The Honorable John Shimkus

1. What are the main regulatory barriers that are preventing the growth of Advanced Biofuels in America?

2. Is there a potential future scenario where Advanced Biofuels could successfully compete and participate in the market without the Renewable Fuel Standard?

3. What are your views on the EPA's 2016 proposed Renewables Enhancement and Growth Support (REGS) Rule?

The Honorable Richard Hudson

1. In 2007 RFS envisioned advanced biofuels eventually overtaking first generation biofuels and comprising most of the qualifying fuels in the program-- 21 billion gallons out of 36 billion by 2022. Why haven't we met that projection and do you believe we will?

You mention in your testimony that technology is commercially ready to produce up to 75 billion gallons of cellulosic biofuels.

2. What technical feasibility issues stand in the way of deploying this technology?

3. What are the economic feasibility issues that are presented by this technology?

4. What will be the price and quality impact to consumers from this fuel?

QUESTIONS FROM THE HONORABLE JOHN SHIMKUS

1. What are the main regulatory barriers that are preventing the growth of Advanced Biofuels in America?

Thank you for the question. Because motor fuel markets are regulated markets – as opposed to free markets – the growth of advanced biofuels is highly sensitive to regulatory market signals. The biggest regulatory issue in the 2013-2016 timeframe was EPA's failure to enforce the law (i.e. set and enforce annual blending requirements). We appreciate that EPA is now enforcing the program on schedule. However, the growth of advanced biofuels depends on resolving additional issues:

a. Fuel Registration – To be RFS-eligible, each advanced biofuel plant must register its fuel (to certify compliance with an RFS-eligible pathway) with EPA. There is an ongoing logjam at EPA when it comes to fuel registration for key commercial-ready technologies. For example, numerous companies are ready to commercialize cellulosic ethanol made from corn kernel fiber at existing corn ethanol plants across the country. EPA must be able to differentiate ethanol made from corn starch and corn fiber at the same plant to track RFS compliance. It would be

unrealistic to expect EPA to adopt compliance protocols for new technologies overnight. However, some technologies have been waiting for fuel registration for two years or more. We are told that some applicants have not received registrations for the same technology already approved at a different production facility. It appears that EPA is holding up all corn fiber registrations to resolve technical issues involving individual registrations, based on the fact that none have come through in some time. The technical questions being looked at by EPA are the right ones to focus on. However, the regulation allows individual registrations to be approved via peer-review (i.e. using outside expertise) if EPA has not yet completed a uniform protocol. The idea is to prevent new technologies from "dying on the vine" while EPA establishes cross-sector eligibility protocols. Because large investments have been made, it is absolutely critical that EPA move quickly on fuel registrations. There is a very real risk that some companies could fail – or go overseas – if they cannot get their product registered for market. EPA staff have made great strides to resolve fuel eligibility issues in recent years. But it is critical to avoid delay among commercial-ready fuels during very challenging economic times in rural America.

b. Waivers and Exemptions - At its core, particularly regarding cellulosic/advanced biofuels, the RFS is an adjustable mandate that allows EPA to account for uncertainty associated with financial markets and the development of new technologies. Due to multiple market variables, we are now in a situation in which EPA has been issuing Small Refinery Exemptions (SREs) – thereby depressing the total RFS volumetric blending requirements. The issue with SREs is not that they are offered to refineries facing economic hardship; but rather, that they are now being offered to some of the largest, most profitable oil refineries in the world. The cumulative impact of SREs in recent years is a reduction in biofuel blending by ~2 billion gallons, across all fuel types. The practical effect of the overuse of SREs is to create a supply glut of RFS-eligible fuel, which in turn depresses biofuel prices, destabilizes the biofuels industry and reduces investment in next generation biofuels. While triggered by concern about RIN prices in the conventional biofuel pool, the trickle-down effect of the over issuance of SREs is very real. On top of SREs, EPA also issues cellulosic waiver credits (CWCs) allowing obligated parties to "paper out" of their cellulosic biofuel obligations (by buying credits for a set price). EPA's current approach to administering the cellulosic biofuel compliance pool is to provide a forecast of expected cellulosic biofuel production capacity together with the issuance of CWCs in a number equal to the Renewable Volume Obligation (RVO). In other words, if the annual RVO for cellulosic biofuels is 400 million gallons, obligated parties know that there will 400 million CWCs also available to them if they arrange to procure *zero* liquid cellulosic biofuels. EPA does not require obligated parties to show cause for needing CWCs. There is nothing in the regulation that requires obligated parties to make a good faith effort to secure liquid D3 gallons instead of CWCs on a year to year basis. As such, obligated parties have the option to buy a predictable, risk-free, condition-free, government-backed waiver as an alternative to buying liquid D3 gallons that would facilitate the RFS. Taken together, SREs and CWCs over-supply RFS markets, destroy biofuel demand and discourage investment in advanced biofuels. The Council recommends that EPA only issue SREs to small refineries facing real economic hardship. The Council has also asked EPA to provide some limitations on CWC issuance (e.g. limit the number of CWCs available to a percentage of actual production that year, require

obligated parties to certify that a good faith effort has been made to secure liquid cellulosic biofuels, etc.). These waivers do not need to be eliminated in order for advanced biofuels to succeed. But SREs and CWCs cannot be issued in such a way as to destroy demand.

