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Testimony

before

U.S. Senate Committee on Environment and Public Works

"The Environmental Protection Agency's Renewal Fuel Standard program"

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Submitted by:

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Chairman Carper, Ranking Member Capito and members of the Senate Committee on Environment and Public Works, I want to thank you for the opportunity to testify on the U.S. Environmental Protection Agency's Renewable Fuel Standard (RFS) and the U.S. Environmental Protection Agency's (EPA) management of this program. I am President of the Energy Policy Research Foundation, Inc. (EPRINC), a non-profit public policy research organization. EPRINC was founded in 1944 and studies energy economics and policy issues with special emphasis on oil, natural gas, and petroleum product markets. I have worked on a broad range of energy security issues for my entire career, both in and out of government, beginning with the 1973-74 Arab oil embargo. For the last two years, EPRINC has undertaken a systematic assessment of challenges and opportunities of the energy transition which raise important challenges to the RFS program in the coming years.

Summary

EPRINC has undertaken research and analysis on the important role of biofuels in the transportation fuels sector since 2006, including a major workshop with the Energy Information Administration (EIA) as far back as 2008. From assessments starting in 2006, we have concluded that the principal drawbacks and risk factors of the program are not the use of biofuels as blendstock for gasoline and diesel fuel, but the statutory mandate which requires ever-larger blending volumes without regard to market conditions, costs or technical constraints. Biofuels represent an important contribution to U.S. energy security by expanding the supply of transportation fuels and large volumes of biofuels (mostly, corn-based ethanol) would be used to meet octane standards and local air pollution requirements even in the absence of blending mandates. However, price risks to consumers from higher transportation fuel costs rise substantially as mandates push biofuel blending above 10 percent of the gasoline pool. Today, the RFS program is raising gasoline prices by approximately 30 cents a gallon.

My testimony today includes (i) a brief historical background on the biofuel mandate, (ii) an assessment of the price risks from biofuel blending requirements under the RFS, (iii) the potential for escalating economic risks to consumers from the RFS program as the U.S. accelerates its efforts to move forward with the energy transition, and (iv) the importance of Congressional action to guide the program's goals and operations as EPA prepares for the 2023

reset under the statute.

Historical Background

Biofuels have long been used as blending components in U.S. transportation fuels to meet a wide variety of fuel specification and environmental requirements.[1] Prior to the recent resurgence in domestic oil and natural gas production, concerns about the U.S.' increasing dependence on imported oil led to the passage of both the Energy Policy Act of 2005 (EPAct05) and the Energy Independence and Security Act of 2007 (EISA). These laws established a broad program to blend renewable fuels into the domestic transportation fuel (gasoline and diesel) pools. These minimum volumes of ethanol and biomass-based diesel (biodiesel) were mandated to rise each year through 2022. At the time that the legislation was enacted, the blending requirements were viewed as being well below the bounds where they would create adverse operational effects. Furthermore, the RFS program was supposed to provide a cost-effective program to reduce petroleum imports as well as provide environmental benefits from a lower carbon fuel.[2]

EISA requires an increasingly aggressive program each year for blending biofuels with petroleum-based transportation fuels. Specifically, ethanol is blended into gasoline, and biodiesel is blended into diesel. These volumetric targets began in 2006 at a total of 260,000 barrels/day (4 billion gallons per year), and were mandated to rise to 2.35 million barrels/day (MBD) or 36 billion gallons per year (BGY) in 2022(Figure 1). However, due to a broad range of technical and cost concerns, EPA has routinely lowered volumetric requirements under provisions permitted by the statute. For 2022, the EPA is proposing to set the RVO for total renewable fuel

[1] For a full discussion of fuel specifications, cost considerations, and regulatory requirements for manufacturing gasoline, see Pugliaresi, L., & Pyziur, M. (June 2015), ***Gasoline Blending: An EPRINC Primer***; http://eprinc.org/wp-content/uploads/2015/06/Updated-Gasoline-Primer-2015.pdf. Also, see Pugliaresi, L., & Pyziur, M. (November 2016), **The Biofuel Mandate: Technical Constraints and Cost Risks;** https://www.dropbox.com/s/6zldnd64svpl44h/Biofuel%20Mandate%20Nov%202015.pdf?dl=0**,** and Pugliaresi, L., & Pyziur, M. (February 2019), **OCTANE: Pathway to a Compromise**; https://eprinc.org/wp-content/uploads/2019/02/Octane-Pathway-to-a-Compromise-Feb-2019-FINAL.pdf.

[2] There is considerable debate on whether ethanol provides substantial environmental benefits from reduced GHG emissions When new land is brought into production lifecycle GHG emissions can increase. When these so-called indirect land use effects are ignored, ethanol can sometimes lower GHG emissions, but it can also add to deterioration in local air pollution. See Christopher W. Tessum, Jason D. Hill, and Julian D. Marshall***, Life cycle air quality impacts of conventional and alternative light-duty transportation in the United States***. Proceedings of the National Academy of Sciences. See www.pnas.org/content/111/52/18490.full.pdf+html.

at 20.77 billion gallons, including 5.77 billion gallons of advanced biofuel, 2.76 billion gallons of biomass-based diesel, and 770 million gallons of cellulosic biofuel. The agency is also proposing to add a 250-million-gallon supplemental obligation and has stated its intent to add another 250-million-gallon supplemental obligation in 2023. The supplemental obligations would address the remand of the 2014-2016 annual rule by the D.C. Court of Appeals in Americans for Clean Energy v. EPA. The agency said spreading the obligation over two years would provide the market time to respond to the supplemental obligation.

One fundamental shift in U.S. petroleum outlook has changed dramatically since EISA became law. U.S. consumption of transportation fuels has declined instead of increased (Figure 2), and the U.S. Energy Information Agency (EIA) forecasts that demand for these fuels will continue this decline in the coming years. The reductions are considerable. For example, in 2022 as we recover from the pandemic, U.S. gasoline demand is likely to be at least 21 percent lower than projections made by EIA in 2007. This is important because volumetric targets are more difficult to achieve under lower demand conditions.

Price Risks to Consumers

A major problem with the program is that meeting the volumetric targets has become increasingly difficult (and costly) because of consumer resistance and technical constraints in achieving biofuel blends into the gasoline pool at percentages higher than 10%; this limitation is commonly known as the "blendwall." The introduction of gasoline blends at 15% (E-15) biofuel by volume has been helpful, but consumer resistance over performance and potential harm to combustion engines has constrained expansion of higher biofuel blends.

The RFS program is administered by requiring all refiners and importers (collectively known under the legislation as Obligated Parties) to document that they have acquired RINs (renewable identification numbers). In turn, these RINs are then acquired from biofuel producers by Obligated Parties registered with EPA, usually, when biofuels are blended into gasoline or diesel. In the early years of the program, the biofuel mandate, or RFS, could be met with so-called conventional biofuels (ethanol) blends below 10% of the gasoline pool. Refiners and other Obligated Parties could, however, blend above their mandated requirements and then retain those extra RINs for sale to Obligated Parties who had not met their mandates or bank them for use in the following year. In recent years, EPA has struggled with the program and has been

consistently late in setting the blending requirements for so-called obligated parties.

A key feature of the biofuel program is that as Obligated Parties are required to increase mandated biofuels above the blendwall, it becomes more likely that the mandates in the RFS will limit compliance options to a narrower set of high-cost strategies with elevated risks of price spikes in the cost of transportation fuels. The compliance program in the RFS operates under a general rule where Obligated Parties must fulfill each category of the RVO as well as the overall mandate. The RFS consists of categories corresponding to the different biofuel types. Compliance is complete when sufficient credits are obtained for each category, and sum to a targeted, required amount. RIN credits that are obtained in excess from blending themore advanced, expensive biofuels can be applied to fulfill compliance in the less advanced biofuel categories. However, the reverse is not allowed: excess credits from a less advanced biofuel cannot be applied to fulfill requirements in a more advanced biofuel category. For example, any renewable fuel that meets the requirement for cellulosic biofuels or biomass-based diesel (BBD) is also valid for meeting the advanced biofuels requirement. Thus, if any combination of cellulosic biofuels or BBD were to exceed their individual mandates, the surplus volume would count against the advanced biofuels mandate, thereby reducing the potential need for imported sugar-cane ethanol or other fuels to meet the unspecified portion of the advanced biofuels mandate.

