops.[19] This would be enough cellulosic biofuel alone to displace more than half of gasoline demand. A Bloomberg analysis released in 2012 looked at eight select regions to assess the potential for next generation ethanol production.[20] The study found that eight regions -- Argentina, Australia, Brazil, China, EU-27, India, Mexico and the United States – could displace up to 50 percent of their demand for gasoline by 2030 making ethanol from a very small percentage of its each region's agricultural residue supply. The economic opportunity, with specific regard to advanced biofuel production, is robust. First, roughly half of the economic benefits discussed in the Oak Ridge paper above are from advanced biofuels. An RFS study by Bio-Economic Research Associates (commissioned by BIO) concluded that compliance with the advanced biofuels requirement of the RFS will create roughly 800,000 direct and indirect jobs.[21]

The cellulosic biofuels industry is acutely aware of public criticism about our rate of deployment. But we would encourage the committees to focus closely on the clear visual and data-statistical evidence of real progress in our industry. From an RFS perspective, the production capacity

[16] See http://www.fuelsamerica.org/pages/fuels_america_releases_new_footprint_anaylsis
[17] See http://www.future-science.com/doi/abs/10.4155/bfs.12.60?journalCode=bfs.
[18] http://fuelsamerica.guerrillaeconomics.net/; http://www.fuelsamerica.org/pages/fuels_america_releases_new_footprint_anaylsis
[19] See https://share.sandia.gov/news/resources/news_releases/biofuels-can-provide-viable-sustainable-solution-to-reducing-petroleum-dependence-say-sandia-researchers/.
[20] See http://www.novozymes.com/en/sustainability/benefits-for-the-world/biobased-economy/white-papers-on-biofuels/Documents/Next-Generation%20Ethanol%20Economy_Executive%20Summary.pdf
[21] See U.S. Economic Impact of Advanced Biofuels Production: Perspectives to 2030, Bio-Economic Research Associates.

of the broader advanced biofuels industry (i.e. all types of fuel qualifying as advanced biofuel under the RFS) exceeded the 2013 statutory target of 2.75 billion gallons established by Congress via RFS2.[22] U.S. EPA relied on the administrative flexibility provided to the agency by Congress to allow more bio-/renewable diesel and less cellulosic biofuel to be used to meet the 2013 standard. But delay should not be interpreted to mean failure when it comes to the commercial deployment of the most carbon-reductive, innovative fuels in the world. The ABBC's website (AdvancedBiofuels.org) details roughly two dozen advanced/cellulosic biofuel projects in the United States and abroad. And there are numerous U.S. commercial facilities now in commissioning or production phases, including:

- Quad County/Syngenta Cellerate (Galva, IA): Quad County Corn Processors and Syngenta formed a joint venture to produce 2 million gallons of cellulosic ethanol (from corn fiber) at their first generation ethanol plant in Iowa and license the technology elsewhere. The facility is producing and selling cellulosic ethanol today that reduces carbon emissions by more than 100 percent in comparison to gasoline, and uses a technology that also decreases energy use while increasing the production of valuable co-products like corn oil.

- DuPont (Nevada, IA): DuPont just held a grand opening for its ~ $225 million cellulosic ethanol facility in Nevada, Iowa. The 30 million gallon per year capacity plant is the largest cellulosic ethanol plant in the world, and will use corn stover biomass (an agricultural "waste" stream) secured from up to 500 farmers within a 30-mile radius around the facility. The project created 1000 construction jobs and will maintain 85 permanent jobs.

- Abengoa (Hugoton, KS): The global renewable energy company has completed construction of a 25 million gallon per year plant in southwest Kansas that will produce ethanol and renewable electricity from agricultural waste. The company has contracted with local farmers to secure the roughly 1,100 dry tons per day of waste feedstock needed to run the plant, and is in position to replicate its successes quickly via its other ethanol plants.

- POET/DSM (Emmetsburg, IA): Project Liberty – a joint venture between POET and Royal DSM – will make ethanol from corn cobs, leaves, husk and stalk that pass through the combine during corn harvest. The 25 million gallon per year plant will produce enough renewable electricity, as a co-product, to power itself and the POET grain ethanol plant next door. POET owns and operates 27 first generation ethanol facilities; most of which are candidates to deploy the cellulosic biofuel production technologies developed in Emmetsburg very quickly.

- Novozymes (Blair, NE): Novozymes, an advanced bio-products and sustainable agriculture company, operates the largest industrial bio-enzymes production facility in the United States in Blair, NE. The facility produces enzymes for conventional and advanced biofuels.

[22] See http://www.epa.gov/otaq/fuels/rfsdata/2013emts.htm

- **Climate Change Emissions**

The vast majority of independent analysis (not directly or indirectly industry funded) confirms that most types of first and second generation biofuels reduce climate change emissions, in many cases by very large amounts, including analysis conducted by U.S. EPA, the California Air Resources Board, the U.S. Department of Energy and top energy labs such as Argonne and Oak Ridge National Laboratories.