c. Unnecessarily Constrained Markets – The Council represents companies producing a wide variety of advanced biofuels and chemicals, including cellulosic ethanol, biodiesel, biogas and bio-jet fuel. On the ethanol side, we represent some of the largest cellulosic ethanol – and advanced biofuel enzyme – production facilities in the world. Unnecessarily constrained markets for any of these advanced biofuel types discourages investment and drives innovation to foreign markets where market demand is more dependable. The best example of unnecessary regulatory constraint is the one related to ethanol blending and Reid Vapor Pressure (RVP). RVP parity is well-understood to be sought by the first-generation ethanol industry. However, advanced ethanol needs market head room to attract investment and grow. We are pleased that the Trump Administration is moving forward with plans to create RVP parity for higher ethanol blends. This one regulatory clarification would: (a) provide instant downward pressure on D6 RIN prices, which in turn would provide regulatory relief for petroleum refineries choosing to buy RINs instead of blending renewable fuels; (b) create instant market headspace for second-generation ethanol producers, who need to show growing ethanol markets to optimize investment in cellulosic biofuels; (c) unleash a new wave of innovation and manufacturing across America as investment flows into second-generation ethanol; and, (d) increase consumer choice at the pump with a cheaper, domestically-produced motor fuel to keep fuel prices down and money in the pocket of American consumers. Some environmental NGOs have argued that the cellulosic ethanol industry does not need a growing overall ethanol marketplace to succeed since second generation ethanol can theoretically displace first-generation ethanol in a constrained marketplace. This is a well-meaning but illogical argument for two primary reasons. First, as shown in a recent Third Way report, most cellulosic ethanol first movers are also first-generation ethanol producers.[1] As such, any policy that requires second-generation ethanol production to displace first-generation ethanol essentially requires cellulosic ethanol first movers to cannibalize their current business model. Ethanol companies are not going to innovate to undercut their own existing technology any more than solar and wind companies would invest hundreds of millions of dollars in better panel and turbine technology if they were only allowed to displace existing solar panels and wind turbines. Second, the primary objective of U.S. ethanol policy – embodied in part by the Energy Independence and Security Act of 2007 – is to reduce the use of foreign oil (i.e. energy independence and security rather than independence from U.S. production of first-generation biofuels). Many of the proponents of the replacement of first-generation ethanol with second-generation ethanol cite climate change concerns as the basis of the position (i.e. because cellulosic ethanol has a better carbon footprint than corn ethanol). However, it is unclear how it is more prudent climatologically to displace corn ethanol (recently assessed by USDA to be 43 percent better than petroleum on a

[1] See http://www.thirdway.org/report/cellulosic-ethanol-is-getting-a-big-boost-from-corn-for-now

full lifecycle basis) rather than petroleum derived from tar sands (~20 percent more carbon intensive than average petroleum) or other increasingly carbon-intensive oil types with cellulosic ethanol. [2]

2. Is there a potential future scenario where Advanced Biofuels could successfully compete and participate in the market without the Renewable Fuel Standard?

Thank you for the question. The RFS is not a distortive mechanism on an otherwise price-driven, free market. Global oil and domestic motor fuel markets are not free markets. The RFS is a corrective mechanism that opens up the petroleum supply chain and provides an economic incentive to blend increasing amounts of biofuels. To illustrate the point, ethanol is currently the cheapest form of octane in the marketplace by more than $1 per gallon. And yet, oil companies are not using more than 10 percent ethanol. If the ethanol industry had the privilege to compete based on price – i.e. free of government intervention – then higher ethanol blends like E15 (certified for use in 95 percent of the passenger vehicles on the road today) would be in high demand. Instead, the oil industry generally only uses as much ethanol as they are forced to by energy security and environmental policies. Ethanol prices are at historic lows due to over-supply in a constrained marketplace. In theory, a free market is conceivable. However, it would require addressing the open price-fixing collusion that is the mission of the Organization of the Petroleum Exporting Countries (OPEC). It would require eliminating inequities in the U.S. tax code that favor oil and gas exploration and production (e.g. percentage depletion allowance, expensing of intangible drilling costs, Master Limited Partnerships (MLPs), etc.). And it would require more aggressively enforcing laws designed to prohibit anti-competitive behavior at the retail level. Irrespective of the non-competitive nature of the marketplace, enacting laws to promote energy and economic security has always been a priority for federal lawmakers. The RFS is very effective at achieving these outcomes.

