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May 24, 2013

The Honorable Fred Upton
Chairman
Committee on Energy and Commerce
House of Representatives
2125 Rayburn House Office Building
Washington, DC 20515

The Honorable Henry Waxman
Ranking Member
Committee on Energy and Commerce
House of Representatives
2125 Rayburn House Office Building
Washington, DC 20515

Dear Chairman Upton and Ranking Member Waxman,

The American Petroleum Institute (API) appreciates the opportunity to respond to your questions in the House Committee on Energy and Commerce white paper examining the greenhouse gas (GHG) emissions and other environmental impacts associated with the Renewable Fuel Standard (RFS).

For reasons explained below, the RFS failed to deliver the GHG, environmental, and other benefits envisioned by the Energy Independence and Security Act (EISA) of 2007. The RFS has not unfolded as expected, and we agree that several implementation challenges have emerged that received little, if any, consideration prior to passage of EISA. The life-cycle impacts of biofuels on air quality, water, and land were not fully comprehended at the time when the law passed. There is insufficient supply of domestic advanced biofuels, including cellulosic biofuel, and the approaching blendwall could result in severe fuel supply disruptions in the U.S.[1] Meanwhile, the overall energy landscape has changed dramatically. Thanks to technology advances, our nation's energy security is enhanced significantly. According to EIA, U.S. crude and natural gas reserves in year 2022 are projected to be, respectively, 23% and 62% higher than what was projected in 2007. The House Energy and Commerce Committee's review is timely. Congress should repeal the RFS as it has become an infeasible mandate.

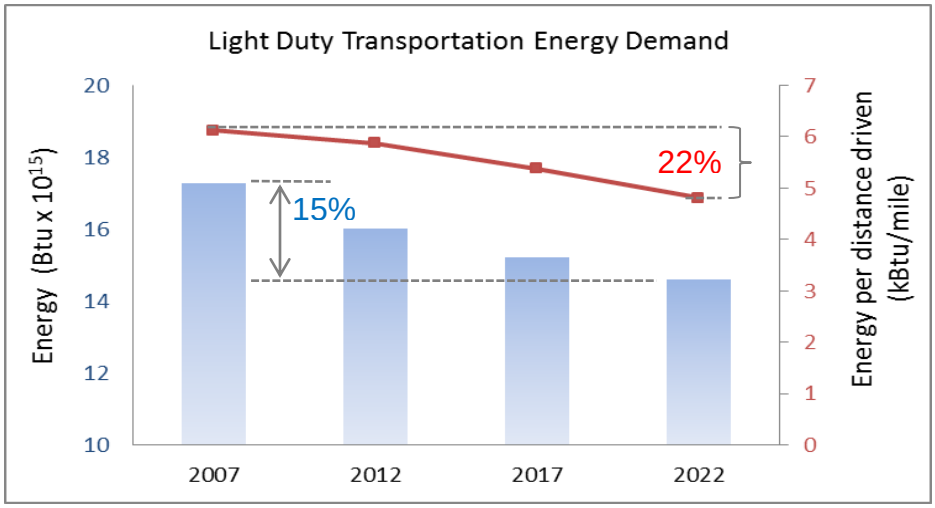
Please find below our responses to the questions for stakeholder input raised in the white paper:

1. **Is the RFS reducing greenhouse gas emissions below that of baseline petroleum-derived fuels? Is the RFS incentivizing the development of a new generation of lower greenhouse gas emitting fuels? Will the RFS produce further greenhouse gas emissions reductions when it is fully implemented?**

   The Renewable Fuel Standard (RFS) is not reducing greenhouse gas emissions (GHG) below that of baseline petroleum-derived fuels.

[1] NERA Economic Consulting, "Economic Impacts Resulting from Implementation of RFS2 Program", October, 2012.

Even though the transportation sector has recently seen a decline in energy demand and associated GHG emissions, these reductions are the result of a decrease in vehicle miles traveled and improvements in vehicle fuel economy, not the RFS. Looking forward, according to EIA data, transportation sector energy demand and associated emissions are projected to decline as a result of vehicle technology improvements, even as vehicle miles driven are projected to increase (see graph below).