For example, the latest peer-reviewed analysis coming out of the U.S. Argonne National Laboratory shows that all types of ethanol – the type of renewable fuel usually scrutinized for its GHG emissions – have significantly lower lifecycle greenhouse gas emissions than petroleum, even with penalty for indirect land use change. Advanced ethanol, in particular, is: (a) vastly more carbon reductive than petroleum; (b) vastly more carbon reductive than the baseline used to analyze the RFS – 2005 gasoline; and, (c) significantly more carbon reductive than technologies often regarded to be the most innovative (electric drive, hydrogen).

Latest Well-to-Wheels Greenhouse Gas Emissions Reduction
Relative to Average Petroleum Gasoline

WTW GHG emission reductions	Corn	Sugarcane	Corn stover	Switchgrass	Miscanthus
Including LUC emissions	19–48% (34%)	40–62% (51%)	90–103% (96%)	77–97% (88%)	101–115% (108%)
Excluding LUC emissions	29–57% (44%)	66–71% (68%)	89–102% (94%)	79–98% (89%)	88–102% (95%)

Source: Argonne National Laboratory[23]

The carbon benefits of increasing the use of renewable fuels are actually even greater when you take into account the fact that renewable fuels replace marginal (rather than average) gallons of petroleum. To illustrate, Petrobras chief Jose Sergio Gabrielli has declared that "the era of cheap oil is over." This means that oil companies are shifting very quickly to an increasing reliance on more expensive and riskier "unconventional" fuels – including tight oil (e.g. the Bakken), deep water (e.g. Gulf of Mexico, Deep Water Horizon) and Canadian tar sands (e.g. Keystone) – to meet the global demand for fuel energy.[24] These fuels are more carbon intensive than the "2005 average petroleum" legislated by Congress in 2007, and replacing RFS renewable fuel gallons with marginal petroleum gallons will result in backsliding with regard to both raw GHG emissions and the Obama Administration's commitment to cut carbon emissions to "protect the health of our children and move our economy toward American-made clean energy sources that will create good jobs and lower home energy bills."[25]

[23] See http://iopscience.iop.org/1748-9326/7/4/045905/pdf/1748-9326_7_4_045905.pdf
[24] See http://www.eia.gov/forecasts/aeo/MT_liquidfuels.cfm#crude_oil
[25] See http://www.whitehouse.gov/the-press-office/2013/06/25/fact-sheet-president-obama-s-climate-action-plan

There are a number of recent studies that have looked at the real world "marginal" impact of increasing the use of renewable fuels. For example, a 2014 analysis conducted by Life Cycle Associates in California concluded that today's corn ethanol – assessed by EPA in 2010 to be 21 percent better than 2005 petroleum with regard to lifecycle GHG emissions – is 32 percent better than 2012 average petroleum and 37-40 percent better than petroleum derived from tar sands and fracking. The report notes that using less renewable fuel will increase the use of these unconventional types of oil:

> The majority of unconventional fuel sources emit significantly more GHG emissions than both biofuels and conventional fossil fuel sources … [t]he biggest future impacts on the U.S. oil slate are expected to come from oil sands and fracking production … significant quantities of marginal oil would be fed into U.S. refineries, generating corresponding emissions penalties that would be further aggravated in the absence of renewable fuel alternatives."
>
> Source: Life Cycle Associates, January 2014

These findings are consistent with recent (lower resolution) assessments by federal agencies. For example, a recent report released by the Congressional Research Service (CRS) found that Canadian oil sands are 14-20 percent more carbon intensive than the 2005 EPA baseline.[26] As such, it is an inescapable reality that any proposal to reduce renewable fuel blending is a proposal to increase U.S. consumption of high carbon intensity, unconventional oil.

4. Conclusion: Congress should not legislate on the RFS and allow the program to deliver on its economic and environmental record and promise

We are often asked by members of Congress if there are ways to accelerate the deployment of the advanced biofuels industry. We would like to respectfully suggest the following:

- **A Stronger Commitment to No Backsliding/Policy Certainty Would Help Attract Project Finance to U.S. Advanced Biofuel Markets**

The U.S. has a number of well-designed policies in place that are driving innovation in the biofuels sector, including but not limited to the RFS, several important tax provisions currently being considered for extension (e.g. the second generation biofuel producer credit, the special depreciation allowance for second generation biofuel plant properties, etc.) and the critical energy title programs in the farm bill. The issue around these policies is not their design; but rather, their dependability as related to legislated permanence (i.e. the perpetual risk of expiration) and funding (i.e. the perpetual risk that they are de-funded). By contrast, federal government support for the

[26] See http://www.fas.org/sgp/crs/misc/R42537.pdf

fossil fuels industry – primarily through the federal tax code but also indirectly via infrastructure and other policies – is almost always permanent. This clear inequity has the practical effect of increasing the risk of investing in renewable versus fossil energy, which in turn drives the development of clean energy overseas to countries with more durable policy commitments (e.g. China, Brazil, etc.). Ironically, policy risk is often more perceptive than substantive and incumbents leverage this investment reality to create a perpetual cloud of uncertainty around landmark biofuel programs. As such, it is absolutely critical to our industry to protect landmark programs – RFS and farm bill energy title among them – at both the messaging and substantive levels. Changing the rules in the middle of the game for any of these policies – however framed politically – has the practical effect of spooking investors and making the U.S. less competitive globally. Ultimately, it will also be critical to reform the federal tax code to, at minimum, remove the inequities that distort investment markets.

