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GAS PRICES

HEARING

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES UNITED STATES SENATE

ONE HUNDRED THIRTEENTH CONGRESS

FIRST SESSION

TO

EXPLORE HOW U.S. GASOLINE AND FUEL PRICES ARE BEING AFFECTED BY THE CURRENT BOOM IN DOMESTIC OIL PRODUCTION AND THE RESTRUCTURING OF THE U.S. REFINING INDUSTRY AND DISTRIBUTION SYSTEM

JULY 16, 2013

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CONTENTS

STATEMENTS

APPENDIX

APPENDIX I

APPENDIX II

GAS PRICES

TUESDAY, JULY 16, 2013

U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The committee met, pursuant to notice, at 10 a.m. in room SD–366, Dirksen Senate Office Building, Hon. Ron Wyden, chairman, presiding.

OPENING STATEMENT OF HON. RON WYDEN, U.S. SENATOR FROM OREGON

The CHAIRMAN. The committee will come to order.

I'd like to begin this morning by expressing my thanks to each and every member of this committee.

As of today, this committee has reported 50 pieces of legislation, half of the total number of bills that have been sent to the floor of the Senate, and I would just like to take note of the fact that this doesn't happen by osmosis. This stems from the fact that there has been a lot of cooperation, a lot of good will on this committee. A number of these bills that have come out of this committee are going to resolve issues that have been pending for literally decades, and I'm going to recognize Senator Murkowski for her statement in a moment, but I just want to note that this could not have happened without her leadership. I'm especially appreciative of Senator Barrasso as well. Note, Senator Baldwin, she's going to enjoy her time on this committee, and I just wanted to begin by expressing my thanks to my colleagues on both sides of the aisle.

Senator MURKOWSKI. Mr. Chairman.

The CHAIRMAN. Yes, Senator Murkowski.

Senator MURKOWSKI. If I may interrupt the Chair, which is not something that I like to do, but you have brought up, I think, a very important reality that here in this committee, we are producing, we are working, we are doing the work that committees should. As we all know, these are some exceptionally tense times right now, here in the U.S. Senate as we try to internally resolve some of our rules have impact on not only the rules process, but really on the comity—not the comedy, but the comity—that goes on within this body, and I think you have clearly led by example, saying bipartisanship needs to be more than just picking one member from the other side and making something happen, and I do hope that we are able to work forward a process in this body that allows us to continue the work that the people in this country expect us to do, but I think we set the example, we set the standard, by as a committee, coming together basically doing our work, rolling up

our sleeves, and doing the task at hand. So I didn't want to miss an opportunity to thank you for your leadership in that vein, and encouraging a process that has allowed us to be the committee that is producing half of the bills that are ready to be heard on the Senate floor, so just thank you.

The CHAIRMAN. I thank my colleague and the fact that you consistently meet halfway is a huge part of why we've been able to do this and I want to express my appreciation.

Today, the committee is going to look at the changes taking place in the U.S. petroleum industry and their impact, not only on the oil industry, but more importantly, on the prices that our people pay at the pump.

At the beginning of this Congress, the committee held its first hearing on the dramatic changes taking place in the U.S. natural gas market due largely to the development of natural gas from shale formations.

Unlike the immediate benefits that American consumers and businesses have seen from low natural gas prices, at the gasoline pump, it's been pretty much business as usual. While the U.S. economy may be benefiting from declining oil imports, prices at the pump have remained consistently high.

For years, a number of representatives in the oil industry have told the American people that U.S. gasoline prices are at the mercy of world oil prices. That was basically the case because of our dependence on imported oil. New oil supplies from America have turned that dynamic on its head. Some regions of the country like the Midwest that have access to the lowest price crude oil have some of the highest refining margins in the Nation. Our committee is going to explore on a bipartisan basis why so many consumers have not benefited from these new lower cost sources of crude oil.

In addition to the changing natural gas market, our country is going through a dramatic shift in oil and gas production. Instead of relying on more and more imports, the U.S. oil industry is now increasingly focused, in the Energy Information Administration's words, on absorbing the significant increases in U.S. oil production, including through export of both crude and petroleum. Whether it's oil from the Permian basin in Texas or the Bakken formation in North Dakota, there are new supplies of oil that were simply not part of the energy equation 5 years ago.

Since 2007, when the Congress passed the last major energy bill, our country has gone from importing upwards of 60 percent of our crude to now importing roughly 40 percent. That is the lowest percentage since 1991. The largest source of those imports, 28 percent, is Canada. According to the Energy Information Administration, this trend is going to continue. The Energy Information Administration is project that the U.S. will increase crude oil production from a low in 2008 of 5 million barrels a day to 8.2 million barrels a day by the end of next year. That's a 64 percent increase.

Another trend that the Energy Information Administration says is going to continue is the decline in expected U.S. gasoline demand, as cars and trucks become more efficient due to higher vehicle mileage standards. Ethanol use, required by the Renewable Fuel Standard, is also displacing about 10 percent of the gas in every gallon sold in the country. That mandate, the RFS mandate,

is going to require even higher blends if left unchanged, which should also further diminish the demand for oil.

