Questions for the Record from Senator Deb Fischer
Follow up from EPW Hearing, February 28, 2016

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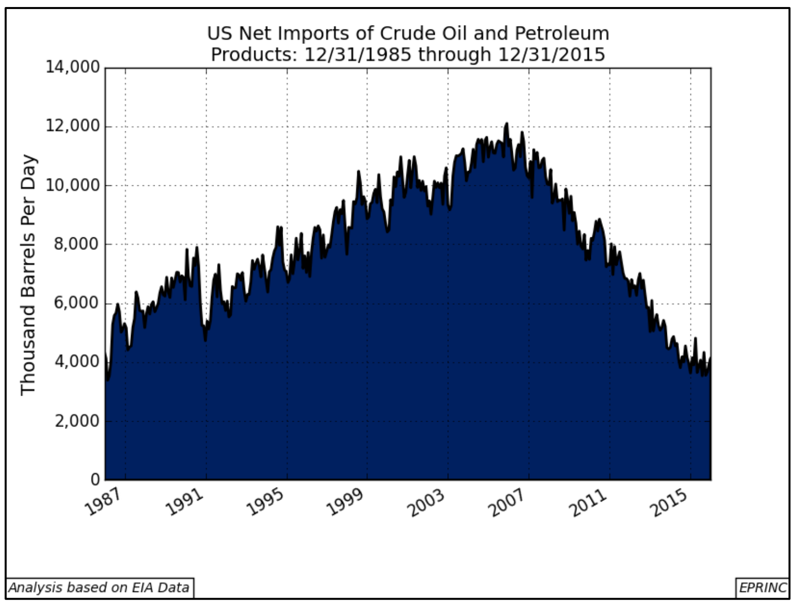
1. *Your November 2015 paper condemning the RFS states "The U.S. has transitioned from an era of energy scarcity to an era of abundance."[1] Yet, the U.S. continues to import about 7.5 million barrels per day of crude oil according to the U.S. Energy Information Administration[2] – that's equivalent to 45% of the crude oil processed by U.S. refiners. And about half of our imported crude oil continues to come from OPEC nations. If the rise of shale has led us into an era of energy abundance and security, why then do we continue to import almost half of our crude oil?*

Answer to Question 1

It is important to fully understand the circumstances of the era of energy abundance. While U.S. crude oil imports have declined from a 2005 peak of almost 12 million barrels per day (BPD) to current levels of 7.5 MBD, combined net imports of petroleum (crude oil and refined products) are down to 4.5 million barrels/day.



The reason for this is that the U.S. has become a large exporter of refined petroleum products: leveraging its world class fleet of refineries and low-cost domestic fuel in the form of natural gas, the U.S. converts a large volume of its crude oil imports into higher valued petroleum products that are exported into the world oil market.

EIA data show that of net imports of 4.5 million barrels per day (MBD) of crude and refined products, 75% of these net imports are supplied by Canada, a stable and contiguous ally of the U.S. For the most part, the U.S. and Canada share an open border and investment regime on petroleum development. U.S. energy security should be viewed within the context of this single North American petroleum market.

Furthermore, declining net imports enhance the U.S. trade position by helping to lower the country's trade deficit.

More importantly, it is the revolution in the extraction of oil and gas from unconventional (so-called shale and tight

[1] " Biofuel Mandate: Technical Constraints and Cost Risks," Max Pyziur and Lucian Pugliaresi, November 2015, https://www.dropbox.com/s/j9lw1i7urw2fwc6/Biofuel%20Mandate%20Nov%202015.pdf?dl=0, page 6.
[2] https://www.eia.gov/dnav/pet/pet_move_impcus_a2_nus_epc0_im0_mbblpd_m.htm

formations) that is fundamentally altering the world oil market and ushering in an era of energy abundance. U.S. oil shale producers have been remarkably resilient to the fall in oil prices, and continue to make progress in lowering the cost of extracting oil and gas.

Advances in technology for hydraulic fracturing and horizontal drilling are still in early, formative periods with recovery rates for unconventional crude oil at between 5%-10% of the available resource in the ground. Improvements in drilling efficiency and operations are continuing, and will likely lead to greater improvements in the coming years. These developments all indicate that the U.S. will continue to play a critical role in world oil production and play a critical role in keeping oil prices in-check.