- **Transparency in RFS RIN Trading Markets Would Help Reduce Unnatural Volatility in RIN Markets and Put the RFS on a More Stable Path Going Forward**

The RFS is designed to drive investment in advanced biofuels and more renewable fuel blending (including infrastructural development). The primary driver of additional biofuel market access within the RFS is the RIN. A RIN is an identification number generated when a gallon of RFS-qualifying renewable fuel is produced. The RIN is attached to the renewable fuel gallon at the point of sale to obligated parties (i.e. oil companies), but can be separated (from the liquid gallon) by obligated parties and sold for whatever price the market will bear. The primary value of the RIN program, other than facilitating compliance accounting and some level of compliance flexibility, is its ability to increase market access for renewable fuels. That is, when an oil company refuses to blend more liquid biofuel, they can buy a RIN on the open market instead. If a significant number of oil companies refuse to blend liquid gallons and seek RINs on the open market, RIN trading and values will increase as a result of their affirmative non-compliance. Higher RIN prices should not be considered a bug in the RFS; they actually provide an extra incentive for other obligated parties to blend liquid renewable fuel gallons, because they acquire a valuable and saleable RIN free of charge with each gallon of renewable fuel purchased. In essence, higher RIN values reward good behavior and facilitate the objectives of the RFS.

Some oil companies and refiners are trying to miscast higher RIN prices as a potential cause for higher gas prices. The Babcock analysis discussed above – which was not funded by industry – clearly shows that higher RIN prices do not increase gas prices primarily because: (a) RINs enter the marketplace free-of-charge with each gallon of renewable fuel; (b) RIN values are created by trading among obligated parties, so it is often the oil industry itself on the profit side of the RIN transaction;[27] and, (c) higher RIN prices actually *reduce* the cost of a gallon of renewable fuel at the wholesale level, which erases the threat of higher gas prices at the retail level.

[27] See http://www.ethanolrfa.org/exchange/entry/what-do-big-oils-quarterly-earnings-say-about-the-real-impact-of-rins-on-u/

That said, the current RIN trading marketplace lacks transparency to the point in which it is difficult for traders and obligated parties to make trades based on dependable, real-time information. While it is not clear what percentage of the 2013 spike in D6 RIN prices came as a result of the lack of transparency in RIN markets – either through hoarding from (blind) "shortage mentality" or other strategies – it is clear that a non-transparent RIN marketplace could be a liability for the program, and in turn, a point of uncertainty for advanced biofuel investing. We believe that federal agencies (e.g. EPA in collaboration with the CFTC) could set up an electronic trading platform – similar to those used in other commodity markets – to ensure that RIN positions and trades are disclosed in real time. We believe this can be done expeditiously and would have an immediate calming effect in the marketplace with regard to RIN volatility and predictability.

- **Market Access to Allow Fair Competition**

There are a number of incongruencies between the goal of increasing the production of advanced biofuels and the regulations that largely dictate outcomes in U.S. liquid fuel markets. It is a basic economic notion that emerging advanced bio-based fuels need a market (i.e. demand) to deploy at commercial scale. And yet, EPA has yet to resolve a number of roadblocks for the increased use of renewable fuels in gasoline.

For example, EPA has thus far refused to address regulatory inconsistencies with regard to vapor pressure for E15 that are contributing to the slower than necessary deployment of the fuel. There is no real substantive issue that supports treating E10 and E15 differently with regard to vapor pressure, but the practical effect is gasoline retailers cannot offer E15 year round. This discourages the utilization of pump infrastructure for marketing and selling of E15. We are also concerned about EPA's ongoing refusal to provide proper credit for Flex Fuel Vehicles (FFVs) in the updated CAFE fuel efficiency standards. Ongoing devaluation and uncertainty with regard to FFV credits dissuades automakers from making simple adjustments to future vehicles to allow price-driven fungibility in gasoline/ethanol markets. Ensuring that every new car manufactured in the U.S. is an FFV would cost consumers next to nothing, but would open up new frontiers for the advanced ethanol industry. This is just one example applicable to ethanol, but it is important to understand that all petroleum alternatives currently face the challenge of having to go through their competitors to reach consumers. Regulatory agencies must be careful not to make market access more challenging.

It is both an exciting and challenging time for the cellulosic biofuels industry and the advanced biofuel industry as a whole. The technology is commercial ready and the industry is deploying at commercial scale. We are embarking on the process of securing efficiencies that can only be achieved via commercialization (i.e. the "experience curve") and economies of scale. When the corn ethanol industry started building plants, their production costs exceeded their feedstock costs by a large margin. However, corn ethanol producers have reduced their production costs by

roughly 60 percent since the first commercial plants were built in the 1980s. Likewise, some solar companies have seen a similar 60-70% production cost reduction in just the last ten years, as capacity has increased significantly. The U.S. is in position to lead the world when it comes to the development of advanced, low carbon biofuels. And yet, we face as much policy uncertainty as we ever have before, almost always generated by fabricated claims about renewable fuels and the RFS. Incumbents in the fuel energy space are going after our tax provisions, our farm bill programs, and of course, the RFS. It is important to understand that this is happening because of the effectiveness, rather than ineffectiveness, of these programs to drive consumer choice at the pump.