So we've gone from being a net importer of petroleum products to a net exporter of petroleum products for the first time in more than half a century. U.S. refineries are now exporting over 2.8 million barrels of gas and diesel fuel and other petroleum products a day, thanks in large part to access to new, cheaper crude oil supplies and abundant low-cost natural gas that's used to fuel the refineries.

The U.S. refining industry clearly has a major competitive advantage over other overseas suppliers, especially for markets in North, South, and Central America, but many of our people want to know why prices are so high here at home when there is so much extra gas and diesel fuel that it can actually be exported. Our people want to know why the flood of new domestic crude hasn't been lowering prices at the pump. Instead, refiners in the middle of the country with the greatest access to the cheapest crudes have had the highest margins with the difference between the cost of the oil they buy and the gasoline and diesel fuel they sell often exceeding $40 or $50 a barrel. In many cases, these refining margins are now at record or near-record levels; some, as I say, over a substantial amount a gallon. What's been good for refiners hasn't necessarily been good for the consumer.

Another important development in the U.S. oil and gas industry are the structural changes that have taken place. The largest refinery in the United States is no longer a major integrated oil company; it's an independent refiner, Valero, who will be testifying here this morning. Refiners often don't own their own distribution terminals. Oil companies no longer own their own service stations. The number of oil refineries in the country has also declined, though total refining capacity is up, making our Nation more dependent on a smaller number of larger, more complex refineries. An outage at one of these refineries, whether planned or accidental, is now a major factor in the price at the pump. Last October, a minor electric power outage in a major refinery in California raised wholesale gasoline prices over 80 cents a gallon in a matter of hours. In the upper Midwest last month, the prices shot up almost—again, a substantial amount, in a week as a result of refinery outages.

I want to thank Senator Franken for highlighting this issue and for his work with me to strengthen our ability to track refinery outages and reduce their impacts on prices to consumers, and I want to highlight again, this has been a bipartisan concern. Senator Hoeven is a co-sponsor of legislation that involves both Senator Klobuchar and Senator Franken to look at reporting in this area. Senator Donnelly has done very good work on that. They're all from the Midwest and they are all seeking to work on an important issue in a bipartisan way.

Today's hearing begins the committee's examination of all of the changes in the oil industry that I have tried to touch on here and what they mean for consumers. Supply is up, demand is down, but prices at the pump are still stubbornly high, and sometimes, are as volatile as the gas itself. Some refiners have enjoyed record mar-

gins, but there's been a lot less joy for millions of consumers at the pump.

We've got a good cross-section of the energy market here today. They include a producer, a refiner, representatives of marketers and consumers, and 2 independent industry analysts who don't have—I guess you'd call it an official dog in the fight; one from the government and one from the private sector.

Mr. Hume is Vice Chairman of Strategic Growth Initiatives for Continental Resources, a very large producer in North Dakota. Mr. Klesse is the Chairman and CEO of Valero. Mr. Gilligan is the President of Petroleum Marketers Association. Mr. Plaushin is Director of Federal Relations for the AAA. Mr. Sieminski is the Administrator of the Energy Information Administration at the Department of Energy, and Mr. Khan is Managing Director for Integrated Oil & Gas Research at Citigroup. So I want to, again, thank my colleagues and recognize Senator Murkowski.

STATEMENT OF HON. LISA MURKOWSKI, U.S. SENATOR FROM ALASKA

Senator MURKOWSKI. Thank you, Mr. Chairman.

I was home in the State over the Fourth of July recess and had the opportunity to spend a little bit of time on the Kuskokwim River. I was going out looking at, talking to individuals in their fish camps about what's happening with fishing, price of fuel, and what that means to them in their villages, and it was just after the spring barge had come and delivered fuel. If you live on the Kuskokwim, you get 2 fuel deliveries a year; you get one in the spring, which is June, and you get one in September, provided that you can get upriver. Sometimes, you can only get one barge in, but basically, your price for fuel is set when those purchases are made, and everyone in the village—it's not like there's any competition out there; it is what it is—and when you're in Bethel, which is the big hub community, paying over $5 a gallon for your fuel, when the barge comes in, you're hoping that it's going to go down. The prices didn't go down, they went up 20 cents, so on Monday, you're sitting at $5.15 and on Tuesday, you're sitting at $5.35 for the balance of the summer with no relief in sight.

You go upriver to Aniak and they were hit with a 20-cent increase in their fuel for the summer. You go 10 miles upriver to Chuathbaluk and there's no fuel; there is just no fuel. You want fuel for your boat, you borrow some fuel from your neighbor and you go downriver to Aniak and it's about a $50 run for that 10 miles.

So in my home State, when we're talking about gas prices, it's real, it's immediate, it directs and it dictates how you live and what it is that you do. So I appreciate the opportunity for good discussion on this and really, how we deal with this from a policy perspective.