The National Academy of Sciences (NAS) study[1] found that "according to EPA's own estimates, corn-grain ethanol produced in 2011, which is almost exclusively made in biorefineries using natural gas as a heat source, is a higher emitter of GHG than gasoline." Based on this statement, one can conclude that in absence of the RFS, it is likely that GHG emissions from the transportation sector would have been lower. Furthermore, NAS concluded that the "RFS may be an ineffective policy for reducing global GHG emissions because the effect of biofuels on GHG emissions depends on how the biofuels are produced and what land-use or land-cover changes occur in the process."[2]

The reason the RFS has not contributed to the reduction GHG emissions to date is that the program has been dominated by corn-grain ethanol. In 2012, according to the EPA, corn-grain ethanol accounted for 85% of the total renewable fuel volume (ethanol energy equivalent basis).[3] As the NAS study notes, "EPA found corn-grain ethanol… to have life-cycle GHG emissions higher than gasoline in 2012 or 2017 unless it is produced in a biorefinery that uses biomass as a heat source (Table 5-4)." The table below from the EPA (Docket number EPA-HQ-OAR-2005-0161-3173) illustrates the fact that greenhouse gas emissions from corn ethanol are almost always higher than those of gasoline.

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[2] National Research Council, *Renewable Fuel Standard: Potential Economic and Environmental Effects of U.S. Biofuel Policy*. Washington, DC: The National Academies Press, 2011.

[3] US Environmental Protection Agency, "2012 RFS2 Data: RIN Generation and Renewable Fuel Volume Production by Fuel Type", available at: http://www.epa.gov/otaq/fuels/rfsdata/2012emts.htm#accordProduction

		Percent Reduction Lifecycle GHG Emisisons								
		2022			2017			2012		
	Time Horizon	30	30	30	30	30	30	30	30	30
	Discount Rate	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Range	Low	Mean	High	Low	Mean	High	Low	Mean	High
Dry Mill NG	**Base Plant (dry DDGS)**	-28%	-17%	-3%	-9%	10%	33%	9%	33%	63%
Dry Mill NG	w/ CHP (dry DDGS)	-31%	-20%	-6%	-13%	7%	30%	5%	30%	59%
Dry Mill NG	w/ CHP and Fractionation (dry DDGS)	-33%	-22%	-7%	-14%	5%	28%	4%	28%	57%
Dry Mill NG	w/ CHP, Fractionation and Membrane Seperation (dry DDGS)	-37%	-25%	-11%	-18%	1%	24%	-1%	24%	53%
Dry Mill NG	w/ CHP, Fractionation, Membrane Seperation, and RawStarch Hydrolysis (dry DDGS)	-41%	-30%	-15%	-23%	-4%	19%	-6%	19%	48%
Dry Mill NG	**Base Plant (wet DGS)**	-39%	-27%	-13%	-21%	-2%	22%	-3%	21%	50%
Dry Mill NG	w/ CHP (wet DGS)	-42%	-30%	-16%	-24%	-5%	18%	-7%	17%	47%
Dry Mill NG	w/ CHP and Fractionation (wet DGS)	-41%	-29%	-15%	-23%	-4%	20%	-5%	19%	48%
Dry Mill NG	w/ CHP, Fractionation and Membrane Seperation (wet DGS)	-44%	-33%	-19%	-27%	-8%	16%	-10%	15%	44%
Dry Mill NG	w/ CHP, Fractionation, Membrane Seperation, and RawStarch Hydrolysis (wet DGS)	-47%	-36%	-22%	-30%	-10%	13%	-13%	12%	41%
Dry Mill Coal	**Base Plant (dry DDGS)**	1%	12%	26%	22%	41%	64%	42%	66%	96%
Dry Mill Coal	w/ CHP (dry DDGS)	-1%	10%	24%	19%	39%	62%	40%	64%	93%
Dry Mill Coal	w/ CHP and Fractionation (dry DDGS)	-9%	3%	17%	12%	31%	54%	32%	56%	85%
Dry Mill Coal	w/ CHP, Fractionation and Membrane Seperation (dry DDGS)	-16%	-5%	9%	3%	22%	46%	23%	47%	76%
Dry Mill Coal	w/ CHP, Fractionation, Membrane Seperation, and RawStarch Hydrolysis (dry DDGS)	-25%	-14%	0%	-6%	13%	36%	12%	36%	66%
Dry Mill Coal	**Base Plant (wet DGS)**	-21%	-10%	4%	-2%	17%	41%	17%	41%	71%
Dry Mill Coal	w/ CHP (wet DGS)	-23%	-12%	2%	-4%	15%	38%	15%	39%	68%
Dry Mill Coal	w/ CHP and Fractionation (wet DGS)	-25%	-13%	1%	-6%	14%	37%	13%	37%	67%
Dry Mill Coal	w/ CHP, Fractionation and Membrane Seperation (wet DGS)	-32%	-21%	-7%	-14%	5%	28%	4%	28%	58%
Dry Mill Coal	w/ CHP, Fractionation, Membrane Seperation, and RawStarch Hydrolysis (wet DGS)	-38%	-26%	-12%	-20%	-1%	23%	-2%	22%	51%
Dry Mill Biomass	Base Plant (dry DDGS)	-51%	-40%	-26%	-34%	-15%	8%	-18%	6%	36%
Dry Mill Biomass	w/ CHP (dry DDGS)	-59%	-47%	-33%	-42%	-23%	0%	-26%	-2%	27%
Dry Mill Biomass	w/ CHP and Fractionation (dry DDGS)	-57%	-45%	-31%	-40%	-21%	2%	-24%	0%	30%
Dry Mill Biomass	w/ CHP, Fractionation and Membrane Seperation (dry DDGS)	-56%	-45%	-31%	-40%	-20%	3%	-23%	1%	30%
Dry Mill Biomass	w/ CHP, Fractionation, Membrane Seperation, and RawStarch Hydrolysis (dry DDGS)	-57%	-45%	-31%	-40%	-21%	3%	-24%	0%	30%
Dry Mill Biomass	Base Plant (wet DGS)	-52%	-41%	-27%	-35%	-16%	7%	-19%	6%	35%
Dry Mill Biomass	w/ CHP (wet DGS)	-59%	-48%	-34%	-43%	-24%	0%	-27%	-3%	27%
Dry Mill Biomass	w/ CHP and Fractionation (wet DGS)	-57%	-46%	-32%	-41%	-21%	2%	-24%	0%	29%
Dry Mill Biomass	w/ CHP, Fractionation and Membrane Seperation (wet DGS)	-57%	-45%	-31%	-40%	-21%	2%	-24%	0%	30%
Dry Mill Biomass	w/ CHP, Fractionation, Membrane Seperation, and RawStarch Hydrolysis (wet DGS)	-57%	-46%	-32%	-40%	-21%	2%	-24%	0%	29%
Wet Mill	with NG	-19%	-7%	7%	-3%	17%	40%	13%	37%	67%
Wet Mill	with coal	8%	19%	33%	24%	43%	66%	40%	64%	93%
Wet Mill	with biomass	-59%	-48%	-33%	-43%	-24%	0%	-27%	-3%	27%
	NG Average	-34%	-23%	-9%	-15%	4%	27%	3%	27%	56%