We very much appreciate the opportunity today to highlight the fact that advanced biofuels are emerging, that renewable fuels are creating jobs and driving pump prices down, and efforts to undercut biofuel programs are occurring because these programs are working, not vice-versa.

Thank you for the privilege of speaking before you today. I look forward to your questions. We have attached some information below to shed light on much of the misinformation associated with implementation of the RFS. Thank you.

ATTACHED:

Attachment A: Easy Answers to a Number of Complex Allegations Made Against Biofuels

Attachment B: Further Analysis of Gas Price Impact of the RFS

Attachment A

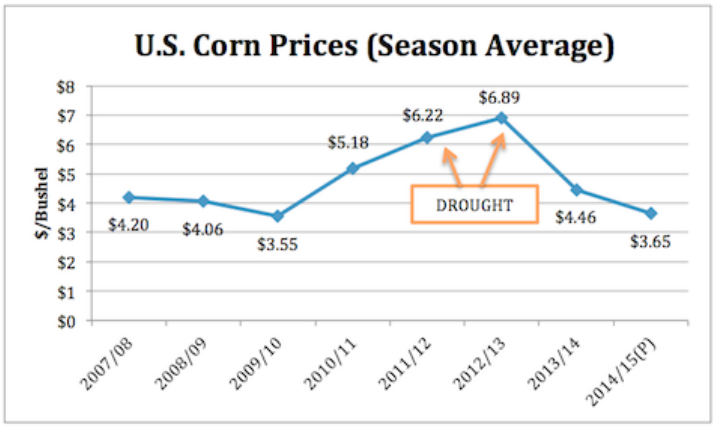
Easy Answers to a Number of Complex Allegations Made Against Biofuels

1. **"Restaurants and the broader food industry are hurting as a result of the RFS."**

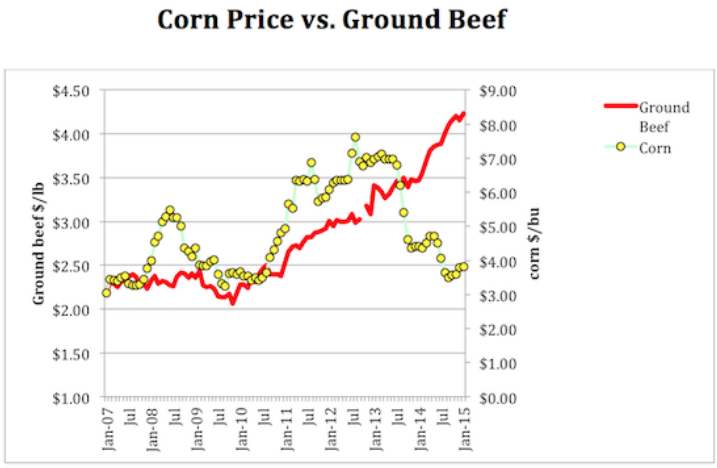
The restaurant industry is not hurting. Chain restaurants, which are outspoken against the RFS, are actually posting some of the best returns in a decade (with the RFS in place).

2. **"Biofuel programs increase feed prices and hurt the livestock industry."**

Corn prices today are lower than corn prices on the day that President Bush signed RFS2 in December 2007. And it does not appear that livestock is suffering. The gross farm value of livestock, dairy and poultry production has increased from an average of $123 billion per year before passage of the RFS to roughly $148 billion per year since 2008. The average profit margin for livestock and poultry values over purchased feed costs has increased by nearly $6 billion per year on average.

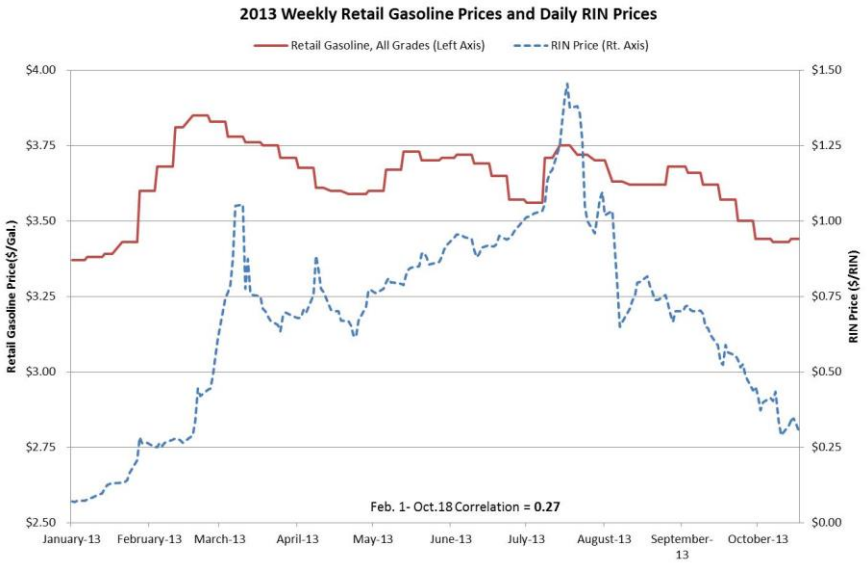


If livestock products like beef are so affected by the RFS and corn prices, why then is the price of beef not coming down with corn prices?