Furthermore, any renewable fuel that meets the requirement for advanced biofuels is also valid for meeting the overall total renewable fuel requirement (which under the statute called for 36 BGY by 2022, but has been adjusted lower by EPA**).** As a result, any combination of cellulosic biofuels, BBD, or imported sugarcane ethanol that exceeds the advanced biofuel mandate would reduce the potential need for corn-derived ethanol to meet the overall mandate. The program does not permit covering the advanced requirements by using larger volumes of E85 or other corn-based biofuels. So Obligated Parties must meet both the overall RVO and also the individual categories, with the exception that exceeding the targets in the more advanced categories can be pushed to down to cover a lower category. By selecting a likely least-cost compliance, the RFS mandate fulfillment is initially done with those biofuel sources that exhibit some combination of lower cost and/or ease of implementation. To date, this has been primarily through the use of corn-based ethanol.

Modeling a range of likely compliance cost alternatives from 2017 to 2022 and viewing the

scenario with the adoption of the RFS mandate as outlined in EISA, EPRINC's calculations before this Committee in 2016 estimated that RVO obligations could increase gasoline prices from approximately 30 cents to 50 cents gallon. Actual data from December 2021 show that the RFS is now raising gasoline prices by nearly 30 cents per gallon (Figure 3). Other than the cost of crude oil (along with federal and state taxes), EPA's RVO targets is now an important component on the price of gasoline.

We understand that there has been in the past some disagreement, especially with EPA, on whether RIN prices are in fact driving up the price of gasoline. Figure 4 provides some additional perspective of this issue by showing recent changes in the crack spread. The crack spread (or margin) is the difference between the price of crude oil and the price of refined products, which include gasoline, distillates, diesel, and jet fuel. These so-called margins in processing crude oil into refined products (crack spread) include both a rate of return on installed capital for processing crude oil into transportation fuels as well as direct costs, of which RIN values are substantial and largely passed on to consumers. Two features shown in Figure 4 are worth noting. First, when small refiner exemptions (SREs) were given to disadvantaged processing facilities (especially in 2018 & 2019), the exemptions had the net effect of reducing system wide blending obligations and this lowered RIN costs. The elimination of the SREs had the net effect of rising system wide RVO costs. Whatever the merits of the SRE program it demonstrates that higher RVOs raise the cost of producing transportation fuels.

Figure 5 shows the recent run up in petroleum product prices as the world emerged from the pandemic and petroleum demand reverted to historical trends. For consumers, the cost of the RFS program was masked by lower oil prices, but as demand returned (and supply was unable to keep up) transportation fuel costs escalated. Part of the escalation in crude oil prices are clearly related to supply chain problems in getting new worldwide drilling operations underway to expand oil and gas production. Some commentators have also suggested that EPA's reset in 2023 should be used as an opportunity to move the program to a low carbon fuel standard that would be driven by more cost-effective criteria directly tied to reducing carbon emissions. As shown in the California case (Figure 6), while such a program would likely reduce some of the dislocations from the blending mandates, it does not eliminate rising costs from the production of transportation fuels.

Changing Market Conditions

The other important change from 2007 concerns over energy security is the remarkable expansion of domestic oil production from the technological revolution in exploration and production of crude oil from unconventional petroleum resources. The surge in crude oil production in the U.S., rising from 5 million barrels/day (MBD) in 2008 to over 12 MBD by 2020 (shown in Figure 7), has been a remarkable achievement of technological innovation and risk-taking in a province most analysts had suspected was undergoing permanent decline. Production suffered during the pandemic, but recovery is underway. After being written off as a petroleum province in permanent decline, the surge in U.S. production has not only reduced U.S. net imports, but made the country largely energy independent.

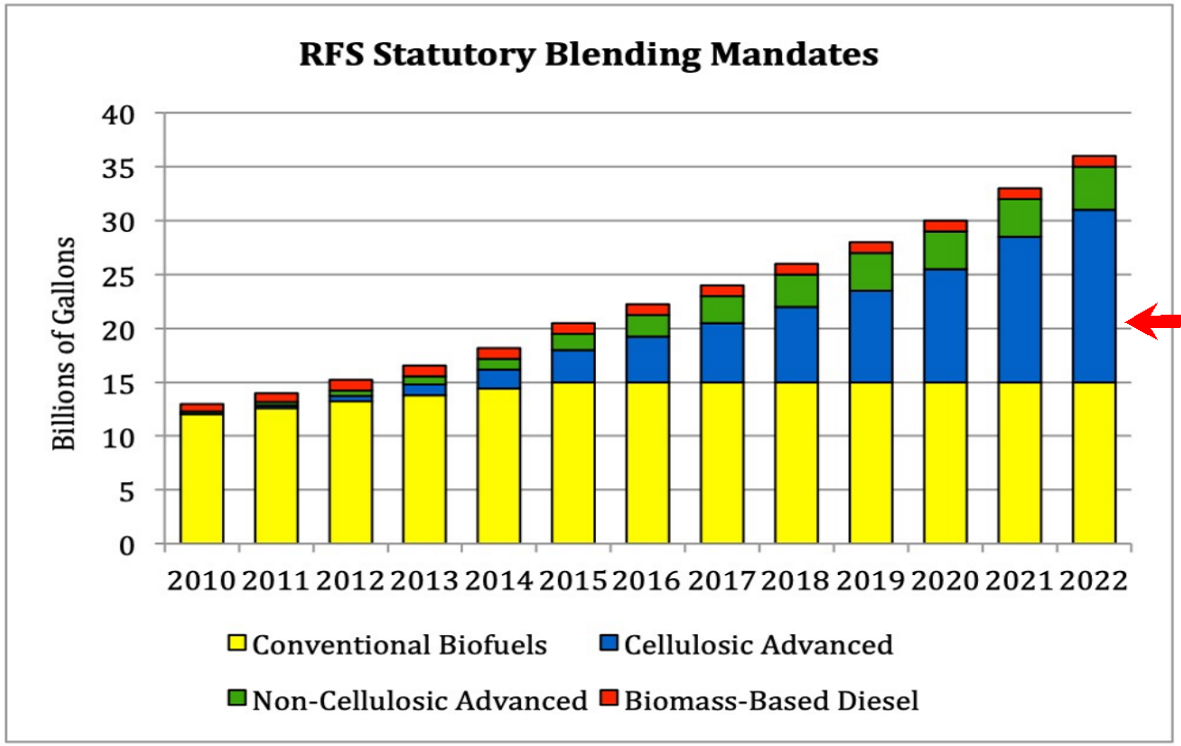
Even accounting for the production losses during the pandemic, the U.S. remains the largest oil and gas producer in the world. These domestic unconventional petroleum developments are altering flows in world crude oil trade and challenging the long-held conventional wisdom on U.S. energy policy that was promulgated in an era of scarcity. As shown in Figure 8, the U.S. provided over 80 percent of incremental worldwide liquids demand between 2010 and 2019. Without the expansion of the U.S., and the entire North American oil and gas production platform, crude oil prices in the U.S., and worldwide would have been substantially higher. In addition, as shown in Figure 9, we have little evidence that oil and gas reserves are stranded assets. If we want to protect U.S. energy security and consumers, we should continue to pursue policies which provide expanded opportunities for domestic oil and gas production. Many of the Administration current policies (halting crude oil & gas pipeline construction, sitting on permits for LNG exports, failure to proceed with offshore oil and gas leasing all pose large risks to U.S. energy security and consumers and create expectations in the marketplace that contribute to rising fuel prices. We should take great care in limiting U.S. oil and gas production before the energy transition is well underway

RFS Program and the 2023 Reset

We are heading into a largely uncharted world full of enormous price and energy security risks. We have an extraordinary responsibility to consider the entire array of risks and to develop

policies that are robust under uncertainties that cannot be easily predicted. Expect failures, cost over-runs and the unexpected. The reset is an opportunity to proceed with a program that both incorporates biofuels into our energy future, but does so in a manner that can adjust to the wide range of uncertainties. Congress should take this opportunity to shape the RFS program in a manner that can withstand a wide range of future challenges and opportunities going forward. Although EPA is required to proceed with the reset under a set of specific criteria, interpretation of the criteria is open to a very large set of alternative policies. In addition, other policies under consideration by the Administration, such as banning internal combustion engines and relying entirely on a future of only electric vehicles is inherently risky as we cannot predict how the technology will play out over time, or whether it will remain a cost-effective alternative for consumers. As shown in Figure 10, experienced analysts with long involvement in modeling our future energy requirements disagree on worldwide requirements over the next 30 years.