I appreciate, Mr. Chairman, your approach on the basic structure for this hearing. I'm optimistic that our decision to look not just at gasoline prices, but a whole range of factors that could be influencing them, will be helpful to us in our policymaking options.

Let me also welcome our distinguished panel this morning. I know you will provide us with valuable perspective on what it

takes to recover, to refine, and to retail our Nation's transportation fuels.

It's hard to believe that it's now been 5 years, almost to the day, Mr. Chairman, since the price of oil rose to an all-time high of $147 a barrel. We're down from that, thankfully, but still, $147 a barrel 5 years ago; it's almost equally hard to believe how much has changed since then. One of the brightest spots in our entire economy has been and continues to be energy production on State and on private lands. After years of listening to critics contend that the U.S. is running out of oil, domestic production has risen by 30 percent over these past 5 years, it's created thousands and thousands of jobs, generated substantial revenues, slashed our OPEC imports. According to a recent analysis by the Wall Street Journal, it has helped reduce volatility in world oil prices and while it's difficult to measure the precise benefit, I believe that rising American production has reduced, or at the very least, restrained some of what we're seeing in terms of prices at the pump. One downside is that production on Federal lands has not kept pace; it actually fell in both 2011 and 2012, and I think that that represents a huge missed opportunity, and all you need to do is look to my State of Alaska. We've got more untapped oil than any other State, we've got broad public support for new production, we've got a major pipeline that is sitting at less than half full; all we're asking for is permission to produce our resources, but we haven't been able to secure that at this point in time.

Now outside of production, I think there are some other factors that are worthy of consideration. I look forward to discussion of transportation and infrastructure constraints and learning what we can do to help resolve those. I'm glad we're going to have a chance to hear about the importance of a robust refining sector, I'm eager to examine some of the regulations that could be impacting our fuel supply, particularly the Renewable Fuel Standards, which I think that Congress needs to reform.

Mr. Chairman, I continue to believe that we need to take every step possible to reduce and stabilize fuel prices for American families and for our businesses, but that's going to include increasing production on Federal lands, increasing the efficiency of our vehicles and increasing the use of alternatives. It will mean rejecting rather than seeking punitive tax hikes, it will require the timely approval of needed projects, including the Keystone Excel pipeline, and the prompt adjustment of any regulation that comes in conflict with our desire for abundant and affordable energy.

So again, I look forward to the witnesses' testimony here this morning and the questions that we'll be able to pose afterwards.

Thank you.

The CHAIRMAN. Thank you, Senator Murkowski, and I think it's very important, the point you made, that there are a variety of factors that go in to this whole debate. We talked about it when we were together in Alaska and I think it's just as correct today and I thank you for a very helpful statement.

For our witnesses, we're probably going to have at least one vote at 11, and what happens on a day like this is Senator Murkowski and I work together from time to time to call some audibles and try to figure out how to keep everything moving, and our hope is

that we'll be able to do it. So if each of you will take 5 minutes or so and highlight your principal concerns, we'll make your prepared statements part of the record. Why don't we begin with you, Mr. Sieminski?

STATEMENT OF ADAM SIEMINSKI, ADMINISTRATOR, ENERGY INFORMATION ADMINISTRATION, DEPARTMENT OF ENERGY

Mr. SIEMINSKI. Thank you, Chairman Wyden.

Right Member Murkowski, members of the committee, thank you for the opportunity to appear here today.

EIA is the statistical and analytical agency at the Department of Energy. By law, EIA's data analysis and forecasts are independent of approval by any other officer or employee of the U.S. Government.

I'd like to make 5 main points today. First, the United States is undergoing a dramatic change in domestic oil product, most of which has occurred in the past 3 years. Domestic oil output is now at the highest level since October 1992. Texas has more than doubled its production and North Dakota's output has nearly tripled. The unexpected pace of the growth has stressed the petroleum supply infrastructure; notably, a dramatic increase in shipments of crude oil by rail from the Bakken in North Dakota reflects both lags in adding pipeline infrastructure and the flexibility of rail shipments to serve coastal refineries. Several pipeline projects are currently underway or proposed which should increase deliveries of domestic crude oil from inland sources to major refining centers, primarily on the Gulf Coast.

Second, domestic crude oil supplies are growing. Refiners face declining demand for gasoline in the U.S. market. Since 2007, demand for gasoline has dropped by almost 600,000 barrels a day and the amount of ethanol being added to the gasoline pool has increased supply by almost 400,000 barrels a day. Imports of gasoline-blending components have declined and exports of refined products, as you noted, Senator Wyden, primarily from the Gulf Coast have increased. Infrastructure constraints within the U.S. limit the movement of petroleum products from refining centers like the Gulf Coast to regions where product demand actually exceeds production capacity like the Northwest. Product exports provide a way for refining centers to optimize crude runs and operations. While virtually all of the new production in the U.S. is light sweet crude, much of the refining capacity in the Gulf Coast has been optimized to run on heavy sour crude. To accommodate the change in crude slate, refiners have a number of alternatives ranging from little or no-cost projects to major capital investments. No matter the cost of the alternative, the ability and extent to which it can be accomplished is unique to each refinery and cannot be estimated accurately by EIA at this time.