While the data from NAS Table 5-4 suggest that corn-grain ethanol may in 2022 reach a point where it has lower life-cycle GHG emissions than gasoline through investments in advanced fractionation and use of biomass for biorefinery heat, in the near term, the RFS has increased GHG emissions above the baseline gasoline. This suggests that while overall energy consumption in the transportation sector has decreased, associated reductions in GHGs would likely have been higher had the RFS not been in place. Furthermore, it is unclear whether the above-mentioned biorefinery investments in fractionation and energy needed to reduce GHGs may take place in the future.

Cellulosic biofuels may offer GHG benefits, but the reality is that following decades of research and "technology forcing" legislation (i.e., RFS1, RFS2, and California's Low Carbon Fuel Standard), cellulosic biofuels have failed to become available at a commercial scale that is economically competitive in the existing U.S. transportation fuels market. EIA currently projects less than 500 million gallons of cellulosic biofuels in 2022, less than 3% of the RFS's aspirational mandate of 16 billion gallons. Until significant volumes of cellulosic biofuels are commercialized, GHG benefits from the use of biofuels in transportation will not be materialized, and the aspirational GHG targets of RFS2 will not be achieved.

2. Could EPA's methodology for calculating lifecycle greenhouse gas emissions be improved, including its treatment of indirect land use changes? If so, how?

According to the NAS, life-cycle GHG estimates vary, and "some of the key drivers in differences include:

- The geographic range considered;
- Whether direct or indirect land-use changes were included in the estimates;
- Assumptions used in estimating indirect land use changes…;
- Flux values used for N_2O emissions;
- How GHG credits from coproduct production were estimated;
- Technologies and fossil fuel used in the biorefineries;
- The fraction of DDGS that is dried versus fed wet to livestock; and
- Baseline volume of ethanol production."