Figure 1
Cost and Technical Constraints Limit Adoption of Statutory Blending Mandates



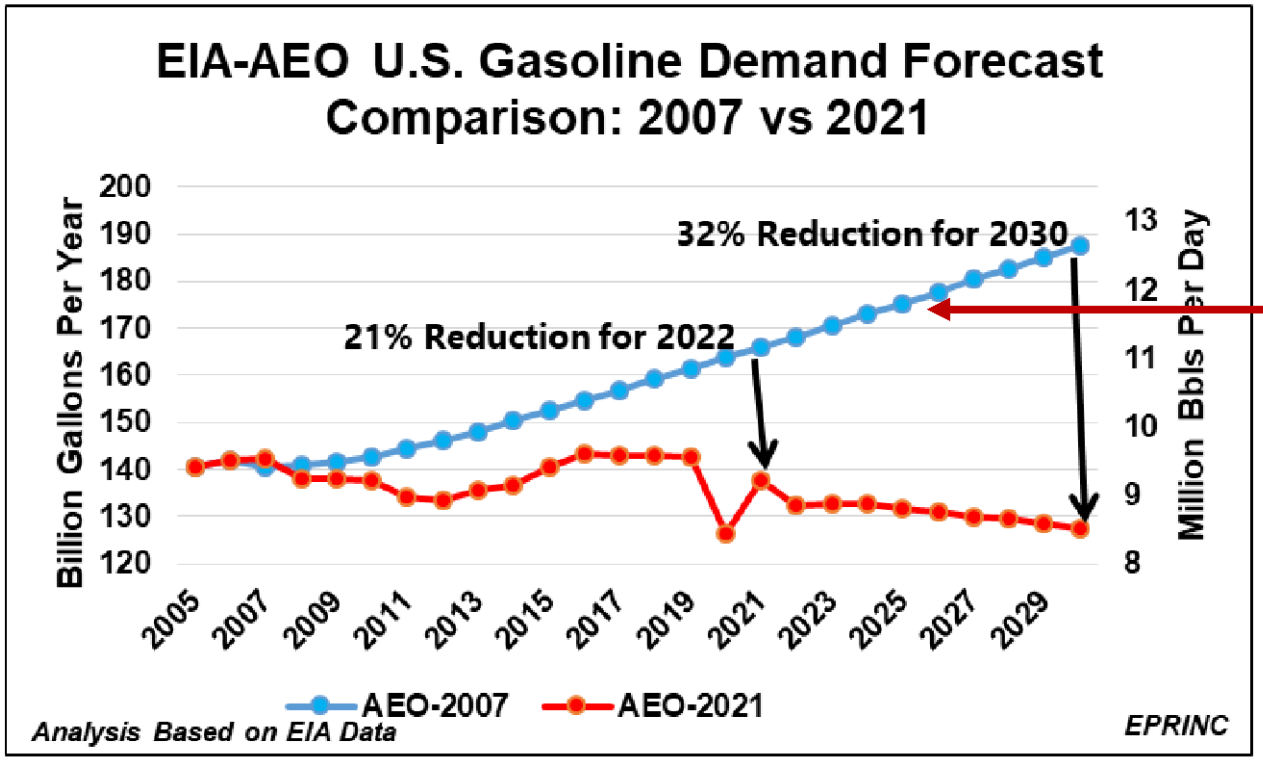
EPA proposal for 2022 sets Renewable Fuel Obligation at 20.8 billion gallons year (BGY)

15 BGY (ethanol + biodiesel)
5.0 BGY (advanced)
0.8 BGY (cellulosic)

Program not meeting original statutory mandates Under EISA (2007)

Figure 2

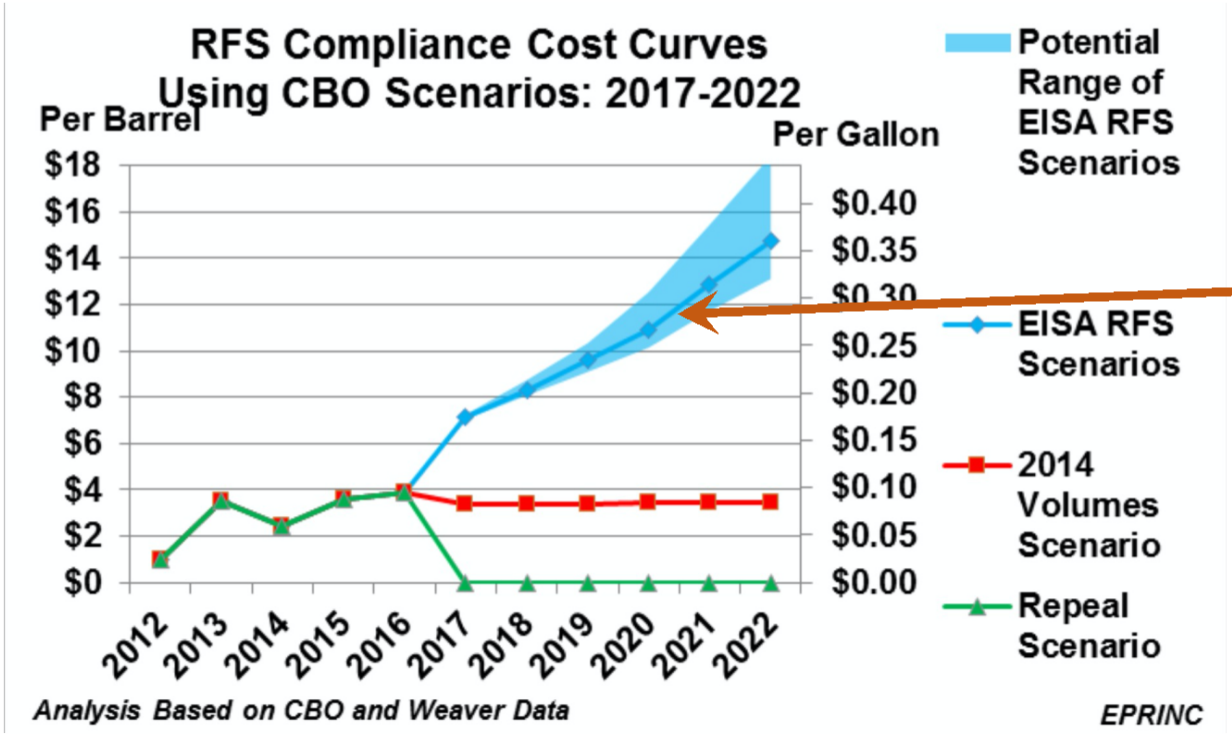
2007 Energy Independence and Security Act (EISA) Expected Large Increases in Gasoline Demand



EISA biofuel mandates could have have been accommodated under EISA 2007 forecast at little or no cost

Figure 3

EPRINC 2016 ANALYSIS OUTLINED COST RISKS FROM VOLUMETRIC TARGETS ABOVE THE BLEND WALL



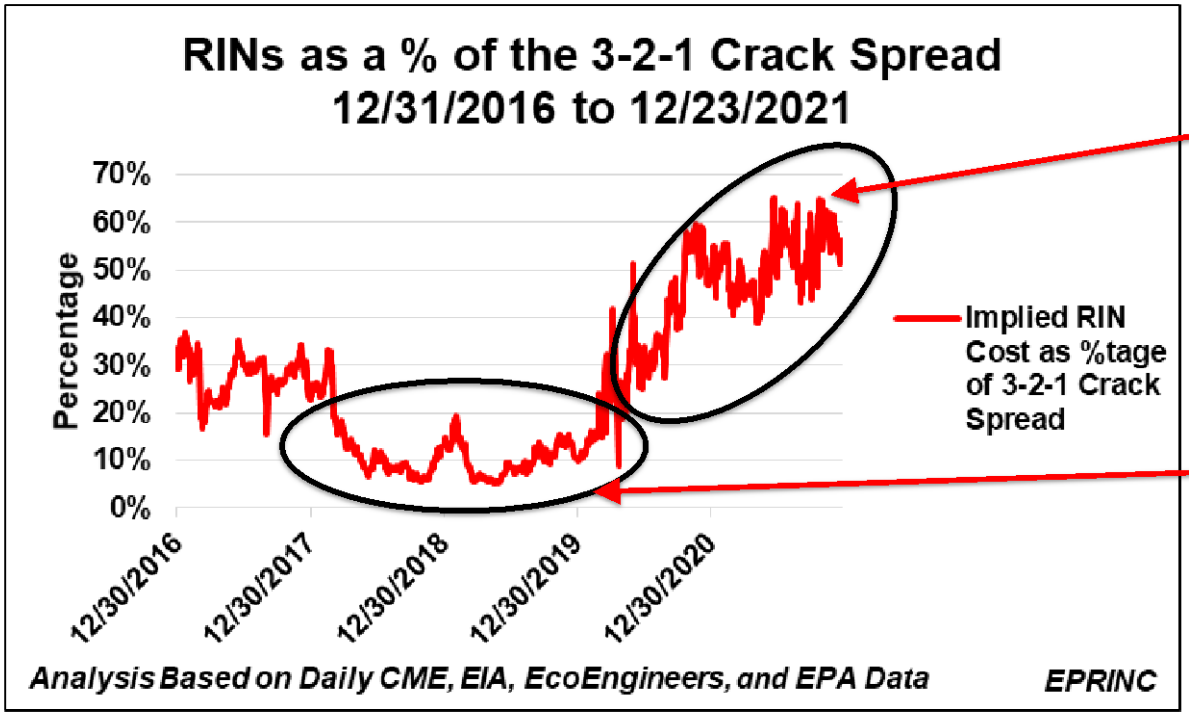
Program costs escalate as mandates drive volumes above the blend wall.