Third point, in 2012, the United States imported 11 million barrels a day of crude oil and refined petroleum products. At the same time, the Nation exported 2.7 million barrels a day of finished petroleum products and gasoline-blend stocks. While most product imports occurred on the East Coast and exports from the Gulf Coast, the U.S. as a whole is linked by a very complex logistical system which transports products and influences prices throughout

the country. As with crude, refined product prices are heavily influenced by the international markets. The U.S. exports a small amount of crude oil to Canada; the first 4 months of this year, the volume was over 100,000 barrels a day, up from the 2012 average of about 60,000 barrels a day.

Fourth point, ethanol, comprising nearly 10 percent of the gasoline pool, has to be moved mainly from the Midwest to market centers along the East, West and Gulf Coasts where it is then blended into the gasoline pool. Short-term fluctuations in regional product supply chains can cause prices in particular regions of the country to be temporarily disconnected from world and national market forces. This spring, 2 unplanned refinery outages in the Midwest, along with delayed restarts at several others, caused average retail gasoline prices to increase by 26 cents a gallon between the end of April and the middle of June. Similar price increases occurred in 2012 on the West Coast after a series of unplanned outages. These occurrences are relatively short-lived, 6 to 8 weeks usually, and are the result of largely unforeseeable circumstances.

Fifth and final point, over the last several years, EIA has recognized significant changes to the supply and demand pattern and patterns for petroleum products, both domestically and with external trade. EIA collects, analyzes and reports more data on our national petroleum supply than any other comparable organization in the world. As resources have permitted, and in some cases, where significant regional transitions have raised concerns with Members of Congress, EIA has monitored, analyzed and reported on potential market changes.

This committee is a very important user of EIA's services and I look forward to working with you. Thank you.

[The prepared statement of Mr. Sieminski follows:]

PREPARED STATEMENT OF ADAM SIEMINSKI, ADMINISTRATOR, ENERGY INFORMATION ADMINISTRATION, DEPARTMENT OF ENERGY

Chairman Wyden, Ranking Member Murkowski, and Members of the Committee, thank you for the opportunity to appear before you today to discuss the U.S. petroleum supply system, which is changing rapidly.

The U.S. Energy Information Administration (EIA) is the statistical and analytical agency within the U.S. Department of Energy. EIA collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding regarding energy and its interaction with the economy and the environment. By law, EIA's data, analyses, and forecasts are independent of approval by any other officer or employee of the United States Government, so the views expressed herein should not be construed as representing those of the Department of Energy or any other Federal agency. As discussed in my testimony, EIA is active in providing both data and analysis that bear directly on supplies of petroleum products in this country. The main points of my testimony are as follows:

The United States is undergoing a dramatic change in domestic oil production. The rate of increase in domestic production continues to surpass even the most optimistic forecasts of recent years. Domestic oil production in the United States has increased significantly, and at 7.4 million barrels per day as of April 2013 is now at the highest level since October 1992. Over the five year period through calendar year 2012, domestic oil production increased by 1.5 million barrels per day, or 30 percent. Most of that growth occurred over the past 3 years. Lower 48 onshore production (total U.S. Lower 48 production minus production from the federal Gulf of Mexico and federal Pacific) rose more than 2 million barrels per day (bbl/d), or 64 percent, between February 2010 and February 2013, primarily because of a rise in productivity from oil-bearing, low-permeability rocks. Texas more than doubled its production and North Dakota's output nearly tripled over that period. Five western

states—Oklahoma, New Mexico, Wyoming, Colorado, and Utah-had production increases ranging from 23 percent to 64 percent over the same three years. This rapid growth has stressed many parts of the U.S. petroleum supply infrastructure.

Currently, transportation constraints are limiting the full impact of increased domestic crude production, but these constraints are expected to ease in the coming years. Historically, about 90 percent of the crude oil and petroleum products in the United States have been transported by pipeline. However, shipments of crude oil by rail from North Dakota's Bakken Shale formation have increased dramatically over the past year, reflecting both lags in adding pipeline infrastructure to transport growing volumes of crude and the ability of rail shipments to serve east coast refineries in the United States and Canada and U.S. west coast refineries, where Bakken crude has its greatest economic value as a replacement for seaborne imports of light sweet crude oil. Crude oil and petroleum products shipments by rail averaged 1.37 million barrels per day during the first half of 2013. (Up 48 percent from 927,000 bpd in same period in 2012) according to the Association of American Railroads (AAR), which tracks movement of commodities by rail. Crude oil accounted for an estimated 50 percent of the combined deliveries in the oil and petroleum products, up from 3 percent in 2009. This topic was discussed in the EIA This Week in Petroleum article of July 11 (See Attachment 1*)

Several pipeline projects are currently under way or proposed which should increase deliveries of domestic crude from inland sources to major refining centers, primarily on the Gulf Coast. Additionally, as discussed in the EIA Today in Energy article of July 10 (See Attachment 2), more Bakken crude is being moved to market by rail. By addressing logistical constraints, these developments are leading to lower discounts for inland crudes. Even before these projects, however, increasing domestic crude production has reduced crude oil imports by almost 1.3 million bpd, or 13 percent, since 2008. Virtually all of the reduction in U.S. crude oil imports is reflected in lower imports from member countries of the Organization of the Petroleum Exporting Countries.

