Testimony of Chet Thompson, President and CEO, American Fuel & Petrochemical Manufacturers

U.S. House Energy and Commerce Subcommittee on the Environment

High Octane Fuels and High Efficiency Vehicles: Challenges and Opportunities

April 13, 2018

The American Fuel & Petrochemical Manufacturers ("AFPM") appreciates the opportunity to provide testimony on the opportunities and challenges with high octane fuels and vehicles. AFPM believes that there is potential for a transition from the Renewable Fuel Standard ("RFS") to a fuel-neutral, 95-RON octane performance standard that could better address the needs of all stakeholders: the auto industry, marketers, biofuel producers, refiners, and most importantly consumers. But given the enormity of the investments that would be required of the refining industry, implementing a 95-RON octane performance standard could only be done in lieu of—not in addition to—the RFS.

The introduction of a high-octane fuel would raise many challenges and thus is not something that the refining industry takes lightly or is ready to fully endorse at this point. Nevertheless, the refining industry sees enough potential in the concept to further explore it as part of more rational and harmonized fuel and vehicle policies. Existing policies intended to improve the fuel economy of the transportation fleet, increase energy security, and support U.S. farm communities are simply not working as intended.

U.S. automakers are struggling to develop economically viable strategies for complying with increasingly stringent fuel economy standards, while still producing vehicles that comport with consumer preferences. They are forced to manufacture vehicles that consumers do not want or

are too expensive for most to afford. They are caught in the middle of overlapping and competing authorities that make one national program difficult.

The RFS is not working as originally intended, either. Although corn ethanol and biodiesel production have increased over the last decade, they have done so at great expense to consumers and the U.S. refining industry. Renewable Identification Number ("RIN") prices have skyrocketed as the United States approached and hit the E10 blendwall. For most refiners, RFS compliance costs now dwarf many other expenses, threatening the long-term viability of many. The program is riddled with uncertainties, inefficiencies, and fraud. Uncertainties will continue to grow as we move closer to the transition of the program to the full discretion of EPA after 2022.

The conventional ethanol industry cannot extract much more out of the RFS. It has already achieved its maximum mandate of 15 billion gallons and its mandated volumes can only go down at this point. The ethanol industry must look to other avenues to grow its market share.

This is where high octane fuels come in. If done correctly—through free market principles, the sunsetting of the RFS, and implemented over a reasonable phase-in period—higher octane fuels have the potential to benefit all stakeholders. Higher octane fuels, specifically 95-RON, would help auto companies improve the efficiency of the internal combustion engine and comply with fuel efficiency standards. It would provide the biofuel industry with the opportunity to expand its market share. It would end the RFS for refiners and provide product flexibility for the marketers. And it could benefit consumers by creating a transparent and competitive market for all liquid fuels to compete.

AFPM is uniquely qualified to address many of these issues, as our members operate approximately 120 refineries, representing more than 95 percent of U.S. refining capacity. AFPM's members produce the gasoline, diesel, jet fuel, and building blocks for the thousands of products that make innovation and progress possible.

The following written testimony summarizes some of the opportunities and challenges associated with high octane fuels.

1. **AFPM supports a legislative process to reform and eventually sunset the RFS program**. The RFS is characterized by litigation, waivers, volatile RIN prices, phantom fuels, and fraud—issues that will only get worse and more uncertain as the mandates rise and as EPA considers volume resets and a post-2022 regulatory environment where no stakeholder knows how the program will be administered.

2. **There is an opportunity for a transition from the RFS to a fuel-neutral 95-RON octane performance standard to be a more consumer-friendly, cost effective, way to meet the goals of the RFS and fuel efficiency targets**. In particular, a phased-in, fuel-neutral 95-RON octane performance standard for new vehicles could be a better way to deliver on the promises of the RFS, including energy security, environmental performance, and economic help for rural communities. Although AFPM is still exploring the issue with its membership, transitioning from the RFS into a fuel-neutral 95-RON performance standard for new vehicles has the potential to be a win for the consumer, the environment, and the automobile, refining, retail, and ethanol industries.

a. **For consumers, a transition from the RFS to a 95-RON performance standard would help reduce the future cost of compliance to meet efficiency targets while increasing choice in vehicles and fuels**.