3. The 2013 RFS-RIN price spike showed that the RFS is a liability when it comes to gas prices

Higher RIN prices do not increase gas prices. Many oil companies are now on record on earnings calls attesting to the fact that they are the ones *profiting* from higher RIN values, because they get the RIN for free when they buy a gallon of renewable fuel and can sell it to other obligated parties.[28]

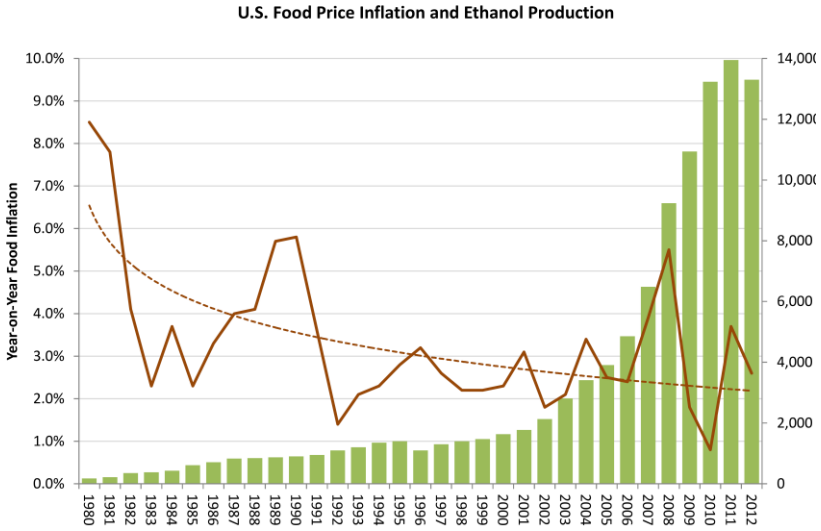


Source: EIA, OPIS

[28] See: http://www.fuelsamerica.org/blog/entry/something-funny-about-those-oil-company-profits

4. "Biofuels have increased food prices in the grocery aisle."

Grocery aisle food prices are not increasing, and they are decreasing *against* increases in ethanol use.

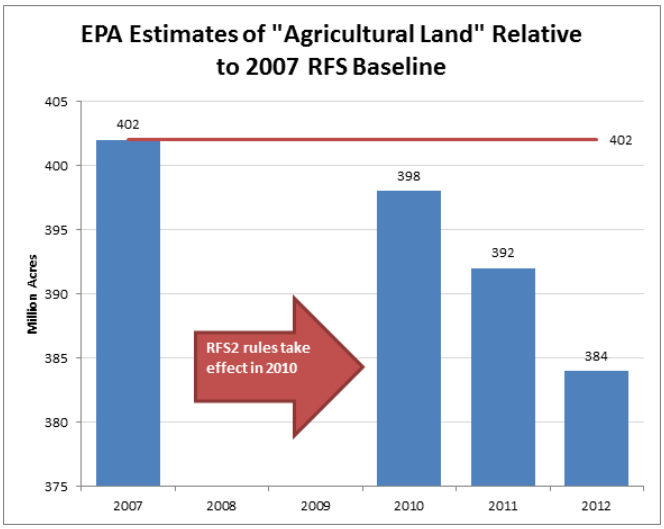


5. "E15 is a threat to boaters and small engines."

E15 is an option at the pump, as opposed to the new baseline fuel, and small engines and boats are not approved to use E15. Boaters and small engine users can simply fill up with other fuel to avoid higher ethanol blends.

6. "The increased use of biofuels has resulted in the plowing of virgin and pristine land."

The national agricultural footprint is not expanding, it's contracting due to efficiency gains.



Update: Total cropland was 336 million acres in 2013 and 340 million acres in 2014 (USDA, 2015)

There is always some regional variation with regard to agricultural land use, but recent allegations about prairie conversion are misleading:

- Critics of the RFS point to reduced acreage in the Conservation Reserve Program (CRP), but acreage in the program went down commensurate with the funding cut in the 2008 farm bill.
- Allegations about "15 million more corn acres planted" are true, but should be considered relative to the more than 20 million acres of wheat taken out of production during the same period. Crops are generally rotating, not expanding.
- Wheat acres dropped more than corn acres increased in the specific states that the Associated Press claimed were using pristine lands for corn ethanol production.

7. "Biofuels do not decrease climate change emissions."

The vast majority of independent analysis (not funded by or associated with the oil industry) confirms that most types of first and second generation biofuels reduce climate change emissions, including analysis conducted by U.S. EPA, the California Air Resources Board, the U.S. Department of Energy and top energy labs such as Argonne and Oak Ridge.