To this end, EPA should model uncertainty (i.e., run models with variation in key parameters). NAS studies that address uncertainty in their models have revealed plausible scenarios in which biofuel GHG emission are higher than those of comparable fossil fuels.

Additionally, EPA should continue to include indirect land use changes in life-cycle greenhouse gas emissions analyses. In doing so, EPA should ensure that its methodologies are consistent with the most up to date scientific standards for life-cycle analysis in the field, and seek peer review by academics and the National Academy of Sciences, not just the DOE labs.

3. Is the definition of renewable biomass adequate to protect against unintended environmental consequences? If not, how should it be modified?

The current narrow definition of renewable biomass (especially 1st generation biofuels) results in negative environmental impacts, in addition to GHGs.

To avoid unintended consequences, renewable biomass definition should include a systems based, complete lifecycle well-to-wheels assessment that results in societal benefits via cost effectiveness and positive environmental impacts in areas such as GHGs, air quality, water, eutrophication, land, soil, biodiversity, food and others as outlined by NAS.

To illustrate the point, the current definition of biomass in the RFS includes corn stover as a feedstock for cellulosic biofuels. Corn stover is often left on fields as cover between harvest and planting. It can help preserve and add nutrients to the soil. Removal of corn stover in significant quantities could lead to deterioration of the health of the soil and cause increased run off of pesticides and fertilizers. This could contribute to increased water pollution.

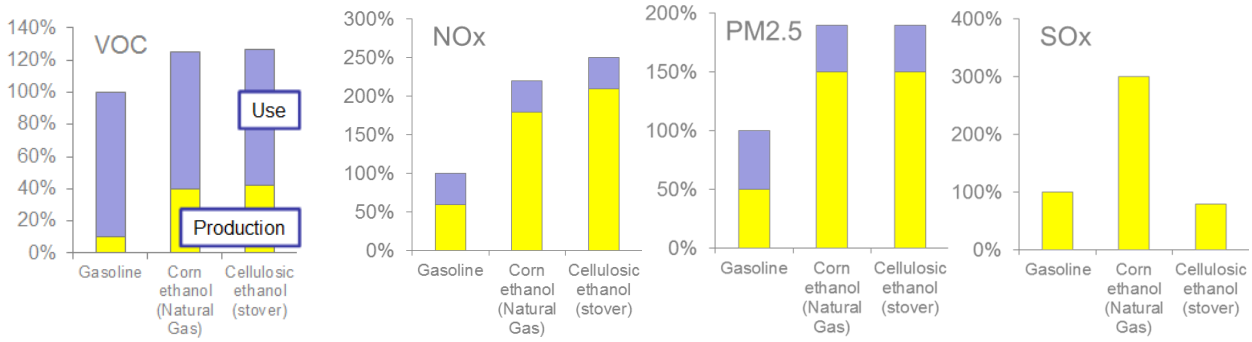
4. What are the non-greenhouse gas impacts of the RFS on the environment relative to a comparable volume of petroleum-derived fuels? Is there evidence of a need for air quality regulations to mitigate any adverse impacts of the RFS?

<u>Air Quality Deterioration</u>
Overall, the expanded use of renewable fuels is generally anticipated to have a variable impact on pollutants. When establishing the expanded RFS2 program in 2010, EPA concluded that pollutants such as hydrocarbons, nitrogen oxides (NOx), acetaldehyde and ethanol would likely increase and others such as carbon monoxide (CO) and benzene were expected to decrease.[4] These emission impacts were anticipated to be highly variable from region to region. The biofuel volumes projected

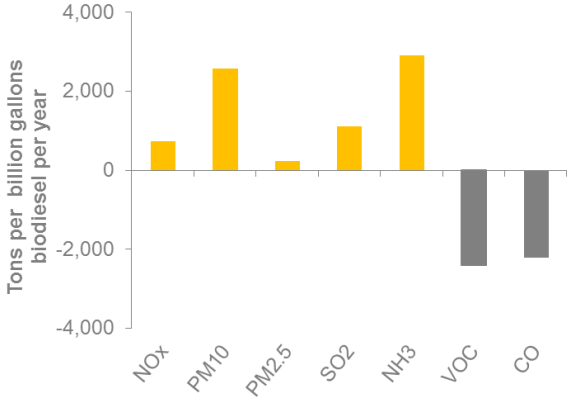
[4] US Environmental Protection Agency, *Renewable Fuel Standard Program (RFS2) Regulatory Impact Analysis*, EPA-20-R-10-006, February 2010.

under RFS2 were anticipated to lead to increases in population-weighted annual average ambient PM and ozone concentrations.