b. **For automakers, a 95-RON used in optimized high-compression engines would provide more than a three percent efficiency gain**. This is the greenhouse gas equivalent of 720,000 battery-electric vehicles each year. Among various octane levels, a 95-RON is also the most achievable on a timeline to help meet near-term efficiency targets and it helps preserve one national program.

c. **For conventional biofuels, a 95-RON provides market opportunity and the potential for growth to meet demand for more octane in the United States**. This provides more upside potential than the RFS but does so through market mechanisms rather than fuel-specific mandates.

d. **For marketers, a 95-RON could provide more flexibility to meet the performance standard by maximizing available options**. Various ethanol blends can be used in different areas of the country to best suit the needs of the local consumers.

e. **For refiners, sunsetting the RFS and transitioning to a 95-RON performance standard could reduce overall compliance burdens and provide achievable targets**. Refiners spend billions of dollars each year to comply with the RFS

through an opaque and inefficient RIN market. Eliminating this mandate would be beneficial to consumers without any further changes to the gasoline pool. However, if the industry is asked to produce higher octane fuels, the benefit of a 95-RON octane is that it is largely compatible with the current infrastructure and refiners can sell it in every state, notably California.

3. **A 95-RON octane performance standard for new vehicles would be a significant shift in the fuel and vehicle market and should not be taken lightly**. Implementing such a standard will require time and significant investment. This includes changes to the refining systems, upgrades at retail stations, labeling, and other standards changes. AFPM is committed to better understanding and exploring all these issues with other stakeholders and policymakers before any policy decisions are made.

AFPM recognizes potential in a more rational and streamlined fuels policy, however, given the level of needed investment for higher octane fuel, there is no scenario where AFPM would consider an octane standard in addition to the RFS. Not only is the investment uncertainty associated with the RFS incompatible with a higher octane standard, but the effect would further distort the fuel and vehicles market, undermining any consumer benefit that might otherwise occur.

I. The Role of Octane in Gasoline and Its Relation to Efficiency

Refiners and blenders produce finished gasolines with the required octane specifications needed to meet the needs of different engines optimized around the fuel. At the most basic level, the octane rating of gasoline is a measurement of the fuel's ability to withstand compression before it will ignite. When a fuel prematurely ignites in an engine cylinder, it causes "knock," which

reduces engine efficiency and in severe cases risks engine damage. The higher the octane rating, the more resistant the fuel is to knock and the more compression it can withstand. High compression engines are a fundamental method for improving efficiency, so octane number is a major factor in engine design driving fuel economy.

In the United States, octane is currently measured by the "anti-knock index" ("AKI"). At most retail stations, drivers see three octane grades: 87 (regular), 89 (mid-grade), and 91-93 (premium). To provide these octane grades, refiners produce a sub-octane blendstock that is subsequently blended with ethanol to produce the finished fuel. These blendstocks are known as Reformulated Blendstock for Oxygenate Blending ("RBOB") and Conventional Blendstock for Oxygenate Blending ("CBOB"). There is also a California-specific fuel blendstock known as CARBOB. CARBOB/RBOB is used in areas that require reformulated gasoline, or about 30 percent of the U.S. market. CBOB is used in the remaining 70 percent.

AKI is an average of two other measures of rating octane—the Research Octane Number ("RON") and Motor Octane Number ("MON").[1] RON and MON are simply different measures of a fuel's performance characteristics under different engine operating severity (or load). Octane blending characteristics are not linear, but as a general matter there is approximately an 8-12 point spread between MON and RON values, with RON value being higher. The majority of the world uses RON as the standard octane measurement.

There are many sources of octane, but ethanol is currently an important source. Most gasoline in the United States today contains 10 percent ethanol. Due to its high octane rating, infrastructure

[1] Consumers currently see the AKI formula on the gasoline pump (R+M/2).

investments already in place to use the material, and widespread availability, AFPM believes ethanol would continue to be used approximately at current levels with or without the RFS.

II. The Potential Benefits of 95-RON Gasoline and Limits on Higher RON Levels

Consumers should always be front of mind for stakeholder groups and policymakers. A 95-RON octane could help preserve consumer choice for vehicles and fuels by helping increase efficiency at a lower cost. In fact, combining fuel and vehicle costs of production, the consumer could see an overall benefit compared to other alternatives. In addition to potential consumer benefits, AFPM believes a 95-RON could balance the needs of the auto industry, refining and marketing industries, and ethanol industry.