Currently the U.S. is also a very limited exporter of crude oil. Any company wanting to export crude oil must obtain a license from the Bureau of Industry and Security (BIS), which is part of the U.S. Department of Commerce. According to the regulations published in Title 15 Part 754.2 of the Code of Federal Regulations, BIS will approve applications for licenses to export crude oil for the following kinds of transactions:

- From Alaska's Cook Inlet
- To Canada for consumption or use therein
- In connection with refining or exchange of Strategic Petroleum Reserve oil
- Of up to an average of 25,000 bbl/d of California heavy crude oil
- That are consistent with findings made by the president under an applicable statute
- Of foreign-origin crude oil where, based on written documentation satisfactory to BIS, the exporter can demonstrate that the oil is not of U.S. origin and has not been commingled with oil of U.S. origin

Monthly exports of crude oil from the United States to Canada have historically averaged 24,000 barrels per day (bbl/d) and were principally delivered to refineries in central Canada. However, U.S. exports to Canada averaged over 100,000 bbl/d over the first 4 months of 2013 as Canadian refineries, like those in the United States, are processing increased volumes of crude oil produced in Texas and North Dakota. At the same time as domestic crude oil supplies are growing, U.S. refiners face declining demand for gasoline in the U.S. market. Since 2007, demand for gasoline in the U.S. has declined by almost 600,000 bbl/d, or 6.3 percent, and the amount of ethanol being added to the gasoline pool has increased by almost 400,000 bbl/d (replacing about 270,000 bbl/d of petroleum gasoline after accounting for ethanol's lower energy content relative to petroleum gasoline) . Therefore, from a crude oil refiner's standpoint, demand for the refined portion of gasoline has declined by almost 900,000 bbl/d, which is the equivalent output of 14 average sized U.S. refineries. As a response, imports of gasoline blending components have declined by almost 500,000 bbl/d, or 43 percent, and exports primarily from the Gulf Coast, have increased by almost 400,000 bbl/d. In 2012, 84 percent of the gasoline exports went to countries in Latin America. In addition, diesel demand in the U.S. declined by 450,000 bbl/d in the same time period, or by 11 percent, leading to a drop in diesel imports of 200,000 bbl/d and increased exports of over 700,000 bbl/

*All attachments have been retained in committee files.

d. Again, in 2012, 61 percent of the diesel exports went to Latin America and 35 percent to Europe.

Infrastructure constraints within the United States, including pipeline capacity and marine vessel availability, limit the movement of petroleum products from U.S. refining centers like the Gulf Coast to the Northeast and other regions where product demands far exceeds product production capability of within-region refining capacity. Product exports provide a way for refining centers to optimize crude runs and operations. Although expected increases in domestic demand for diesel should reduce future distillate exports, gasoline exports are likely to increase. Domestic demand is expected to continue to decline due to improvements in the efficiency of new vehicles subject to fuel economy standards that grow steadily more stringent through the 2025 model year as well as the potential increased use of higher-percentage ethanol blends and other biofuels to meet the requirements of the renewable fuel standards. Access to relatively low cost domestic crude oil and natural gas has given U.S. refineries a cost advantage in serving foreign product markets compared to refiners located in other countries who also compete to serve those markets . While access to growing supplies of domestic crude is generally advantageous for U.S. refiners, they do face some challenges in changing their input slates to accommodate the quality mix of U.S. crude production. Specifically, while virtually all of the new crude production in the U.S. is light sweet crude, much of the refining capacity in the Gulf Coast is optimized to run heavy, sour crude.

To adapt to increasing supplies of domestic light sweet crude, there are a number of alternatives available to refiners that range from little or no cost to major capital investments that would only be justified by large crude price differentials.

The low cost alternatives are those which do not meaningfully change the average gravity of the crude for which the refinery was designed. First of all, refiners can simply utilize unused light crude capacity and increase the amount of crude that they run. Since 2008, refinery runs have increased and average crude gravity has gone up, particularly on the Gulf Coast, indicating that spare light crude capacity was being utilized. By 2012, however, U.S. refiners ran at a utilization rate of 88.8 percent, the highest level since 2007 and a level which many analysts view as effectively full utilization after accounting for typicallevels of planned and unplanned outages.