Latest Well-to-Wheels Greenhouse Gas Emissions Reduction
Relative to Average Petroleum Gasoline

WTW GHG emission reductions	Corn	Sugarcane	Corn stover	Switchgrass	Miscanthus
Including LUC emissions	19–48% (34%)	40–62% (51%)	90–103% (96%)	77–97% (88%)	101–115% (108%)
Excluding LUC emissions	29–57% (44%)	66–71% (68%)	89–102% (94%)	79–98% (89%)	88–102% (95%)

Source: DOE Argonne National Laboratory[29]

There are very few studies claiming that biofuels increase carbon emissions. These studies are often oil industry funded or associated with a group funded by the oil industry, and/or rely on questionable assumptions unsupported by the mainstream scientific community.

For example, the "Science" analysis used in recent oil industry television commercials is one conducted in 2008 by an analyst then affiliated with the German Marshall Fund and now affiliated with the World Resources Institute – both oil industry funded groups. The analysis drives a large land use carbon penalty by assuming in the modeling that the U.S. uses *double* the corn ethanol ever required by the RFS. The work is not part of the conversation anymore when it comes to accurate carbon accounting – as higher resolution, independent work has essentially debunked the report.

[29] See http://iopscience.iop.org/1748-9326/7/4/045905/pdf/1748-9326_7_4_045905.pdf

Attachment B
Further Analysis of Gas Price Impact of the RFS

The focal point of the oil industry's attempt to escape their obligations under the RFS is to cast their willful non-compliance with the law as involuntary (i.e. because of the blend wall) and in the interest of protecting consumers (i.e. because higher RIN prices are a "cost of compliance" that will be passed on to consumers). These arguments are not based in fact.

With regard to the ability to blend more renewable fuels, obligated parties can blend more E15 (15% ethanol by content; a high-octane premium fuel approved by EPA for use in two-thirds of the vehicles on the road today), E85 (85% ethanol by content), biodiesel (most engines are warrantied to handle higher biodiesel blends), and/or more renewable diesel. With specific regard to E85, there are enough "flex fuel" vehicles on the road to consume at least 3 billion additional gallons of ethanol if, according to independent analysis, price per mile costs aligned with E10.[30] As discussed, market conditions and higher D6 RIN prices (which happened as a result of the oil industry's affirmative decision not to blend more E85 and E15 notwithstanding the lower price of ethanol) combined to allow E85 prices to be significantly below the wholesale cost of gasoline (including the energy density adjustment). If the underlying question at hand relates to the cost of enforcing the RFS as designed, which we suspect it is, the administration should be reaffirming its commitment to the RFS to save consumers money.

EPA now acknowledges that high RIN prices do not increase gas prices. In a recent memorandum on the subject, EPA states that "the RIN market seems to be functioning generally as expected; providing an incentive for the continued growth of renewable fuels in the transportation fuel market *without causing overall increases to the retail price of transportation fuel."*[31]

As discussed in the EPA memorandum, the RFS basically imposes two realities on the marketplace: (1) the potential cost of paying for RINs if obligated parties choose not to blend more renewable fuel; and, (2) the cost or savings of the qualifying renewable fuel required by the program. Looking at RINs first, higher RIN prices are not costing the American consumer money because RINs enter the marketplace free of charge. For example, a D6 "conventional renewable fuel" RIN is generated with every gallon of renewable fuel produced, and cannot be separated for sale by the renewable fuel producer. RINs are separated for sale *by obligated parties*, so the profit from sale (or cost incurred from purchase) exists within the oil industry. This is why so many oil companies are now on record on earnings calls attesting to the fact that they were the ones *profiting* from higher RIN values in 2013.[32] It is also the reason why no correlation could be found between gas prices and RIN prices during the critical period in 2013 when RIN prices appeared to cause the Obama Administration to change its stance on the RFS. See next page.

[30] See http://www.card.iastate.edu/publications/dbs/pdffiles/13pb15.pdf
[31] Burkholder, Dallas. "A Preliminary Assessment of RIN Market Dynamics, RIN Prices, and Their Effects," U.S. EPA-Office of Transportation and Air Quality (May 14, 2015). Available at: http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2015-0111-0062
[32] For summary of oil companies RIN profits, see: http://www.fuelsamerica.org/blog/entry/something-funny-about-those-oil-company-profits.

Examples of Oil Industry Earnings Call Statements Regarding RINs

American Petroleum Institute — The Mirage: Says its members are getting hit by high RIN prices, the costs of which are being passed through to consumers at a rate of $14 billion per year

- **"RIN prices are near an all-time high … the RFS is a grave economic threat and must be stopped immediately."**
  - Jack Gerard, testimony to Energy and Commerce Committee, July 2013

BP — Says it has profited from RIN trading

- **"We're net long RINs. We've been able to trade into this spike recently and done quite well out of it. I'm very pleased about that."** (http://www.reuters.com/article/2013/07/30/bp-rins-idUSL1N0G00XG20130730)

ExxonMobil — Says that the obligation to purchase RINs has not affected its earnings