According to the NAS, "for corn-grain ethanol, life-cycle emissions of major air pollutant species (for example CO, NO_X, $PM_{2.5}$, VOC, SO_X, and NH_3) are higher than for gasoline. It is clear from the study and the charts below that the non-greenhouse gas impacts of the RFS are at least as severe as the GHG impacts noted above. Across the board, the RFS has the potential to have significant negative air quality impacts; in fact, standard consumption of gasoline is better in this regard. As the NAS study notes, "studies that have considered the ultimate impacts of biofuels have consistently found corn-grain ethanol to have human health damage costs equal to or higher than gasoline." The charts below reflect the fact that biofuel emissions exceed those of gasoline.



There are similar effects for biodiesel as articulated in the EPA 2013 RFS biomass-based diesel standards rule, and reflected in the chart below, which shows higher net emissions from biomass-based diesel.[5]



<u>Unsustainable land use expansion</u>

Largely because of the massive allocation of corn to ethanol production, the acres planted to corn have increased dramatically since the implementation of the RFS. 78.3 million acres were planted to corn in 2006, the year before the RFS2 was passed, and USDA is projecting 97.3 million acres will be planted to corn this year. These kinds of changes are unprecedented in recent decades, and their overall environmental impacts are unknown. Papers published in the journal of the Proceedings of the National Academy of Science (PNAS) indicate that the biodiversity, water quality and carbon sequestration benefits of lands enrolled in the USDA Conservation Reserve Program may be lost, and that grassland conversion to crop production in the western corn belt is expanding

[5] U.S. EPA, "Regulation of Fuels and Additives: 2013 Biomass-Based Diesel Renewable Fuel Volume; Final Rule." September 27, 2013. http://www.gpo.gov/fdsys/pkg/FR-2012-09-27/pdf/2012-23344.pdf

into marginal lands that are more susceptible to erosion and water quality degradation.[6,7] A 2011 USDA report estimates that on about two-thirds of US agricultural land, fertilizer use fails to conform to best management practices.[8] Much of the additional land put into corn production is thought to be more susceptible to environmental degradation such as soil erosion and runoff of fertilizer and pesticides.

It is difficult to predict the future land and water impacts from the harvesting of biomass feedstocks required to produce the projected 16 billion gallons of ethanol equivalent biofuels mandated by the RFS by 2022. The NAS assesses that there will be insufficient feedstock from forest residue and municipal waste alone to produce 16 billion gallons of ethanol equivalent cellulosic biofuels mandated by the RFS by 2022. NAS further states that between 30 and 60 million acres of additional land might be required to produce these volumes of cellulosic biofuels from agricultural feedstocks. This translates to 15 to 30 times the area of Yellowstone National Park or, at the high end, the area of all US national parks combined.

High water consumption and negative impact on water quality

Including agriculture production water use, ethanol requires significantly higher volumes of water than gasoline; this is reflected in the table below from Argonne National Laboratory.[9] (GGE = Gasoline Gallon Equivalent)

Fuel (feedstock)	**Average Net Water Consumed**
Corn ethanol	**17-239 gallon/gallon ethanol (25-358 gallons water per GGE)**
Switchgrass ethanol	**1.9-9.8 gallon/gallon ethanol (2.8-14.7 gallons water per GGE)**
Gasoline (all crudes)	**2.6-6.2 gallon/gallon gasoline**

Similar peer-reviewed data shows that freshwater use in production of gasoline is significantly less than that of corn ethanol.[10]

The environmental dangers of the RFS are not limited to corn-grain ethanol, or its use in small volume blends. A 2012 peer-reviewed paper by the University of Minnesota compared gasoline to E85 for 12 different kinds of environmental impacts and found that, in the aggregate, E85 blends were from 6% to 108% worse than gasoline, and were worse by 23% on average in the overall sustainability metric.[11] A similar independent study by the premier Swiss research institute, EMPA, showed that for most biofuel pathways, only ozone depletion and climate change were more

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[6] Ilya Gelfanda, et al., "Carbon debt of Conservation Reserve Program (CRP) grasslands converted to bioenergy production." PNAS 2011, 108 (33): 13864-13869

[7] C.K. Wright and M.C. Wimberly, "Recent land use change in the Western Corn Belt threatens grasslands and wetlands." PNAS 2013, 110 (1): 4134–4139.