3. What are your views on the EPA's 2016 proposed Renewables Enhancement and Growth (REGS) Rule?

Thank you for the question. There are a number of important advancements contained in the REGS rule. We support EPA's ongoing efforts to include additional biofuels under the RFS (including but not limited to bio-intermediates, sustainable wood, etc.). On the bio-intermediates side, we do not think a separate compliance regime is necessary. Environmental regulations – especially those designed to displace petroleum products – should not be so burdensome as to discourage the intended outcome of the law. We very much support the inclusion of several new pathways, including but not limited to qualifying cellulosic biofuels made from fast-growing hybrid poplar and willow. Finally, we support and appreciate EPA's proposal to update its fuel regulations to define fuel blends containing 16 to 83 volume percent ethanol as ethanol flex fuel. Such as effort would help attract investment and increase demand for advanced ethanol, while also providing consumer choice at the pump and facilitating the statutory goals of the RFS.

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[2] See https://www.usda.gov/oce/climate_change/mitigation_technologies/USDAEthanolReport_20170107.pdf; http://www.businessinsider.com/canadas-oil-sands-produce-20-more-greenhouse-gases-2015-6; and, http://www.ibtimes.com/us-shale-oil-boom-when-it-comes-co2-emissions-not-all-crude-oil-created-equal-1843616.

QUESTIONS FROM THE HONORABLE RICHARD HUDSON

1. In 2007 RFS envisioned advanced biofuels eventually overtaking first generation biofuels and comprising most of the qualifying fuels in the program – 21 billion gallons out of 26 billion by 2022. Why haven't we met that projection, and do you believe we will?

Thank you for the question. The U.S. biofuels industry is little more than a quarter century old. And yet, it is now the one of the largest employers in the U.S. renewable *energy* sector by some estimates. For example, the International Renewable Energy Agency estimates that of the ~ 806,000 Americans employed by the renewable energy sector in the United States, more than 283,000 of them are employed by the liquid biofuels industry (more than any other renewable energy sector including solar and wind).[3] Other analysis shows higher U.S. renewable fuel employment numbers,[4] but the point is the same: the U.S. renewable fuel industry is a vital part of the U.S. manufacturing sector with the potential to do even more to reduce foreign oil dependence, create jobs and commercialize cleaner fuels.

The statutory vision of the RFS was for advanced biofuels to constitute 21 of 36 billion gallons by 2022 (~58 percent of the total). Today, advanced biofuels constitute roughly 4.88 of 19.88 billion gallons (~25 percent of the total). This is a tremendous achievement given the unexpected market and regulatory conditions we have faced since 2007, including but not limited to: (1) a 100-year recession starting almost immediately after the passage of RFS2 in 2007; (2) the more than two years it took for the (highly complicated) RFS rule/regulation to be finalized in 2010; (3) the non-enforcement of the RFS from 2013-2016; and, (4) the massive uncertainty and demand destruction stemming from midstream proposals to change the rules of the RFS (e.g. export allowance) and the huge uptick in Small Refinery Exemptions (SREs) issued in 2016-2018.

There have been some technical challenges and market shakeouts related to those challenges. However, we are now seeing the best technologies rise to the top. The challenge going forward is persevering through times of regulatory and policy uncertainty and getting to the part of the commercial learning curve that produces even better results. This latter point is an important one. Innovators can secure amazing advancements in the lab and in demonstration phases (e.g. 80 percent price reductions for the enzymes needed to produce advanced biofuels). But the last and arguably most critical stage of development comes as a direct result of replicating the successes at commercial scale; or more specifically, securing efficiencies that can only be achieved with economies of scale. That is where most early-commercial and commercial-ready cellulosic technologies are today. The cellulosic biofuels

[3] See http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Jobs_Annual_Review_2017.pdf and http://m.dailykos.com/story/2017/5/31/1667650/-U-S-needs-to-accelerate-growth-in-green-jobs-by-treating-climate-change-like-the-crisis-of-WWII.

[4] See https://fuelsamerica.org/resources/fuels-america-releases-new-footprint-analysis/.

industry will succeed in producing massive quantities of fuel if we can create more political stability around the program and clear regulatory and red-tape logjams at EPA.