The challenge for the biofuel industry is to continue to make progress in developing alternative supplies which are both cost-effective to consumers and acceptable to current and future automobile technologies.

For the record, EPRINC does not condemn or promote the blending of biofuels into domestic transportation fuel. Our research has solely focused on the costs and benefits of the RFS mandate. When blended into gasoline, ethanol can play an important, and cost effective, role in meeting both automobile and environmental fuel specifications. The use of ethanol in the gasoline pool, when adjusted to both market and technology limitations, presents no major economic or technical risks as a supplement to the production of gasoline. The fundamental policy challenge is directly attributable to a regulatory regime that requires annual upward adjustments in volumetric targets in ethanol use, without regard to either its contribution to the cost of gasoline or technical limitations in the use of ethanol within the U.S. automobile fleet.

It is not ethanol per se that presents a risk of a price spike in gasoline or a major risk to automobile engines, but the federal mandate requiring ever larger volumes of ethanol into the gasoline pool. The current regulatory regime, if not reformed in some substantial manner, will likely spike gasoline prices.

As federal mandates take the U.S. gasoline pool above 10% ethanol by volume, a range of alternatives exist to increase blending volumes, but all the alternatives require more costly fuels and many face legal and technical constraints. One alternative is the greater use of gasoline blended at 15%, called E15. However, many automakers have expressed their concerns with engine damage resulting from E15 and consumers have been reluctant to use the fuel in large numbers. In addition, E15 can only be used in vehicles model year 2001 and newer; it is illegal to use E15 in older vehicles and all small engines. Higher blends at 16 to 51% ethanol are sometime available, but these volumes have been very small and face similar concerns as E15. An additional gasoline product is E85 that blends ethanol into gasoline in proportions ranging between 51% and 85%. This fuel can only be used in so-called flex fuel vehicles (FFVs). Consumers have been resistant to E85 because of (1) its high cost when adjusted on a BTU basis to regular gasoline; (2) limited availability; (3) higher frequency of refill; and (4) its poor mileage. While almost 10 million, or 4% of the U.S. motor vehicle fleet are FFVs, less than 10% of that number, or 0.3% of the total motor vehicles actually use E85.

2. *Your November 2015 paper suggests that so-called RFS "compliance costs" for refiners could lead to gas prices being marked up by 6-7 cents per gallon in the next few years. But this assumes that every refiner must purchase RIN credits on the open market, when we know for a fact that most RIN credits are, in essence, acquired for free by refiners when they buy ethanol. Isn't this a fundamental flaw in your analysis?*

Answer to Question 2

The EPRINC calculations and model are a stylized representation of a 100 thousand barrel per day (TBD) refining facility. Our analysis shows the added costs of compliance to a merchant refiner, one that cannot capture RINs from distribution and marketing operations.

EPRINC's compliance-cost analytical approach was adopted from two sources: (1) the Congressional Budget used by Sandra Dunphy of Weaver Consulting, a Houston-based consultancy[3]. In the case of the CBO, they assume three scenarios: 1) RFS repeal; 2) freezing the RFS mandate through 2022 at 2014 levels; and 3) full compliance of RFS2 statutory requirements including the cap on corn ethanol at 15 billion gallons. Sandra Dunphy's model projects the compliance costs on a hypothetical 100 TBD, estimating the RVOs under CBO's three scenarios. Dunphy's approach is not unique; it is one that is also shared by other analysts, including ClearView Energy Partners, among others.

Operationally, ethanol is not acquired or handled directly by refiners. It is purchased and used by blenders and terminals, the second-to-last place in the motor vehicle fuel supply chain before it is delivered to filling stations. This is because biofuels absorb water up to 100% of their mass, and cannot be transported by pipeline from refineries to blenders and terminals. Water contaminates the fuel and/or causes corrosion or other damage to the pipeline system; therefore, final fuel blending is done at the terminal.

Refining is the transformational, or middle, part of a supply chain that begins with exploration and production for crude oil and ends with the marketing and distribution of products.

Refining operations can be found in different corporate configurations. Those that include extensive exploration and production businesses along with refining operations are known as "integrateds." Examples of these include ExxonMobil and Chevron.