[8] Marc Ribaudo, et al., "Nitrogen in Agricultural Systems: Implications for Conservation Policy." USDA Economic Research Report No. ERR-127. September 2011. Available: http://www.ers.usda.gov/Publications/ERR127/

[9] M. Wu and Y. Chiu, "Consumptive Water Use in the Production of Ethanol and Petroleum Gasoline – 2011 Update." Center for Transportation Research, Energy Systems Division, Argonne National Laboratory, July 2011.

[10] Joost Schornagel, et al., "Water accounting for (agro)industrial operations and its application to energy pathways." *Resources, Conservation and Recycling*, April 2012, Vol. 61: 1-15.

[11] Yi Yang, et al., "Replacing Gasoline with Corn Ethanol Results in Significant Environmental Problem-Shifting." *Environmental Science and Technology*, 2012 46(7): 3671-3678.

favorable relative to petroleum. Indicators such as eutrophication, acidification, water depletion, eco-toxicity and land use were consistently higher than petroleum fuels for most biofuel pathways.[12] Corn-grain ethanol was one of the poorest performing biofuels in the comprehensive study.

Overall, as shown by these studies, the RFS2 is a good example of "environmental problem shifting" inherent in EPA's current approach on biofuel production, and of EPA's failure to adequately analyze these impacts relative to petroleum fuel production. These findings continue to show that the expected environmental gains from the RFS have yet to be realized, and likely have contributed to increased degradation of air, water and soil resources due to overwhelming reliance on corn ethanol. Furthermore, they suggest that any benefits the RFS held may not materialize given EIA projections of cellulosic production.

Eutrophication

According to the NAS study, "increased cropping area of corn for ethanol production is assumed to exacerbate eutrophication and hypoxia due to the high inputs of nitrogen, phosphorous, and pesticides required for corn production." NAS assumes that with 10.6 t/ha of soil erosion, 4.8 kg of soil are eroded per liter of ethanol produced. The USDA has published their findings of nitrogen impacts to surface and groundwater quality due to biofuel production by 2015 that shows continued increases in impacts above the baseline.[13] A 2008 paper published in PNAS predicted that meeting the corn ethanol mandates of the RFS2 would prevent EPA from making progress in its goals to reduce water quality impacts (e.g., hypoxia, eutrophication) of nitrogen in the Upper Mississippi River Basin and the Gulf of Mexico.[14]

Contamination of surface and groundwater with fertilizers and pesticides continues to have extensive deleterious effects in most of the Midwestern US in addition to the often-noted Gulf of Mexico hypoxic zone, and soil erosion also continues to degrade these landscapes and associated waterways. Overall, there is insufficient recognition of the huge water quality impacts that are widespread in rivers, streams, lakes and ponds throughout the Midwest. These problems were highlighted in EPA's recent draft "National Rivers and Streams Assessment: 2008-2009".

5. Has implementation of the RFS revealed any environmental challenges or benefits not fully anticipated in the statute?

The environmental effects of the RFS described above may have not been fully comprehended when EISA was enacted. Starting with the grandfathering of existing ethanol plants, ethanol use had higher life-cycle GHG emissions than gasoline in 2011, and likely continued through the present. Additionally, the impacts of ethanol on the water supply, in terms of both quality and use, as well as the atmosphere were not fully comprehended until the NAS report in 2011 highlighted significant concerns as described in previous sections. These greenhouse gas and other environmental issues are exacerbated by the unlikely prospects for any significant commercial cellulosic biofuel production in the near future. The RFS was designed to have payoffs toward the end of the program, as the aspirational GHG benefits were expected to be provided by significant

[12] EMPA, "Harmonisation and extension of the bioenergy inventories assessment." 2012

[13] USDA, "Surface-Water and Groundwater Impacts of Meeting Biofuel Targets Vary by Region." http://www.ers.usda.gov/topics/farm-economy/bioenergy/findings.aspx#impacts

[14] Simon D. Donner and Christopher J. Kucharik, "Corn-based ethanol production compromises goal of reducing nitrogen export by the Mississippi River." PNAS 2008, 105(11):4531-4518.

growth in the volumes of low GHG-emitting cellulosic biofuels that the program was intended to incentivize. Without these fuels, the RFS will continue to be an environmental burden.