A. The Automobile Industry and the Environment

The automobile industry faces significant challenges in meeting existing fuel efficiency targets set by EPA and the National Highway Transportation Safety Administration ("NHTSA"). Higher octane fuel would enable use of engines with higher compression ratios to increase engine efficiency. For example, based on conversations with the automobile industry, AFPM observed that a two-point increase in the engine compression ratio yields slightly more than a four percent efficiency increase. This combination of a higher octane fuel with an optimized higher compression engine provides the most realistic, affordable solution to help the automobile industry attain regulatory compliance.

The cost of energy efficiency improvements involves a tradeoff between the cost of producing a higher octane fuel and the cost of other vehicle technology changes to improve efficiency. The graphs in Appendix B shows that as octane value increases, the cost to produce the fuel increases. The higher the octane, the higher the refining investment and operating cost.

However, as the octane of the fuel increases and vehicles can use higher compression engines to get more fuel efficiency, more expensive options to achieve the efficiency are not required.

As a result, it is critical to evaluate any change to fuel and vehicles on a well-to-wheels basis. Based on conversations with the auto industry, a four percent efficiency target is a reasonable target to achieve using a combination of fuel and higher compression engine technologies on a timeline that would ensure market availability during the MY2022-25 compliance period. AFPM worked with the automobile industry to evaluate what the lifecycle effect on CO2 emissions and cost of production would be at different octane levels. Although producing higher octane fuel results in higher CO2 emissions from refinery facilities, these increases are more than offset by the significant reduction in tailpipe CO2 from the new higher compression vehicles. The cost of the emission improvements was lowest between 94-96, compared to meeting all the efficiency improvements with only changes to engine technologies.