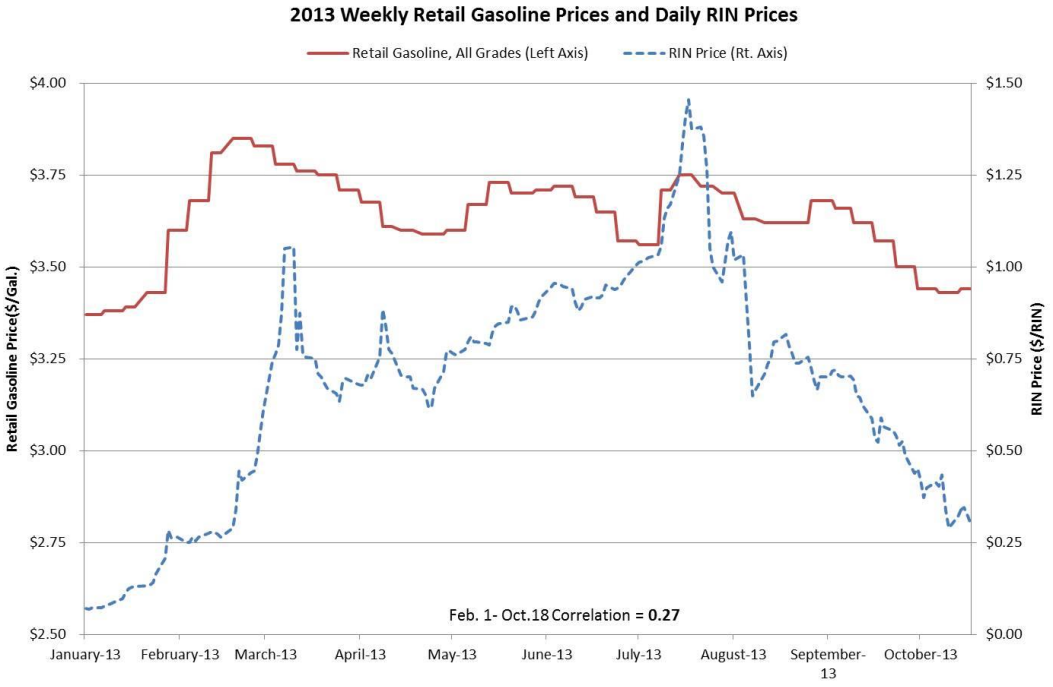
- **"No, not at all."**
  - David Rosenthal, Vice President of Investor Relations & Secretary, when asked by an analyst if RINs had any material impact on ExxonMobil's quarterly financial performance (ExxonMobil 2nd Quarter Earnings Call. 8-1-2013)

Murphy Oil — Says it has profited from higher RIN prices

- Murphy reported the increase in its refining/marketing income in the quarter **was "…primarily due to better results for ethanol production operations and higher sales prices for ethanol renewable identification numbers (RINs) in the current period. …Profit from ethanol RIN sales was higher in 2013 due to significantly stronger sales prices for these credits." (**http://online.wsj.com/article/PR-CO-20130731-916461.html)

Oil Industry Economist — Philip K. Verleger says renewable fuels have saved consumers at least hundreds of billions

- **"The US renewable fuels program has cut annual consumer expenditures in 2013 between $700 billion and $2.6 trillion. This translates to consumers paying between $0.50 and $1.50 per gallon less for gasoline."** (http://www.pkverlegerllc.com/assets/documents/130923_Commentary1.pdf)



Source: EIA, OPIS

With regard to the cost of the qualifying fuel, higher RIN prices have the practical effect of increasing the available supply of affordable liquid fuel during a period of tightness in the global supply of petroleum. As discussed, energy economist Philip K. Verleger (who served as an advisor on energy issues to both the Ford and Carter administrations) recently said, "the U.S. renewable fuels program has cut annual consumer expenditures in 2013 between $700 billion and $2.6 trillion … [t]his translates to consumers paying between $0.50 and $1.50 per gallon less for gasoline."[33] Verleger adds:

> Just as only Richard Nixon could ironically break the US taboo on trading with China, only George W. Bush could have successfully introduced measures to drive down crude prices. These prices today are between **$15 and $40 per barrel lower** than they would be had Congress not endorsed his proposals to boost ethanol production and blending with gasoline. Today, the Bush measures ***add the equivalent of Ecuador's crude oil output to the world market at a time of extreme tightness***." - Oil economist Philip K. Verleger, Jr. (September 23, 2013)

Other assessments have reached a similar conclusion.[34] The most comprehensive is a paper published by former EPA contractor Bruce A. Babcock and Sebastien Pouliet from the Center for Agricultural and Rural Development (CARD), with support from the National Science Foundation, which seeks to "to provide a transparent economic analysis of the impact on consumer fuel prices from mandates that increase the consumption of ethanol;" or, more specifically, "to estimate the impact of RIN prices on the pump price of fuel."[35] CARD has developed a model to predict a range of different market impacts occurring as a result of the RFS. Among other findings, the paper concluded that:

- "… feasible increases in the ethanol mandate in 2014 will cause a small *decline* in the price of E10 [the predominant blend of gasoline in the market today]."

- "… one of the costs that does not need to be considered is an increase in the pump price of fuel, because we show that the most likely outcome from increasing ethanol mandates is a drop in pump prices, not an increase."