6. What is the optimal percentage of ethanol in gasoline? What is the optimal percentage of biomass-based diesel in diesel fuel?

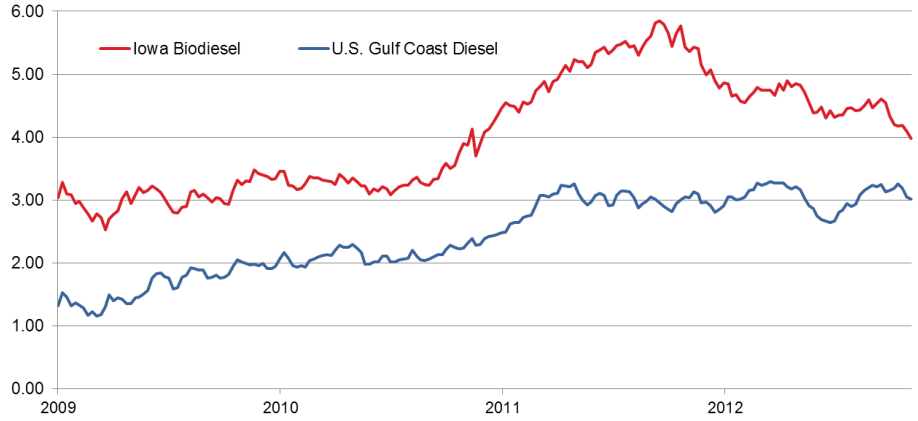
The RFS mandates the use of both ethanol and biodiesel. Currently, nearly all gasoline sold in the U.S. is blended with up to 10% ethanol by volume (E10). The vast majority of gasoline-fueled vehicles on the road, as well as the existing fuel distribution infrastructure (excluding pipelines) has been designed, certified and warranted to function properly using motor gasoline containing no more than 10% ethanol by volume. Fuel suppliers use ethanol at blends of up to 10% in consideration of many factors, including ethanol mandates, government regulatory and industry fuel specification requirements and standards, vehicle technology and fuel delivery infrastructure compatibility constraints, consumer expectations regarding vehicle performance and operating cost, and market price signals.

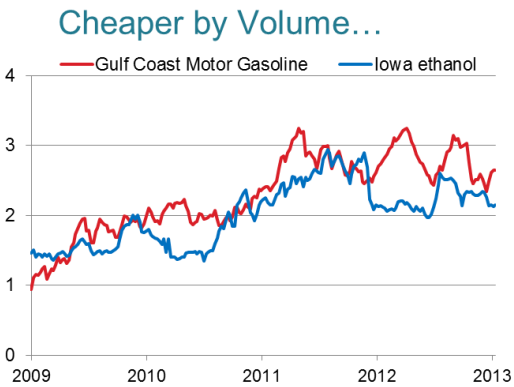
Fuel suppliers frequently blend biodiesel into petroleum diesel, at volumes of up to 5% for similar reasons. The ASTM International specification for conventional diesel fuel, D975, allows up to 5% biodiesel in conventional diesel fuel. And, most diesel engine/vehicle manufacturers approve the use of B5 and lower blends, as long as the biomass-based diesel portion of the blend meets the ASTM International specification D6751 and/or EN14214. The use of B5+ biodiesel blends is tempered by at least two key ongoing issues: the oxidative stability of the fuel (a fuel storage concern)[15], and low temperature operability impacts (an engine performance concern arising from the increased potential for fuel filter plugging due to wax buildup and/or reduced fuel flow under cold ambient conditions).