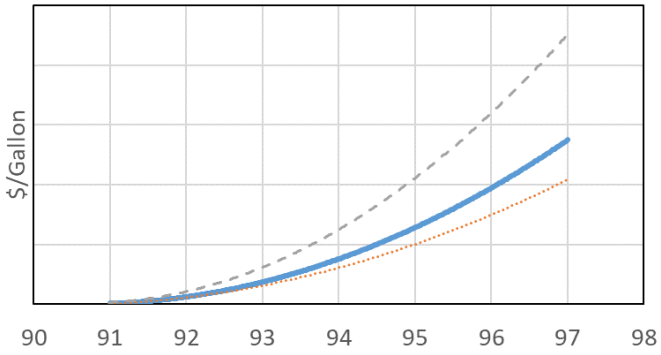

Figure 2: Gasoline Cost of Production Increases as RON Increases

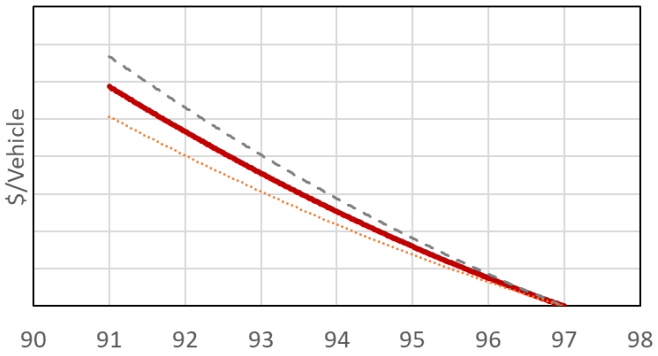

Figure 1: Vehicle Cost of Production Decreases as RON Increases

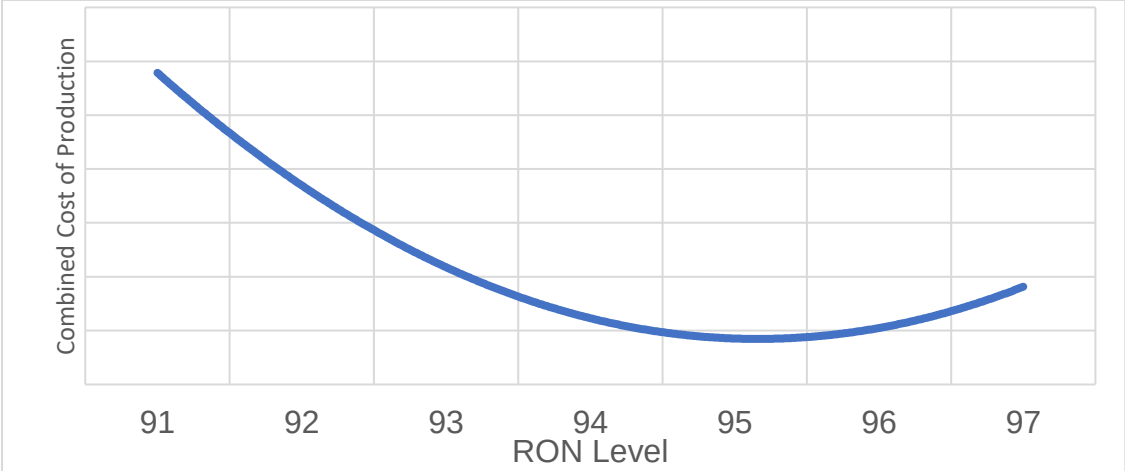

Figure 3: Combined Vehicle and Fuel Impact to Achieve 4% Efficiency Gain

To evaluate the differences between 94, 95, and 96-RON, we evaluated factors outside the refinery system, including regulatory challenges. AFPM concluded that 94-RON had a lower octane rating than current premium and thus would likely be incompatible with the legacy premium vehicle fleet. In evaluating the difference between 95 and 96-RON, it became increasingly clear that California is an important limiting factor for increased octane. Specifically, California's air quality emission regulations limit the ability to increase the octane rating of the base gasoline to achieve more than a 95-RON E10 gasoline standard, and even reaching 95-RON E10 for all gasoline in the state is a steep challenge. Moreover, California regulations prohibit the use of E15. Therefore, using E15 to produce a high octane fuel above 95-RON is not feasible in California. Nor is California alone. Five other states also have limitations or prohibitions on E15 use. Any octane standard that creates a de-facto E15 mandate would prevent the implementation of a single nationwide high octane fuel specification.

Because of these considerations, AFPM concluded that *if* a national octane standard were to take the place of the RFS, a 95-RON performance standard is the optimal level. A 95-RON standard would have several advantages.

A 95-RON octane fuel would enable future optimized vehicles to achieve more than a three percent fuel-efficiency gain, a third of the remaining way toward meeting existing EPA/NHTSA targets that have not been already planned and engineered by the auto industry. It has the potential to be widely available and commercially feasible in the MY2022-25 timeframe, when auto companies need to meet CAFE requirements. It will reduce emissions from the transportation sector at a lower cost than other vehicle technology alternatives. A three percent efficiency gain may seem modest but is substantial. It achieves overall CO2 reduction equivalent to 720,000 battery electric vehicles in the U.S. each year. For context, fewer than 200,000 electric vehicles were sold worldwide in 2016. Importantly, AFPM's analysis concluded that a 95-RON octane gasoline can be produced within current environmental performance requirements.

B. Marketers and Refiners

A fuel-neutral 95-RON octane performance standard benefits the marketing community by maximizing flexibility to achieve the performance standard, compared with higher octane levels. A 95-RON standard would allow retailers to optimize their fuel offering based on available fuel supply and infrastructure compatibility to meet the performance specification with different ethanol formulations up to E15. Consumer-based demand drives technological transformation more effectively and efficiently than command and control policies like the RFS.

For refineries, a 95-RON standard would allow for a more efficient transition than higher octane levels because it would allow for the utilization of existing refinery capacity, distribution, and retail infrastructure on a timeline that can help meet 2022-25 CAFE targets. RON levels greater than 95 would require significant initial investment across the supply chain and a longer time line for implementation. For example, a 95-RON will not require significant refinery investment

during the early transition years. AFPM's analysis indicates that the industry could meet more than half of current gasoline demand with 95-RON before substantial investment at the refinery level is required. Likewise, because 95-RON produced as E10 is similar to fuels on the market today, it would not require significant changes in the bulk transfer and midstream market, and is compatible with underground tankage and other equipment at retail. As previously discussed, 95-RON is already the standard for fuel sold in much of the world, including Europe. Switching from an AKI standard to a RON standard would provide more flexibility for refiners, potentially lowering supply costs.

C. Ethanol Industry

Any discussion about the RFS and octane must involve consideration of the ethanol industry. It is no secret that AFPM opposes the RFS. However, the refining industry also believes that ethanol is a quality product that is competitive with or without the RFS. Under the status quo, the corn ethanol industry has little else to gain. The United States is using ethanol for approximately 10 percent of its gasoline supply—about 14.3 billion gallons in 2017. Despite claims to the contrary, high prices for RINs have not appreciably increased ethanol blending (see figure 4). Market volumes of E15 and E85 continue to be small compared to the vast majority of gasoline that is blended as E10. Biodiesel has become the incremental fuel that is used to meet the conventional biofuel volume standard. There is little reason to believe this dynamic will change substantially in the next five years.