RFS program (*Dec 2021*) adding about 28 cents a gallon to price of gasoline

This tracks current cost increases in production of transportation fuels (as shown in "crack spreads")

Figure 4

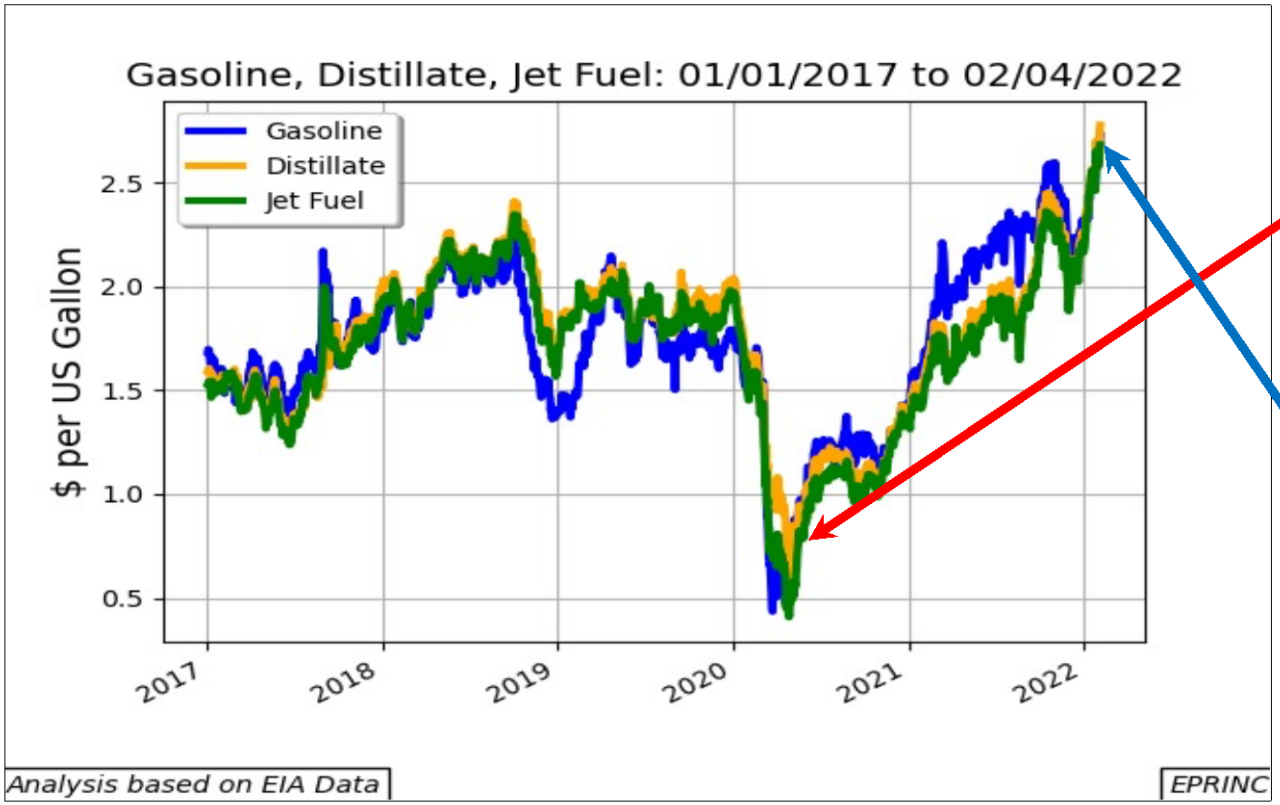
PRODUCTION COST OF GASOLINE AND DIESEL FUEL ARE RISING BECAUSE RFS MANDATE COSTS ACCELERATE ABOVE THE BLENDWALL



The cost of biofuel mandates (reflected in RIN prices) have been on the rise

Small Refinery Exemptions (SREs) helped keep RIN costs low.

Figure 5 **ERA OF LOWER CRUDE AND PRODUCT PRICES MAY BE OVER**

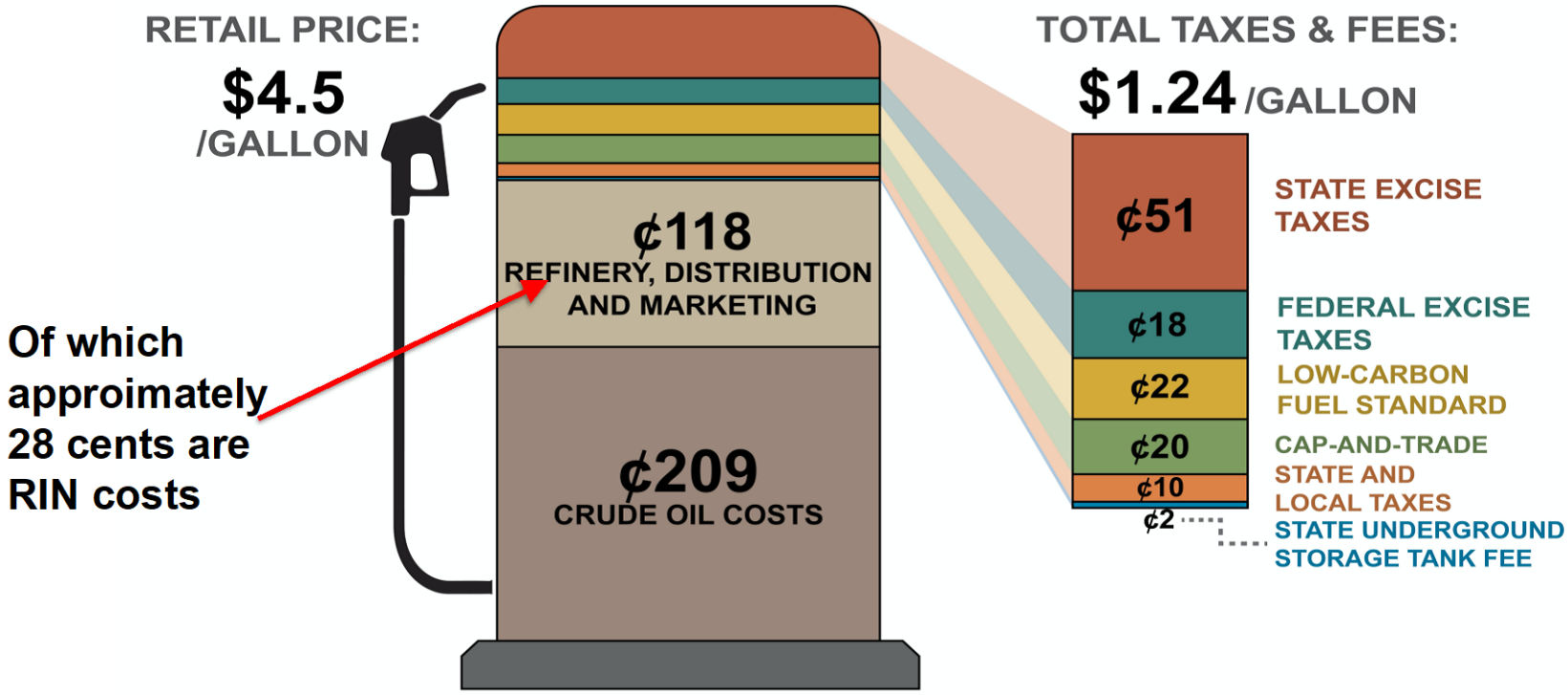


Lower fuel prices (from lower crude costs) masked the cost of the regulatory programs

Higher prices may be around for a long time as the world recovers from the pandemic and both government regulatory policies & ESG policies/initiatives have limited investment in legacy fuels

Figure 6

Other Programs Can Also Add to Consumer Costs, e.g. California



Price data as of January 17, 2022; Low-Carbon Fuel Standard and Cap-and-Trade data as of September 2021
Source: EPRINC figure based on data from the California Energy Commission and WSPA