In other instances, companies that own refineries have extensive marketing and distribution entities in the form of product pipelines and terminals. It is only through ownership of terminal blending operations that refiners can capture detached RINs and apply them to their RVOs (Renewable Volume Obligations). Valero Energy and Marathon Petroleum are examples of this type of petroleum business. Together, they have 23 refineries with a combined processing capacity of about 4.5 MBD (million barrels per day), or 25% of the United States. They also have extensive blending/terminal operations where they can acquire RINs to meet their respective RVOS. However, to be clear, both companies cannot fully meet their RVOs from their own blending operations; they still need to make large purchases of RINs in order to achieve full RVO compliance.

In a final case, certain refiners have no exploration and production businesses, as well as limited ability to accumulate RINS from blending or terminal operations. In this case, they are known as "merchant refiners." In order to fulfill their RVOs, merchant refiners have to purchase RINs from other entities that have surplus RINs that they have accumulated in excess of their respective RVOs. Given the constructs of the RIN markets, which lack considerable transparency and liquidity, acquiring RINs is not trivial. In sum, RINs are not free.

The best example of a merchant refiner is PBF Energy, currently owning and operating four refineries for a total of 540,000 of refining capacity, and no terminals. (PBF's purchase of ExxonMobil's Torrance, CA refinery has not been completed. Once that is finalized, then PBF will directly own related terminal operations)

RVO costs are presented in SEC filings by Obligated Parties, primarily by refiners. Given that there are no accounting guidelines regarding RVOs, refiners and other obligated parties have the discretion as to how much detail they present in their 10-Ks regarding their RFS obligations. However if expenses in particular categories are considerable, then it is prudent to disclose these costs. On pages 23-24, and Exhibit 11 on p. 31 of EPRINC's

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[3] Dunphy, S. (2013). RINs: *The Good, The Bad*; Presentation for the Nebraska Ethanol Board. Houston, TX: Weaver and Tidwell, L.L.P. (http://www.ne-ethanol.org/presentations/forum/2013/dunphy.pdf)
Dunphy, S. (2013). What is a RIN, and why should you care? RFS2 Presentation to NASEO. Houston, TX: Weaver and Tidwell, L.L.P. (http://www.naseo.org/Data/Sites/1/events/winterfuels/2013/Dunphy.pdf)
Dunphy, S. (2013). What is RFS2: A Primer. Presentation at Cowen & Co. Renewable Fuels Summit. Houston, TX:

analysis[4], RVO costs are presented for PBF Energy, as well as Valero Energy and Marathon Petroleum, as well as other refiners for the years 2012 to 2014; this data has been taken from the companies' 10-Ks. As it is illustrated, RVO costs are not trivial both as a total amount and as a percentage of direct operating & SGA expenses (less feedstock costs, depreciation & amortization, and interest & taxes).

Since EPRINC's *The Biofuel Mandate: Technical Constraints and Cost Risks* was published in November 2015, 10-Ks have been released for 2015. An updated form of Exhibit 11 is included here showing additional data for 2015.

PBF Energy's RIN costs vary between 5% and 16% of total direct operating expenses, or from $43.7 to $171.6 million. If all of PBF's refining capacity were used to produce transportation fuels for domestic purposes, then the additional compliance cost added into fuel prices would be $0.005 per gallon in 2012 rising to $0.02 per gallon in 2015.

Of the two largest U.S. refiners, Valero Energy and Marathon Petroleum, the RIN costs range from 5% to 14% of total direct operating expenses, or from $100 to over $500 million, depending on the reporting period and scope of the RFS mandate. While the magnitude of the RVOs declined somewhat in 2014 from previous years, 2015 figures have increased over those of 2014.

Exhibit 11 from EPRINC Study

(Updated to Include Data from 2015 SEC Filings, all dollar amounts in millions)

	RIN Cost ($Millions)				RIN Cost as Percentage of Op & SGA)				Direct Operating & SGA Expenses Less Cost of Sales, Dep & Amort, Interest & Taxes				Nameplate
Refiners	2012	2013	2014	2015	2012	2013	2014	2015	2012	2013	2014	2015	Bbl/CalDay
Marathon Petroleum	$105.0	$264.0	$141.0	$212.0	5.9%	13.6%	6.2%	9.3%	$1,773.0	$1,945.0	$2,270.0	$2,275.0	1,700,000
PBF Energy	$43.7	$126.4	$115.7	$171.6	5.1%	13.8%	11.3%	15.8%	$859.2	$917.0	$1,026.8	$1,085.8	540,000
Tesoro	N/A	$116.0	$125.0	N/A	N/A	5.2%	4.6%	N/A	$1,702.0	$2,248.0	$2,744.0	N/A	850,000
Valero	$250.0	$517.0	$372.0	$440.0	7.1%	13.9%	9.5%	12.5%	$3,513.0	$3,710.0	$3,900.0	$3,533.0	2,769,000
Western Refining	$4.0	$30.5	$28.2	$35.5	0.6%	4.3%	2.5%	3.1%	$644.7	$711.0	$1,125.1	$1,129.0	151,000
Analysis based on Company SEC Filings													*EPRINC*