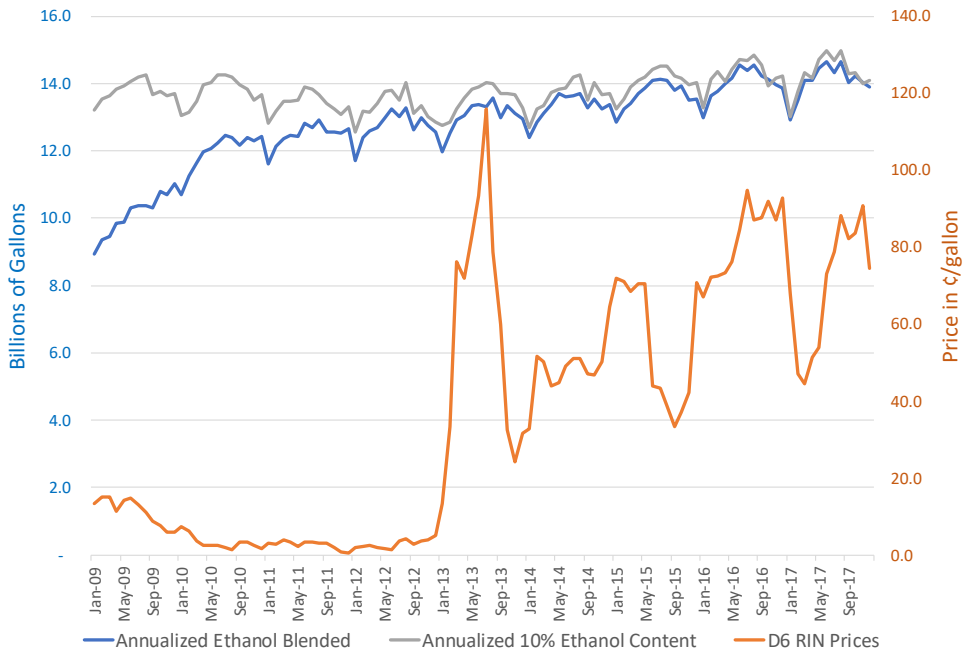

Figure 4 No Correlation Between RIN Prices and Ethanol Consumption

Ethanol is an economic source of octane and as a general matter would be advantaged by a 95-RON standard that increases demand for octane barrels (see figure 5). To achieve full 95-RON across the entire gasoline supply, refiners would need to invest billions of dollars. As a result, as an available and low-cost octane source, ethanol (E15 in particular) could become a market-driven fuel in many markets, as increasing numbers of E15 compatible vehicles enter the fleet and replace legacy vehicles that were not designed for E15 use. Based on our analysis, a 95-RON octane standard would be a more stable policy than the RFS for the ethanol industry, with more upside potential. However, the true value of a fuel-neutral, 95-RON performance standard is that the market will determine the correct balance between refining investments to produce the fuel at E10 or less, or the retail investments needed to produce the fuel at E15.