Figure 7

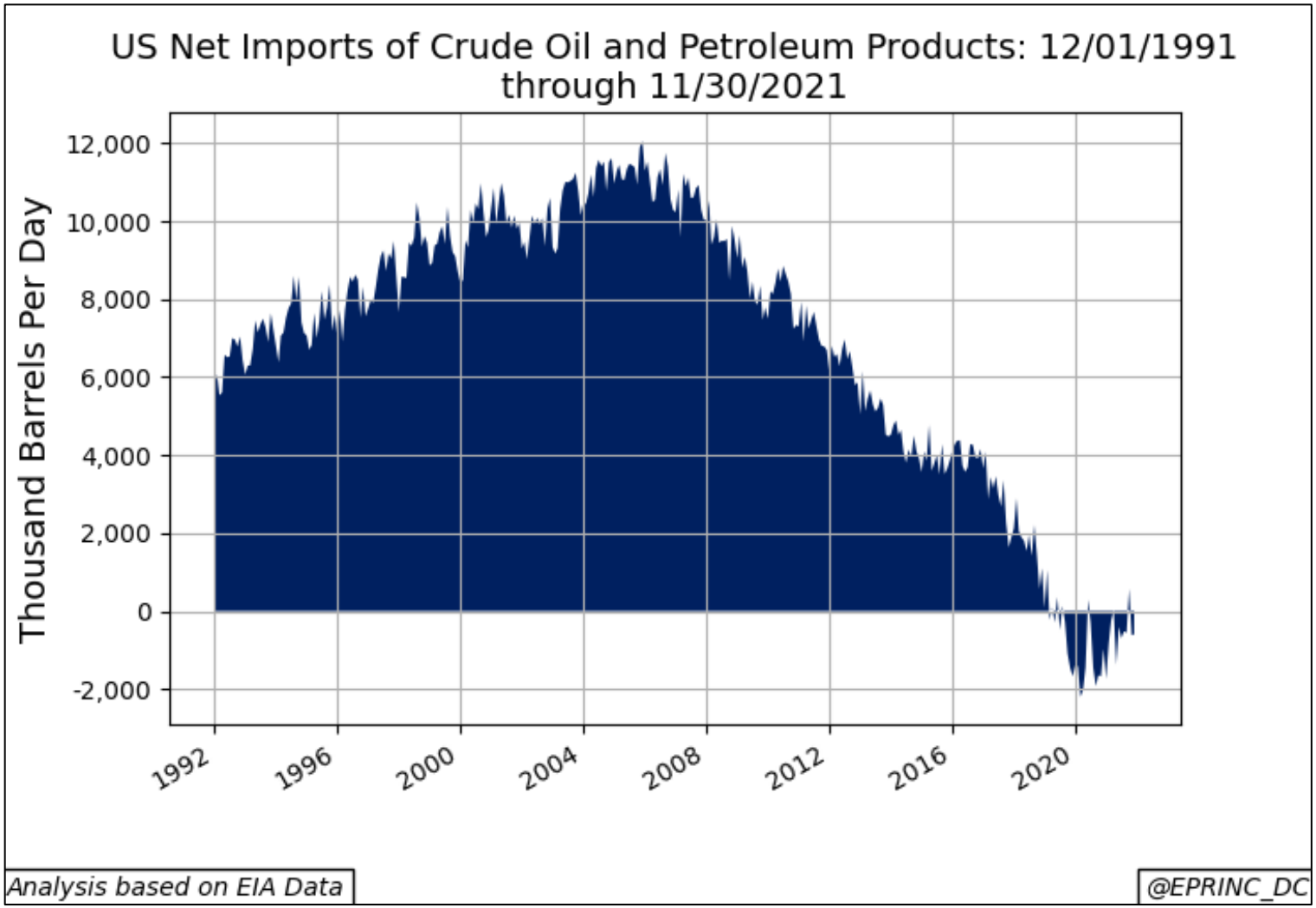
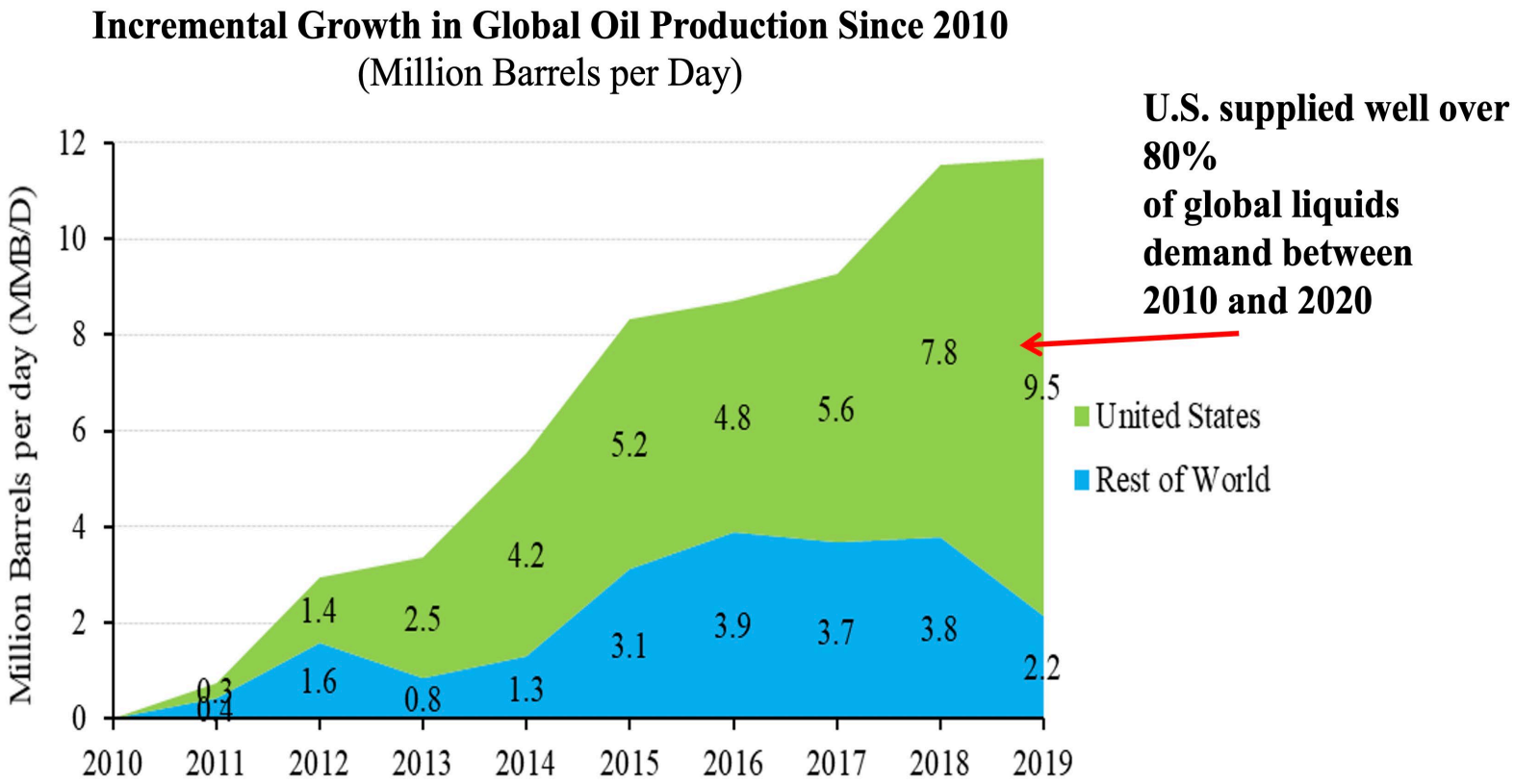

US Net Imports of Crude Oil and Petroleum Products: 12/01/1991 through 11/30/2021
Thousand Barrels Per Day
12,000
10,000
8,000
6,000
4,000
2,000
0
-2,000
1992
1996
2000
2004
2008
2012
2016
2020
Analysis based on EIA Data
@EPRINC_DC