4 See the table on "RVO Costs & Revenue To Refiners, Blenders, and Marketers" in EPRINC's publication, *The Biofuel Mandate: Technical Constraints and Cost Risks*

As is stated in Tesoro Corporation's 10-K filing for 2015,

> *"While we generate RINs by blending renewable fuels manufactured by third parties, we purchase RINs on the open market to comply with the RFS2. While we cannot predict the future prices of RINs, the costs to obtain the necessary RINs could be material. Our financial condition and results of operations could be adversely affected if we are unable to pass the cost of compliance on to our customers, pay significantly higher prices for RINs, and generate or purchase RINs to meet RFS2 mandated standards."*

Two features contribute to volatility in the RIN market, and lead to increased prices for transportation fuels. First, there are significant uncertainties and constraints associated with complying with the RFS mandates. There are limitations on production and imports of renewable fuels and variations across the country in the market's ability to distribute, blend, dispense, and consume these fuels.

Second, while it is cost-effective to blend ethanol up to 10% for each gallon of gasoline sold today, it is much more difficult to blend above 10%. Retail stations offering higher blended fuels are limited geographically, and there are only a limited number of vehicles nationwide that can use blends such as E15 and E85. The compliance options open to the petroleum industry to meet higher RFS mandates are few, and those that exist are costly. It is simply not possible to increase the volume of renewable fuels that must be blended into the transportation pool without correspondingly increasing prices to consumers at the pump. This point was also made by EIA's Deputy Director, Howard Gruenspecht at the hearing that compliance costs are likely to increase more in an era of low gasoline prices.

The challenge of higher compliance costs in a low-gasoline price environment is expected to prevail for the next several years. Historically, mandated ethanol blending has not exceeded 10% of the gasoline pool. For most of the recent past, the cost of ethanol has typically been lower (than gasoline), and there is an economic incentive for the market to use more ethanol to lower the cost of the blended fuel up to 10% of the gasoline pool. For most of this period, RIN prices have been very low, just a few cents. However, we are now in a market environment where price of ethanol is often the same price as gasoline or, in some cases, even higher. Even if we were in a market where there were no technical constraints, such pricing conditions would reduce the incentive for additional ethanol use. As long as we remain in a regulatory environment requiring ethanol blending above 10% of the gasoline pool, obligated parties will face substantially higher costs to achieve blending volumes that cross the 10% blendwall.

The conclusions of EPRINC's analysis is consistent with a broad set of reviews of the RFS program by analysts both in an outside of government, including the Congressional Budget Office (CBO), Congressional Research Service (CRS), and the Energy Information Administration (EIA).

> 3. *Past EPRINC studies suggested that the RFS would force refiners to reduce their production of gasoline and diesel to minimize their compliance obligations under the RFS. But, in reality, we have seen record gasoline and diesel production by U.S. refiners in recent years, even as RIN credits have had relatively higher values. How do you explain this?*