- "The oil industry continues to rely on their own commissioned study (NERA 2012) that predicts gasoline producers will have no choice but to cut domestic sales of gasoline to reduce their obligations under the RFS … [t]he study's conclusions – that expansion of ethanol mandates would cause severe damage to the economy – are simply not credible unless EPA were to ignore set mandates at such a high level that they literally could not be met regardless of the level of investment in new fueling infrastructure."

[33] See http://www.pkverlegerllc.com/assets/documents/130923_Commentary.pdf.
[34] See, for example, Cui, J., H. Lapan, G. Moschini, and J. Cooper. (2010). "Welfare impacts of Alternative Biofuel and Energy Policies." American Journal of Agricultural Economics 93(5): 1235-1256.
[35] See http://www.card.iastate.edu/publications/dbs/pdffiles/14pb18.pdf at p. 5.

- "Our results should reassure those in Congress and the Administration who are worried that following the RFS commitment to expanding the use of renewable fuels will result in sharply higher fuel prices for consumers."

- "The reason the oil industry and much of the livestock industry have joined forces against biofuels is one of simple industry economics: their industries would benefit from cheap corn and reduced competition from ethanol."

There are numerous other examples of detailed analysis of the effect of RIN prices on gas prices:

- Irwin & Good of the University of Illinois examined 2012-2013 prices for CBOB, ethanol and D6 RINs to determine the impact of rising RIN prices on retail gasoline prices.[36] They found that "the basic zero sum nature of relationships in the supply chain and recent price trends for CBOB blendstock and ethanol suggests that the impact, if any, has likely been small, at most a few cents."

- In a May 2015 update to a 2014 study, Informa Economics (Attachment 4) concluded that, "Changes in prices of renewable identification numbers (RINs) did not cause changes in retail gasoline prices from 2013 through the first quarter of 2015."[37]

- Analysis by economists at Iowa State University found that "the most likely outcome from increasing ethanol mandates is a drop in pump prices, not an increase."[38] Further, they concluded, "Many in the oil industry have used the specter of higher pump prices to argue against increased mandates. …These findings show that concern about the consumer price of fuel do not justify a reduction in feasible ethanol mandates."

- Retired Yale and Calgary professor Philip Verleger conducted an economic study that concluded the "RIN price impact on retail prices is small and transient."[39] He found that competition in the gasoline supply chain tends to diminish any price increases when refiners or blenders tried to embed the RIN price into E10 prices.

- EIA confirmed the absence of any connection between RIN prices and retail gasoline prices, stating: "To date, there is no evidence that retail gasoline prices have been affected by high RIN prices. While the cost of refined gasoline blendstock can be affected by high RIN prices, the increased cost to gasoline blenders is almost exactly offset in 2013 by their increased

[36] Irwin, S. & D. Good (Mar. 2013), "High Gasoline and Ethanol RINs Prices: Is There a Connection?" Link: http://farmdocdaily.illinois.edu/2013/03/high-gasoline-ethanol-rins-prices.html
[37] Informa Economics, Inc. (May 2015), "Analysis of Whether the Prices of Renewable Fuel Standard RINs Have Affected Retail Gasoline Prices." Link: http://ethanolrfa.3cdn.net/f1c5dfa9ac9743e9f8_csm6bcb8e.pdf
[38] Pouliot, S. and B.A. Babcock (Jan. 2014). Center for Agricultural and Rural Development (CARD); Iowa State University. "Impact of Increased Ethanol Mandates on Prices at the Pump." CARD Policy Brief 14-PB 18. Link: http://www.card.iastate.edu/publications/synopsis.aspx?id=1218
[39] Verleger, P.K., Jr. (Jan. 2014), "The Renewable Fuel Standard: How Markets Can Knock Down Walls." Link: http://www.pkverlegerllc.com/publications/papers/the-renewable-fuel-standard-how-markets-can-knock-down-walls-january-2014-1162/

revenue generated from the sales of RINs separated when they blend ethanol into gasoline."[40]

- A former member of President Obama's Council of Economic Advisers, who took part in the interagency review of the original 2014 RVO proposal, recently found that "…the price of E10 does not vary with RIN prices…" and that RIN prices actually serve to "…decreas[e] the price of fuels with high renewable content (like E85)."[41]

On the critical issue of cost, irrespective of its statutory relevance with regard to EPA's proposal, it is clear that the RFS is engineered to achieve its objectives without increasing pump prices in the immediate term. The program is already creating – and will continue to facilitate – more systemic consumer benefits via its profound impact on reducing foreign oil dependence. Weakening the RFS, on the other hand, will cost consumers at the pump by tightening global liquid fuel supplies, reducing the availability of a cost reductive renewable fuel and exacerbating the impact of speculation.

[40] Presentation by Mindi Farber-DeAnda, EIA Office of Petroleum, Natural Gas, and Biofuels Analysis to Advanced Biofuels Association (Nov. 20, 2013). Washington, D.C.

[41] Stock, James H. (April 2015). Columbia SIPA Center on Global Energy Policy. "The Renewable Fuel Standard: A Path Forward." Available at: http://energypolicy.columbia.edu/sites/default/files/energy/Renewable%20Fuel%20Standard_A%20Path%20Forward_April%202015.pdf