Second, refiners can simply substitute domestic light sweet crude for imported volumes, most of which, according to EIA data, has already been accomplished on the Gulf Coast. Refiners on the East and West Coasts still import significant amounts of light sweet crude, but with rail shipments and eventually pipeline additions, imports can be displaced. Lastly for a low cost alternative, refiners can blend more light sweet crude with heavier crudes to meet their desired crude quality. The ability and extent to which this can be accomplished is unique to each refinery and cannot be estimated by EIA at this time.

Other available options that involve changing the average crude quality run at a particular facility away from its typical inputs require either operational changes based on short term market incentives or capital investments which require longer term incentives. Operationally, refiners can run more light sweet crude but at the expense of total crude input, a loss that must be incentivized by relative crude prices. For longer term capital investments, there are two basic alternatives available to refiners. The first, lower cost option would be to process light sweet crude to remove its lightest components, thereby making it more like medium gravity crude which could then be used as a substitute for imported medium crude. The more costly approach would be to invest in larger units throughout the refinery which deal with lighter components of crude such that light sweet crude could substitute for heavy crude. Again, these investments are unique to each refinery and are based on individual company investment decisions.

In spite of the dramatic changes in the U.S. petroleum supply system, prices of both domestic crude and petroleum products continue to be driven by the international market, albeit subject to short term fluctuations in the supply chain. The United States continues to rely on imported crude oil and petroleum products to meet domestic demand. In 2012, the United States imported 11.0 million bbl/d of crude oil and refined petroleum products. At the same time, the nation exported 2.7 million bbl/d of finished petroleum products and gasoline blendstocks that are also priced on the international market. While most product imports occur on the East Coast and exports from the Gulf Coast, the United States as a whole is linked by

a complex logistical system which transports product and influences prices throughout the country (see Figure 1*).

The petroleum product supply system has developed over many decades to serve demand centers from both local and distant refining centers. More recently, an added complexity has resulted from the requirement to move ethanol from its predominant Midwest supply region to regions throughout the country where it is blended into the gasoline pool (see Figure 2*).

As noted above, short-term fluctuations in regional product supply chains can cause prices in a particular region of the country to become temporarily disconnected from world and national market forces. This spring, two unplanned refinery outages in the Midwest along with delayed restarts at several others caused average retail gasoline prices to increase by 26 cents per gallon between the end of April and the middle of June. The price increase was more dramatic in parts of North Dakota and Minnesota but by the end of June, prices had returned to a more normal level. Similar price increases occurred in 2012 on the West Coast after a series of unplanned outages. While we recognize the burden these price increases place on the American public, these occurrences are relatively short-lived and are the result of largely unforeseeable circumstances.

EIA remains actively engaged in monitoring and reporting on matters related to domestic petroleum product supplies. EIA collects, analyzes, and reports more data on our national petroleum supply system than any other comparable organization in the world. We access data on where crude is produced, what type of crude it is, where it goes, and the ultimate slate of refined products. We collect data on product movements by pipeline and ship and have an extensive database on crude and product imports including the product type and crude quality, the importing entity, and the country (and port) of origin. Like any other organization covering a rapidly changing industry, we also recognize the need for increased data collection and analysis. Over the last several years, EIA has recognized significant changes to the supply and demand patterns for petroleum products both domestically and with external trade. As resources have permitted, and in some cases where significant regional transitions have raised concern with Members of Congress, EIA has monitored, analyzed and reported on potential market changes, including the following:

- U.S. exports of petroleum products
- The proposed sale or closure of three East Coast refineries
- West Coast refinery outages and gasoline price increases
- Possible closure of the Tesoro refinery in Hawaii
- Closure of the Hess Port Reading, NJ refinery
- Midwest refinery outages and gasoline price increases

We have been developing a system to collect crude production data at the well head to better monitor and project domestic crude production. EIA is monitoring the following emerging trends in transportation and midstream infrastructure: crude shipments by rail, barge and truck (see Attachment 1 July 11 This Week in Petroleum article), crude oil pipeline capacity additions and reversals, re-purposing of natural gas pipelines to crude oil and gas liquids service, changing availability of coastwise compliant and foreign flag vessels. We regularly publish a variety of reports on important petroleum supply trends, including This Week In Petroleum, the Short Term Energy Outlook and the Annual Energy Outlook. Although EIA has followed Atlantic basin petroleum product trade for decades, we are currently challenged to keep up with the expanding products trade within the Americas and across the Pacific. This Committee is a very important customer of the EIA and I would look forward to a discussion with you.

Thank you for the opportunity to testify before the Committee.

ATTACHMENT 1—THIS WEEK IN PETROLEUM

U.S. CRUDE OIL INCREASINGLY MOVES BY BARGE, TRUCK AND RAIL

The U.S. Energy Information Administration (EIA) recently released its annual data series tracking how crude oil reaches the refinery gate. Not surprisingly, the 2012 data show heightened reliance on crude receipts via barge, truck and rail.