Figure 8



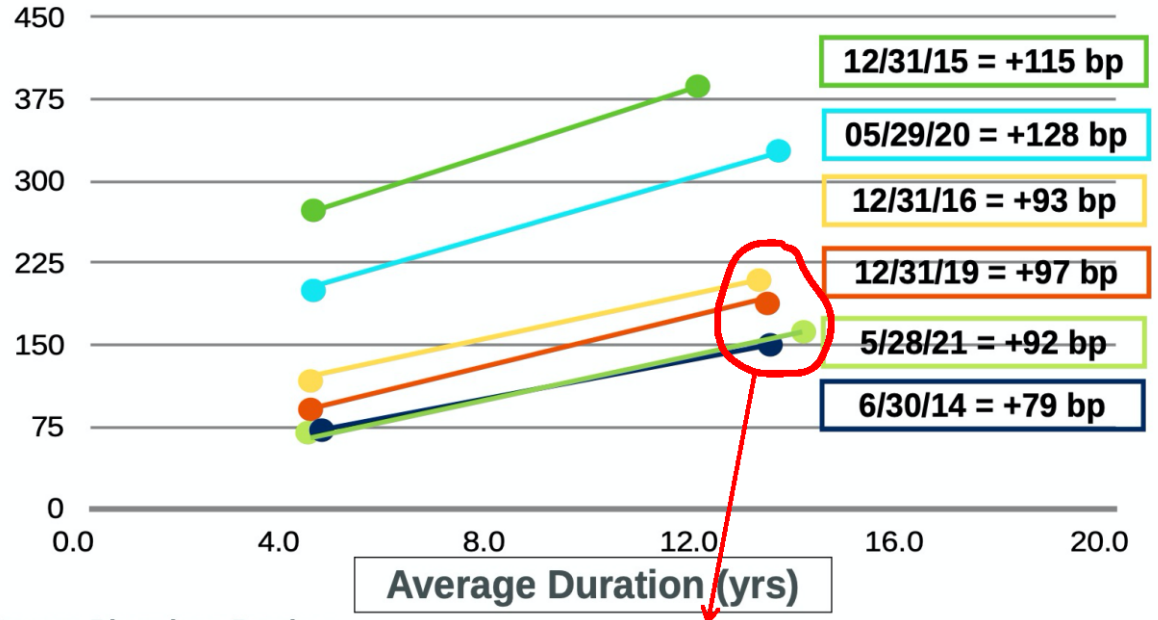
Source: EPRINC figure based on data from BP Statistical Review of World Energy 2021

Figure 9

Stranded Assets?

Risk Averse Long Dated Investment Grade Bondholders Like Oil & Gas

Since the shale-related reset of world oil prices that began in mid-2014, the IG energy credit spread curve has not steepened meaningfully, other than temporary spikes caused by oil price volatility (mainly the 2020 pandemic and related OPEC+ market share war).



Source: Bloomberg Barclays

Bond holders are not buying into stranded assets, yield curve is not rising steeply

Source: Paul Tice, Stern Shool of Business, NYU; EPRINC Chart of the Week

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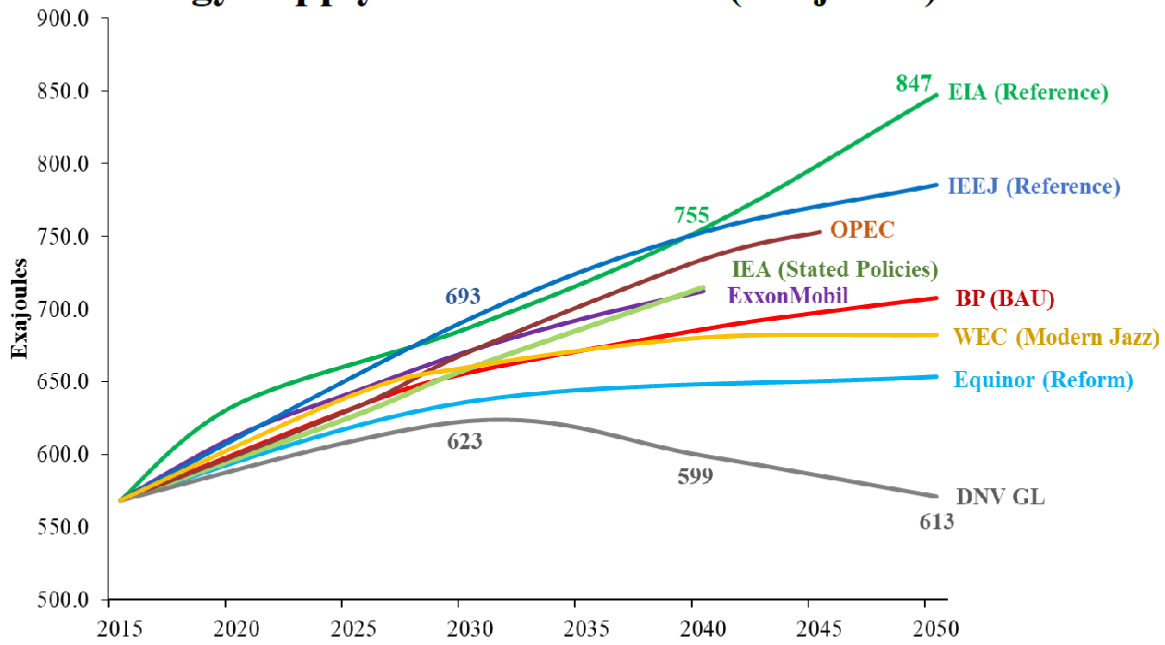
Figure 10

US Energy Policy Should be Robust Against Uncertainty

Energy Supply Scenarios to 2050 (Exajoules)

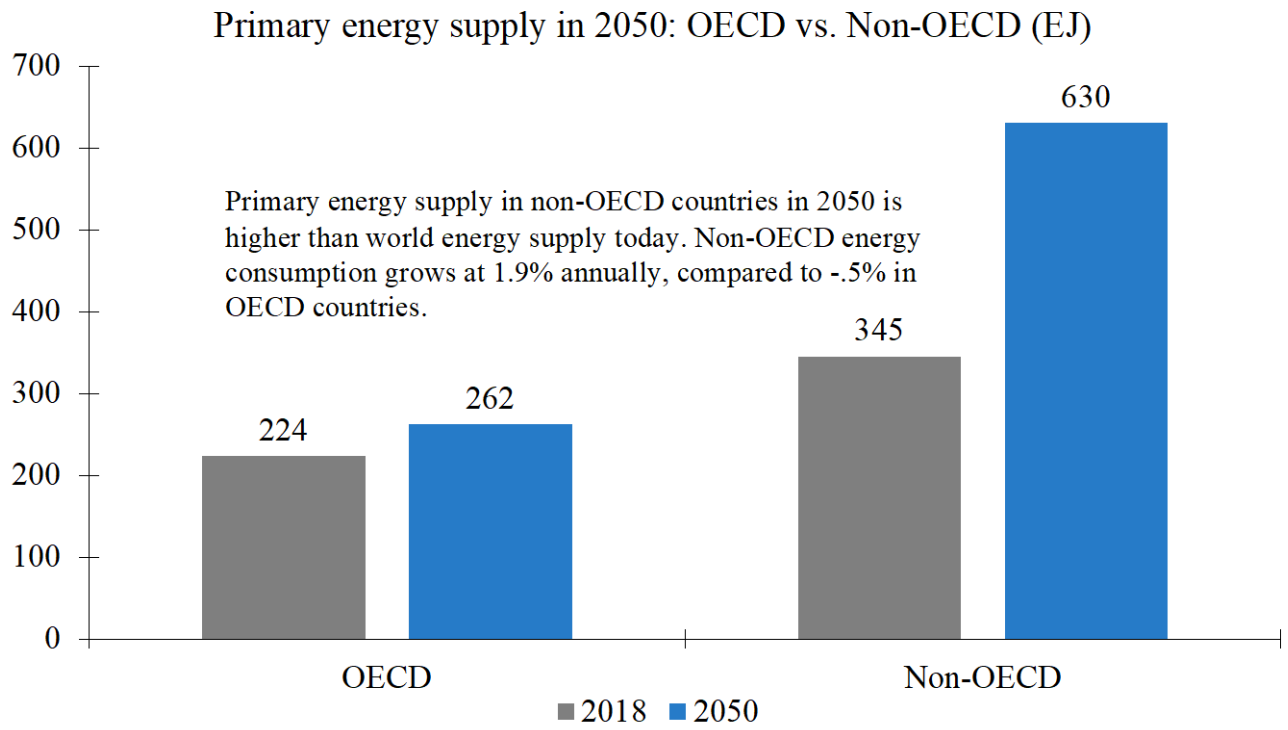
How do you explain the wide differences in outlooks?



Note: Exajoule (EJ) is a comprehensive unit of energy, roughly equivalent to 1.05 quadrillion British thermal units (quads). One EJ equals 10^{18} (one quintillion) joules, and one joule equals the amount of work done on a body by a 1 Newton force that moves the body over 1 meter. One exajoule per year = 447,000 barrels of oil equivalent per day.