You mention in your testimony that technology is commercially ready to produce up to 75 billion gallons of cellulosic biofuels …

2. What are the technical feasibility issues that stand in the way of deploying this technology?

Thank you for the question. There is no "one issue fits all" when it comes to cellulosic biofuel technology. Some companies are already producing cellulosic biofuels at commercial scale in the United States, Canada, Europe and other regions. The closest thing to a universal challenge that we face is related to the "front end" of the biomass conversion process. My testimony referenced the National Renewable Energy Laboratory (NREL) estimates for the *potential* commercial capacity of cellulosic biofuels to illustrate the point that the United States contains massive quantities of cellulosic biomass material that could be converted into fuel energy without displacing existing markets. The challenge is in perfecting the technologies necessary to break down tough cellular plant material into more easily fermentable biomass. Some of the challenges are very easy to understand (e.g. dirt/stone in baled biomass) and take time to resolve. Others – e.g. variability in output – are more technical in nature. The RFS is the key to unlocking the potential of cellulosic biofuels because the investment flows backwards from the anticipated market opportunity created by the RFS. To illustrate, the oil fracking industry has testified before Congress that the key to making oil and gas fracking technology a commercial reality was advantageous federal tax provisions offered to oil and gas that allowed fracking innovators to recover the costs associated with failure and reinvest them into eventual success.[5] This tax certainty for oil and gas was a linchpin to success in the same way that the economic incentive to blend more biofuels (provided by the RFS) is the linchpin to the commercial deployment rates of cellulosic biofuels. As discussed above, innovators can secure amazing advancements in the lab and in demonstration phases (e.g. 80 percent price reductions for the enzymes needed to produce advanced biofuels). But the last and arguably most critical stage of development comes as a direct result of replicating the successes at commercial scale; or more specifically, securing efficiencies that can only be achieved with economies of scale. That is where most early-commercial and commercial-ready cellulosic technologies are today.

3. What are the economic feasibility issues that are presented by this technology?

Thank you for the question. The economics of advanced biofuels depends on many variables, including the cost of a barrel of oil relative to the production cost of advanced biofuels. Conventional ethanol is already $1 per gallon cheaper than wholesale gasoline. But the savings of using ethanol are more significant than that because the ethanol replacement cost of octane (i.e. the cost of alternative non-ethanol octane enhancers such as aromatics/alkylates, etc.) is higher than the wholesale cost of gasoline. Cellulosic ethanol – for example – is in some cases already cheaper than its competitors in the gasoline octane industry. The biggest challenge that we face as in industry is *irrespective of the economics* how do we convince our competitors in the oil industry to blend biofuels? Global oil and domestic motor fuel markets are not free markets. The RFS is a corrective mechanism that opens up the petroleum supply chain and provides an economic incentive to blend increasing amounts of biofuels. To

[5] https://archives-energycommerce.house.gov/sites/republicans.energycommerce.house.gov/files/Hearings/EP/20120913/HHRG-112-IF03-WState-HammH-20120913.pdf

illustrate the point, ethanol is currently the cheapest form of octane in the marketplace by more than $1 per gallon. And yet, oil companies are not using more than 10 percent ethanol. If the ethanol industry had the opportunity to compete based on price – i.e. free of government intervention – then higher ethanol blends like E15 (certified for use in 95 percent of the passenger vehicles on the road today) would be in high demand. Instead, the oil industry generally only uses as much ethanol as they are forced to by energy security and environmental policies. Essentially, the top slate of cellulosic biofuel technologies has achieved commercial-ready or early-commercial economics. But that achievement is different than convincing the oil industry to sign long-term offtake agreements to buy cellulosic biofuels. The RFS solves the latter problem.

4. What will be the price and quality impact to consumers from this fuel?

Thank you for the question. The price impacts are discussed above. The most common biofuel – ethanol – is almost $1 per gallon cheaper than gasoline as of November 2018. It is also important to note that – irrespective of pump price – more consumer dollars spent on domestically produced biofuel means more consumer dollar recirculation through state and national economies, more jobs and more economic growth.

Fuel quality is tightly regulated. Ethanol producers must produce to an ASTM specification, and conventional/advanced ethanol is chemically the same irrespective of feedstock. This is also true for biodiesel and renewable diesel. The obvious challenge going forward – if consumers are introduced to greater choice at the pump – is consumer education and the avoidance of misfueling. The risk reward ratio is good for the economy and the consumer, because the new fuels coming online today are either cheaper than gasoline (e.g. E15/E20) or recirculate more consumer dollars through U.S. economies (as opposed to being exported to OPEC countries) – or both. E15 blends, which are certified for use in ~95 percent of the vehicles on the road today but are not suitable for small engines, have an orange warning label next to the pump. Consumers should be familiar with looking before they pump as diesel fuels have been available on the same pump island for decades.