There has been much discussion about the rise in U.S. crude oil production and the resulting overhang in inventories at Cushing, Oklahoma and elsewhere in the midcontinent because of pipeline infrastructure that has not kept pace with burgeoning domestic crude oil supply. The supply-pipeline mismatch is encouraging market participants to increasingly rely on alternative transportation options.

*All figures have been retained in committee files.

From 2005 to 2010, 96 percent of refinery crude oil receipts came by pipeline and tanker (ship). With relatively low costs and high capacity, pipelines have long been the delivery method of choice for inland refineries. Coastal refineries, on the other hand, have typically been served by tankers of waterborne imports or offshore production. In 2011, this usage began to decline, and in 2012, pipelines and tankers delivered 93 percent of crude oil processed by U.S. refiners (Figure 1*). The balance is made up primarily of domestic crude supplies carried via barge, rail and truck. Foreign receipts via barge have declined slightly.

Because truck and rail are less cost-effective options for moving crude, they typically have accounted for a very small portion of refinery crude receipts, averaging just 1 percent of total receipts from 2000 to 2010. Starting in 2011, this truck and rail volume increased, and in 2012 it represented 3 percent of refinery receipts. Additionally, domestic barge receipts also increased, and now account for close to 3 percent (Figure 2*). Expanding existing pipelines or building entirely new ones is costly and requires lengthy regulatory review. Using trucks and trains on the other hand, provides greater flexibility and uses existing infrastructure. As long as the Bakken and WTI prices trade at a large enough discount to global, waterborne crudes, these transportation patterns are likely to persist or even expand.

EIA collects data on crude delivery methods annually from all U.S. refineries. In cases where multiple transportation modes are used, respondents report the mode used for the last 100 miles. If several modes are used, and none is more than 100 miles, the method representing the longest distance is recorded. This may partially explain the increase in domestic barge traffic, with crude oil loaded on rail cars at production areas and then transferred to barges for the final leg of some journeys to refineries, particularly on the East Coast and along the Mississippi River. With increased rail traffic reported by the Association of American Railroads for the first half of 2013, it is likely that the EIA data on domestic crude receipts by rail will be higher in EIA's 2013 survey.

In addition to delivering more crude oil to U.S. refineries, railroads are shipping U.S. crude oil to eastern Canadian refineries. While the Midwest has been the traditional source for U.S. crude oil exports to Canada, a recent increase in exports is being led by deliveries from the Gulf Coast (waterborne) and the East Coast. The exports from the East Coast are primarily barrels that moved east from North Dakota's Bakken region by rail and are then exported through New York state. Small amounts of Canadian crude are also starting to move by rail to U.S. refineries, with 2011 marking the first time in 10 years that foreign-sourced rail shipments were reported. At nearly 1,000 barrels per day (bbl/d), this was the highest volume of foreign oil-by-rail recorded since EIA started publishing these data in 1981. In 2012 that number set a new record of more than 11,000 bbl/d.

Gasoline price decreases while diesel fuel increases

The U.S. average retail price of regular gasoline decreased less than a penny to $3.49 per gallon as of July 8, 2013, up eight cents from last year at this time. The Midwest price increased two cents to $3.41 per gallon, while prices in all other regions decreased. The largest decrease came in the Rocky Mountain region, where the price is $3.61 per gallon, down three cents from last week. The Gulf and West Coast prices both decreased two cents, to $3.30 and $3.88 per gallon, respectively. Rounding out the regions, the East Coast price is down one cent to $3.46 per gallon.

The national average diesel fuel price increased one cent to $3.83 per gallon, 15 cents higher than last year at this time. The Rocky Mountain price decreased one cent to $3.81 per gallon, while prices in all other regions increased. The largest increase came on the Gulf Coast, where the price is up two cents to $3.75 per gallon. The East Coast, Midwest, and West Coast prices all increased a penny, to $3.83, $3.82, and $3.95 per gallon, respectively.

Propane inventories gain

Total U.S. inventories of propane increased 1.0 million barrels from last week to end at 57.4 million barrels, but are 5.8 million barrels (9.2 percent) lower than the same period a year ago. The Gulf Coast region led the gain with 1.0 million barrels, while East Coast stocks increased by 0.2 million barrels. Midwest stocks increased by 0.1 million barrels and Rocky Mountain/West Coast stocks decreased by 0.3 million barrels. Propylene non-fuel-use inventories represented 5.3 percent of total propane inventories.

ATTACHMENT 2—TODAY IN ENERGY

RAIL DELIVERY OF U.S. OIL AND PETROLEUM PRODUCTS CONTINUES TO INCREASE, BUT PACE SLOWS

With U.S. crude oil production at the highest level in two decades, outstripping pipeline capacity, the United States is relying more on railroads to move its new crude oil to refineries and storage centers. The amount of crude oil and refined petroleum products transported by rail totaled close to 356,000 carloads during the first half of 2013, up 48 percent from the same period in 2012, according to Association of American Railroads (AAR).