Answer to Question 3

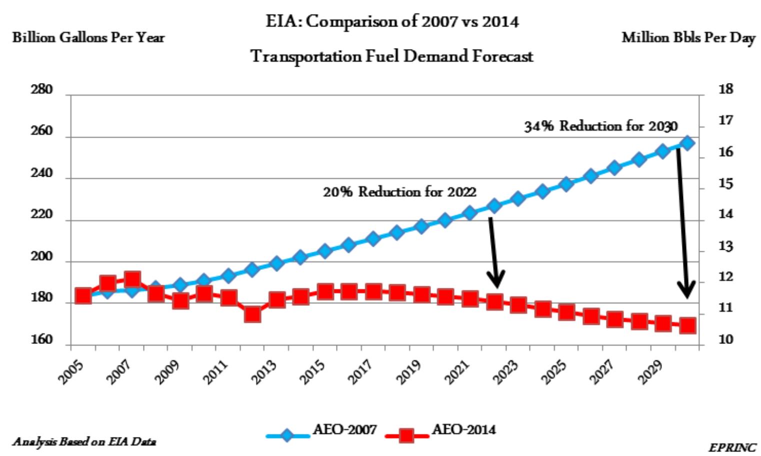
It is important to distinguish between the production of gasoline and diesel fuel that is marketed to the domestic market and the volumes that are marketed for foreign sales (exports). A combination of low natural gas prices and access to rising crude supplies have made it possible for U.S. refiners to compete in markets abroad. Sales to foreign markets do not require the purchase of RINs and blending of biofuels. However, sales to domestic markets must meet EPA RVO requirements. As blending requirements exceed 10% of the gasoline pool, refiners will face a range of costly adjustments to meet the standard. In some cases, the most cost effective adjustment will be to reduce sales to the domestic market if the alternative blending options are more costly.

4. *One of your arguments against the RFS is that gasoline demand has fallen and the so-called "blend wall" got here sooner than expected. But it was obvious to anyone who looked at the RFS2 in 2007 that ethanol blends above E10 would be needed for RFS compliance in the long term and, in fact, EPA predicted in 2009 that the "blend wall" would arrive as soon as 2013 or 2014.*

And gasoline demand has actually risen significantly after bottoming out in 2012, with EIA predicting the second highest level of gasoline consumption ever this year. How do you reconcile these facts with the argument that "the RFS needs changes because gasoline demand is falling"?

Answer to Question 4

Although the U.S. is experiencing an increase in transportation fuel demand (which includes gasoline), long-term trends still point to little or no growth, and in some scenarios a sustained decline. In 2007, the EIA outlook for demand for U.S. transportation fuels (gasoline and diesel) was projected to grow from 12 MBD in 2007 to 17 MBD in 2030. However in 2014, EIA revised its projection for 2030 downward from 17 MBD to 11 MBD. This reduced growth resulted from a combination of improved automobile mileage performance, people driving less, and reduced economic activity.



When Congress established the RFS mandate in 2005, and revised it upward in 2007, the consensus opinion expected the economy would continue to grow and expand at historic rates and that transportation fuel demand would increase; with these increases, there would be no difficulty accommodating greater volumes of ethanol and other renewable fuels into the transportation fuel pool. At the time, there was little understanding or concern about market constraints that would make it difficult to increase the volume of renewable fuels blended into transportation fuels.

Recent transportation fuel demand is on the increase; but it is considerably less than the magnitude that was projected in 2007 and this is summarized in a recent analysis by EIA,

> *Motor gasoline consumption increased by an estimated 240,000 b/d (2.7%) in 2015 to an average of 9.2 million b/d, the highest level since the record 9.3 million b/d in 2007. Although total nonfarm employment and total highway travel have increased by 2.9% and 3.7%, respectively, since 2007, improving vehicle fuel economy continues to hold gasoline consumption in check throughout the forecast period. Gasoline consumption is forecast to increase by 90,000 b/d (1.0%) in 2016, as a forecast 2.1% increase in highway travel because of employment growth and low retail prices is partially offset by continuing increases in vehicle fleet fuel economy. In 2017, gasoline consumption is forecast to fall by 10,000 b/d (0.2%).*[5]

Clearly, while there has been significant growth in gasoline demand recently, this is not enough to overcome the cost and technical constraints created by the volumetric targets in the legislation.

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[5] See http://www.eia.gov/forecasts/steo/report/us_oil.cfm

5) Is your research funded by the oil and gas industry?

Answer to Question 5

EPRINC receives untied funding for general research on petroleum matters from a broad set of industries, including the petroleum industry. However, we pride ourselves on open access to our data and analysis and the use of widely accepted research methodologies and standard economic assessments to evaluate policy initiatives. The quality of EPRINC's research on a broad range of petroleum issues is recognized internationally and by the federal government.

Over the last five years, EPRINC's single largest funding source has been the Office of Net Assessment (ONA) at the U.S. Department of Defense. For ONA, EPRINC has provided detailed assessments of how the strategic outlook for the U.S. is fundamentally altered from the domestic oil and gas production growth of the North American petroleum renaissance.

In addition, EPRINC was brought in to assist DOE with their assessment of the distribution of crude oil throughout the North American continent in the Quadrennial Energy Review.