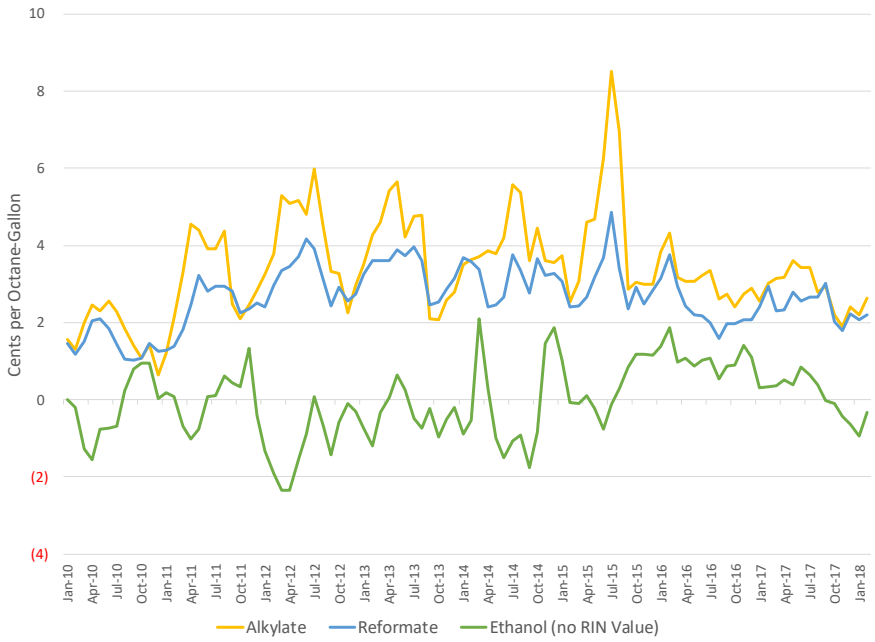

Figure 5: Ethanol is an economic source of octane

III. Challenges with Introducing a 95-RON Gasoline and Other Considerations

AFPM has invested considerable time and energy into better understanding what the refining industry would need to do to meet an increased octane standard. The key area of uncertainty is what needs to happen outside the refinery gate and in the retail market. To ensure the benefits of a higher octane fuel are realized, it is important that Congress consider misfuelling prevention that prevents new, optimized vehicles from using lower-octane fuels. AFPM members own very few retail stations, so the involvement of the retail and marketing industry is critical in these discussions.

AFPM's analysis about the feasibility of producing a higher octane fuel concluded that a new high octane fuel can be produced to meet current environmental requirements around gasoline additives and volatility standards. Policymakers should be aware, however, that increasing octane out of the refinery is likely to increase some stationary source emissions. The increased

greenhouse gas emissions are more than offset by lower emissions from the tailpipe, but permitting issues—most notably in California—may be a challenge. Likewise, regional air quality issues may be challenging. AFPM does not believe these challenges are insurmountable, but it is nevertheless important to understand them.

Most importantly, it is critical to consider the consumer impacts of any policy transition. Compared to business as usual, consumers will likely face lower upfront vehicle costs to meet efficiency standards. However, reducing emissions is not free. Depending on the precise market reaction to meet the performance standard, the refining industry would face billions of dollars in investments to meet a 95-RON standard. However, given the rate at which the vehicle fleet turns over, a full transition to a 95-RON gasoline may take close to 20 years. As a result, the precise consumer impact is difficult to predict.

To minimize the potential impact on consumers, it is critical to allow the market to function as efficiently as possible. To that end, any discussion about an octane standard must include the sunset of the RFS. The RFS is currently a multi-billion dollar per year compliance issue for the refining industry, and much of that capital is spent to purchase RINs for ethanol blended into a E10 fuel that would have been used regardless of the mandate. If the refining industry is to make a multi-billion dollar investment to reduce greenhouse gas emissions from the sector, it is critical that Congress streamline fuel regulations to make it more tenable.

Conclusion

AFPM recognizes that there are many questions that need to be addressed before any stakeholder, including AFPM, or policymaker fully embraces the concept of a transition from the RFS to a 95-RON octane standard. This includes considering questions about the

implementation, transition, and misfuelling mitigation. However, AFPM believes there is enough potential benefit to consumers and all stakeholders with an octane standard to merit discussion about these issues, but only within an overall conversation about RFS sunset.

A 95-RON octane standard could enable more efficient engines, promote competition among various fuel technologies, and is feasible nationwide in a shorter timeframe than higher RON standards. It is critical that any octane standard is fuel neutral to facilitate maximum flexibility in meeting the standard. AFPM cannot and will not support an octane standard layered on top of the existing RFS and will not support any octane standard exceeding 95-RON. Finally, recognizing that a full transition to a new fuel could take many years, policymakers should consider ways to minimize potential consumer impacts during the transition period.

AFPM appreciates the Committee's efforts to work with stakeholders to identify good policies to solve our nation's fuels and vehicle challenges. This work could not come at a more crucial time. Fuel economy standards are being reviewed, RFS compliance costs are threatening good paying jobs, and the RFS is careening toward a future with no statutory guardrails. Now is the time to bring together consumers, refiners, biofuel producers, marketers, and the auto industry to find policies that work better for consumers and all stakeholders. AFPM is committed to continue working with you to find solutions and appreciates your leadership.

Summary Testimony of Chet Thompson, President and CEO, American Fuel & Petrochemical Manufacturers

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