Additional Information
On Long Term Price Risks for Petroleum Products & EVs

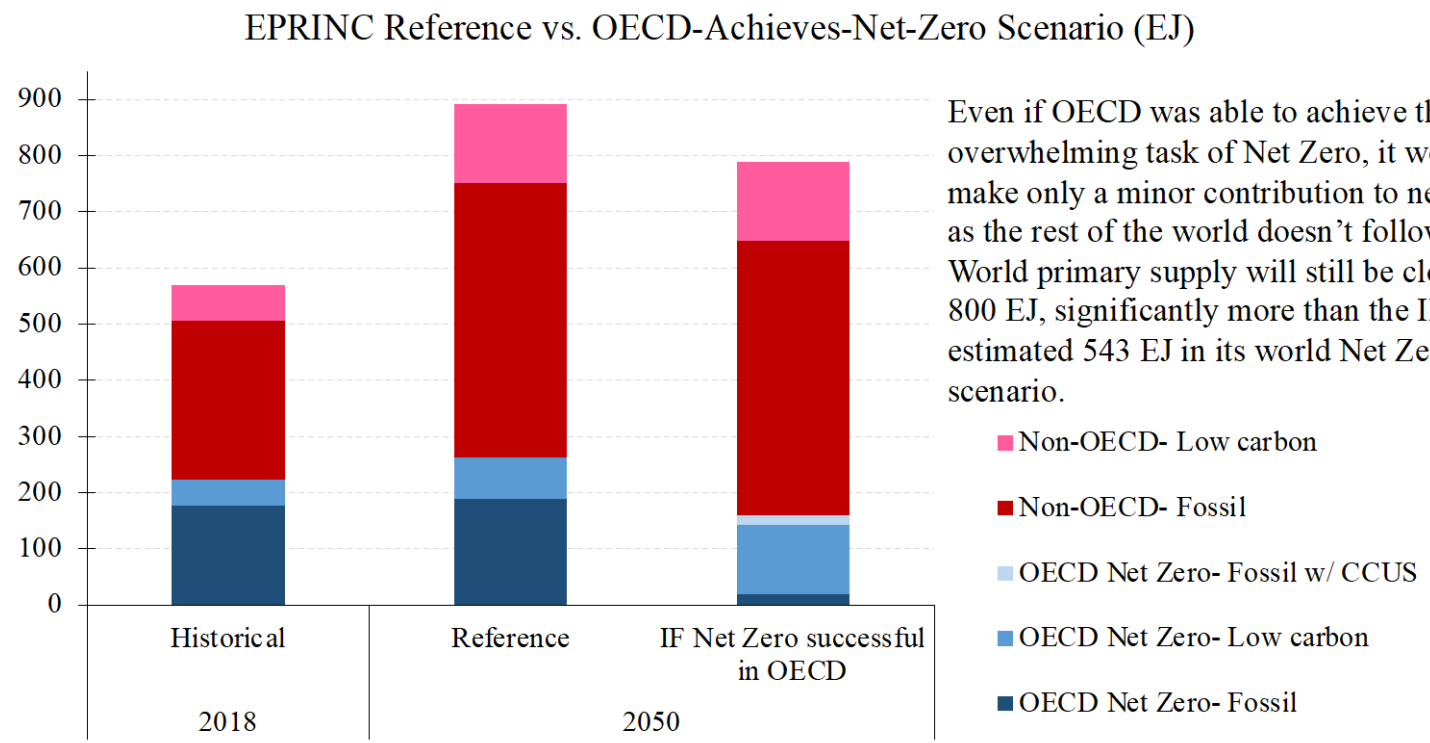
Figure 11 Non-OECD Will Drive 88% of Global Energy Growth Through 2050



Source: EPRINC analysis and projections based on historical data from IEA World Energy Balance

Figure 12

Even If OECD Approaches Net Zero, Non-OECD Will Struggle to Follow Suit



Even if OECD was able to achieve the overwhelming task of Net Zero, it would make only a minor contribution to net zero as the rest of the world doesn't follow suit. World primary supply will still be close to 800 EJ, significantly more than the IEA's estimated 543 EJ in its world Net Zero scenario.

Figure 13

The U.S. is a Leader in Oil and Gas Production

(In specialty minerals, the U.S. is highly dependent on foreign sources of supply)