It is clear from the current use of ethanol and biodiesel that fuel suppliers view biofuels as products which have the potential to add value. The perception of having the potential to add value, however, does not suggest that a mandate like the RFS is an appropriate or needed program. Continuing to force consumption of biofuels under the mandate of the RFS could have negative environmental consequences as noted above. Additionally, because biofuels have been more expensive than their petroleum based counterparts, continuing the mandate could have negative economic consequences as can be deduced from the historically higher prices of ethanol and biodiesel reflected in the EIA charts below. Finally, continuing the mandate could result in mechanical problems. For instance, exceeding E10 with the use of gasoline blended with higher levels of ethanol, e.g., 15% ethanol (E15) by volume, not only carries the risk of infrastructure compatibility and long-term engine durability problems, but has more recently been shown to cause vehicle fuel system breakdowns. [16]

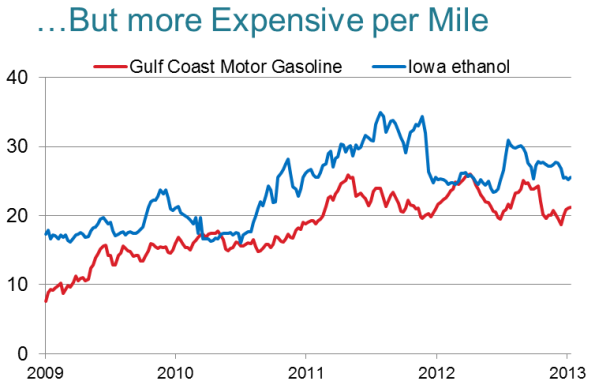
[15] Terry, B., McCormick, R., and Natarajan, M., *Impact of Biodiesel Blends on Fuel System Component Durability*, SAE Technical Paper 2006-01-3279, 2006, doi:10.4271/2006-01-3279.

[16] See, for example, the letter from Robert L. Greco III, American Petroleum Institute, to Vice Chairman Chris Stewart and Ranking Member Suzanne Bonamici, House Committee on Science Space and Technology, Subcommittee on Environment, dated February 26, 2013.





Gasoline and ethanol prices and ethanol margins
Dollars per gallon



Gasoline and ethanol prices and ethanol margins
Dollars per million Btu

7. What are the best options for substantially further reducing greenhouse gas emissions from the transportation sector? Is the RFS an important component of such efforts?

Based on projections from the US Energy Information Administration, *2013 Annual Energy Outlook*, Reference Case Scenario, total greenhouse gas emissions from the transportation sector are projected to decline to a low 2030, before recovering by 2040. This trend is driven largely by changes in greenhouse gas emissions from highway vehicles. Key factors underlying this trend for highway vehicles include the recently promulgated CAFE/GHG requirements for model year 2017-2025 light-duty vehicles as well as the recently issued GHG standards for heavy-duty vehicles.

According to the EPA, there are a number of options for further reducing greenhouse gas emissions from the transportation sector. The "best" option must be determined through careful evaluation of technical feasibility, overall costs and benefits, and relative cost-effectiveness, as well as an assessment of the political will to implement a given approach. The RFS is not an important component of such efforts. To reiterate our answer to question #1 above, the RFS has potentially minimized the contribution to recent reductions in overall GHGs from the transportation sector, and

> it is not expected to make a meaningful impact in the near future, given the lack of commercial scale production of cellulosic biofuels. The RFS requires blending of ethanol in gasoline at levels much higher than the 10% limit used in the design, certification, and warranties of the vast majority of vehicles and fuel retail infrastructure to date. As we indicated earlier in responding to congressional questions regarding blend wall/fuel compatibility issues with the RFS, API believes that this federal mandate is irretrievably broken, unworkable in practice and should be repealed.[17]

As previously stated, the RFS contains unfulfilled aspirational goals and numerous unintended environmental consequences and other adverse impacts. Again, we appreciate the opportunity to provide these responses. If you have any questions, please don't hesitate to contact us.

Sincerely,

Bob Greco
Group Director: Downstream and Industry Operations

API is a national trade association that represents all segments of America's technology-driven oil and natural gas industry. Its more than 500 members – including large integrated companies, exploration and production, refining, marketing, pipeline, and marine businesses, and service and supply firms – provide most of the nation's energy. The industry also supports 9.2 million U.S. jobs and 7.7 percent of the U.S. economy, delivers $86 million a day in revenue to our government, and, since 2000, has invested over $2 trillion in U.S. capital projects to advance all forms of energy, including alternatives.

[17] American Petroleum Institute, *Responses to the House Energy and Commerce Committee Questions for Stakeholder Comments, White Paper Series on the Renewable Fuels Standard: Blend wall/Fuel Compatibility Issues*, April 5, 2013.