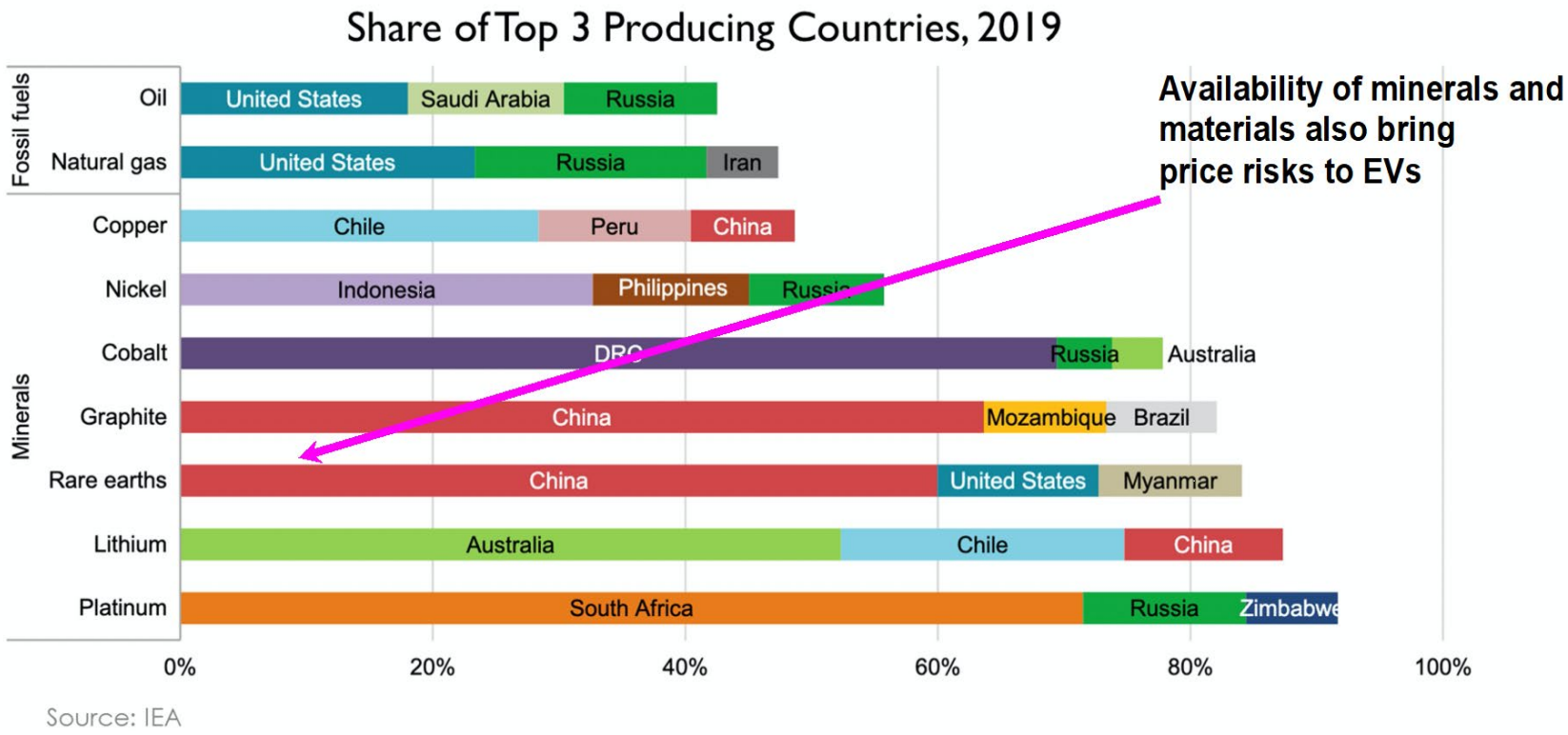


FIGURE 14

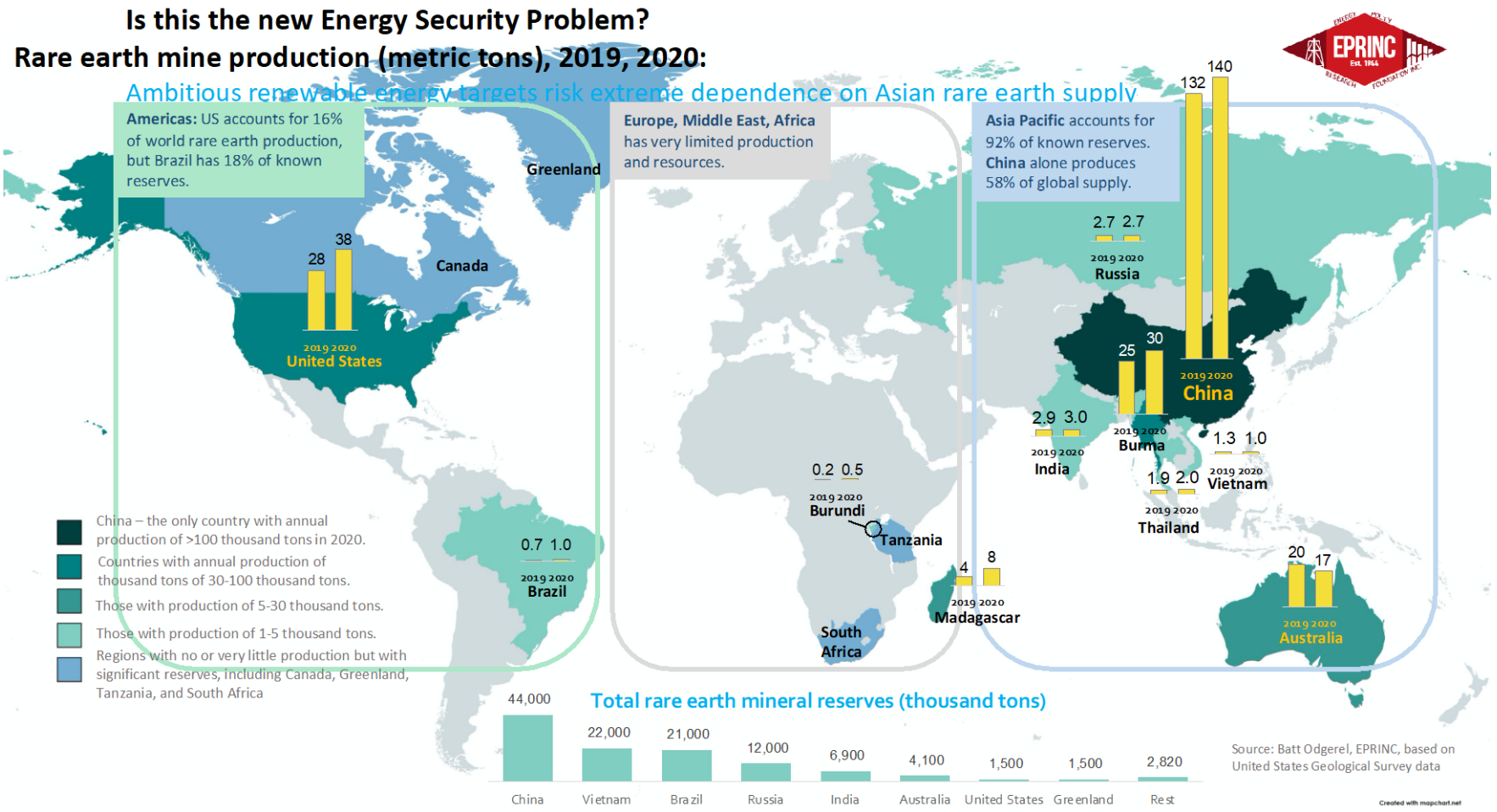
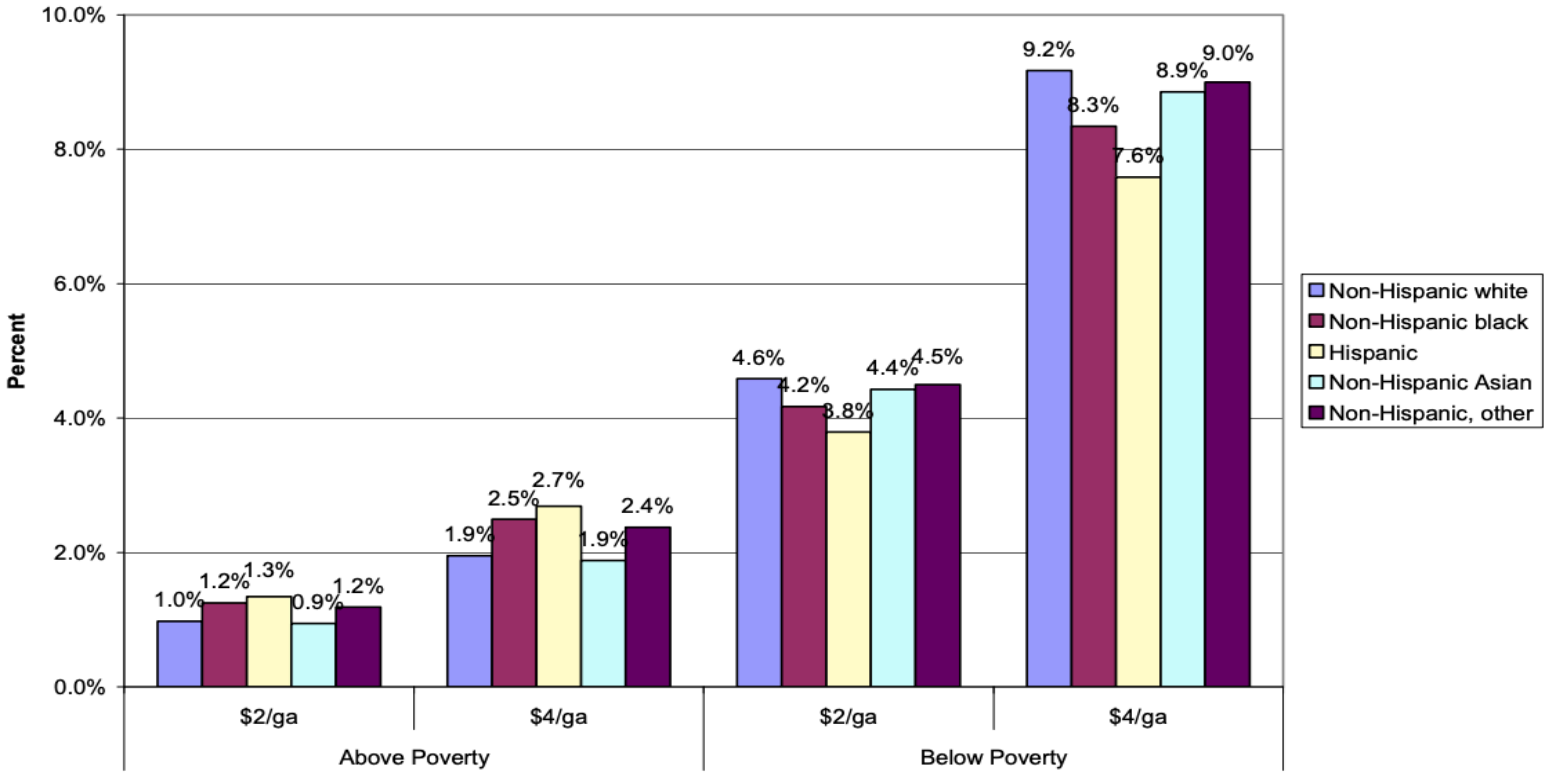

Is this the new Energy Security Problem?
Rare earth mine production (metric tons), 2019, 2020:
Ambitious renewable energy targets risk extreme dependence on Asian rare earth supply
Americas: US accounts for 16% of world rare earth production, but Brazil has 18% of known reserves.
Europe, Middle East, Africa has very limited production and resources.
Asia Pacific accounts for 92% of known reserves. China alone produces 58% of global supply.
Greenland
Canada
28
38
2019 2020
United States
0.7 1.0
2019 2020
Brazil
0.2 0.5
2019 2020
Burundi
Tanzania
South Africa
4
8
2019 2020
Madagascar
2.7 2.7
2019 2020
Russia
132
140
25
30
2019 2020
China
2.9 3.0
2019 2020
India
2019 2020
Burma
1.3 1.0
2019 2020
Vietnam
1.9 2.0
2019 2020
Thailand
20
17
2019 2020
Australia
China – the only country with annual production of >100 thousand tons in 2020.
Countries with annual production of thousand tons of 30-100 thousand tons.
Those with production of 5-30 thousand tons.
Those with production of 1-5 thousand tons.
Regions with no or very little production but with significant reserves, including Canada, Greenland, Tanzania, and South Africa
Total rare earth mineral reserves (thousand tons)
44,000
22,000
21,000
12,000
6,900
4,100
1,500
1,500
2,820
China
Vietnam
Brazil
Russia
India
Australia
United States
Greenland
Rest
Source: Batt Odgerel, EPRINC, based on United States Geological Survey data
Created with mapchart.net

FIGURE 15

Rising Cost of Transportation Fuels Harm Low-Income and Many Minority Communities



Source: Urban Institute