U.S. weekly carloadings of crude oil and petroleum products averaged nearly 13,700 rail tankers during the January-June 2013 period. With one rail carload holding about 700 barrels, the amount of crude oil and petroleum products shipped by rail was equal to 1.37 million barrels per day during the first half of 2013, up from 927,000 barrels per day during the first six months of last year. AAR data do not differentiate between crude oil and petroleum products, but it is generally believed that most of the volume being moved in the 2006-10 period was petroleum products and most of the increase since then has been crude oil. Crude oil accounts for about half of those 2013 daily volumes, according to AAR.

The roughly 700,000 barrels per day of crude oil, which includes both imported and domestic crude oil, moved by rail compares with the 7.2 million barrels of crude oil the United States produces daily, based on the latest 2013 monthly output numbers from the U.S. Energy Information Administration.

The jump in crude oil production from North Dakota, where there is not enough pipeline capacity to move supplies, accounts for a large share of the increased deliveries of oil by rail. North Dakota is the second largest oil producing state after Texas, as advanced drilling technology has unlocked millions of barrels of tight oil in the Bakken Shale formation.

More Bakken crude oil moving to market by rail has helped narrow the difference between the spot prices for Bakken crude oil and international benchmark Brent crude oil in recent months to its smallest gap-less than $5 per barrel-in more than one-and- half years. The narrower spread reduces the incentive to ship oil to coastal refineries. This development, along with the lack of railcars (some estimates cite a 60,000 car backlog) may explain the slower growth shown in 2013 carload data.

The CHAIRMAN. Very good. Thank you.

Mr. HUME.

STATEMENT OF JEFFREY B. HUME, VICE CHAIRMAN, STRATEGIC GROWTH INITIATIVES, CONTINENTAL RESOURCES INC., OKLAHOMA CITY, OK

Mr. HUME. Chairman Wyden, Ranking Member Murkowski and members of the committee, my name is Jeff Hume. I serve as Vice Chairman of Strategic Growth Initiatives for Continental Resources, an Oklahoma City-based independent oil and gas producer, where I've worked for the past 30 years. It's an honor to address you on this important subject matter at hand.

Just to clear one thing up before we get started, I noticed in the purpose statement for this oversight meeting that the word "boom" is used to described the current growth in U.S. domestic oil production. Indeed, total petroleum liquids production in our country has accelerated tremendously in the recent years. In fact, the U.S. has recently surpassed Russia and is running neck and neck with Saudi Arabia in the rankings of the world's largest producer of petroleum liquids. However, oftentimes, I hear the word "boom," it is used in reference to an air-like dot-com bubble or some other wild business cycle that inevitably ends in a bust. This is not the case with respect to the recent gains in U.S. oil production.

A much more accurate way to describe the current rise in domestic production would be to use the word "renaissance" as this re-

markable rebirth of the U.S. onshore oil industry is being driven by sustainable technology developments such as horizontal drilling.

Today, crude oil is indisputably a global commodity. Our Nation and the world have changed remarkably since the U.S. crude oil export restrictions were acted in the 1970s. The conditions that originally justified the establishment of short supply controls in the wake of the 1973 Arab oil embargo are no longer indicative of how our petroleum supply and distribution channels function.

As an American, I'm proud to say the U.S. has some of the most sophisticated and complex refineries in the world. Billions of dollars of investment have enabled our domestic industry to efficiently convert lower-priced heavy sour crude oil and bitumen imports into low sulfur fuels. But as Chairman Wyden noted in his March 13th letter to the EIA and again today, efficiency gains and growth in aggregate U.S. refining capacity have been accompanied by a nearly 25 percent reduction in the number of refineries in operation over the past decade. This has resulted in a greater marginal impact of a single domestic refinery on the supply of gasoline. Planned maintenance turnarounds, as well as unplanned weather-related events, are now more impactful than ever.

In today's environment, 2 good ways to lower prices Americans pay for gasoline and fuels are to support additional domestic production at both private and government lands, and to find creative ways to make supply and distribution change more efficient. Supporting a strong domestic oil production industry is critical for the health of our economy, as it creates jobs and produces a valuable product for consumption or export.

It is this growth in productivity and production activity over the past several years that has contributed to a drop in U.S. reliance on imported oil. It has also added high-paying jobs and spurred production in the Nation's large petrochemical industry.

It is worth noting, however, that the energy business is very capital-intensive. Without current law regarding intangible drilling costs, otherwise known as IDCs, and percentage depletion, producers would not be able to generate the capital necessary for the continued growth in domestic drilling and production activity.

A recent study by Wood Mackenzie suggests that repealing producer's deduction for IDCs in 2014 could result in a 15–20 percent drop in annual domestic drilling, meanwhile, curtailing over 400 billions of investment from 2014–2023. Consequently, 65,000 jobs per year would be lost in the oil and gas industry. To me, these figures provide powerful evidence for the need to maintain support of the oil and gas industry as a very positive contributor to our economy and American way of life.

I'd also like to mention briefly the role of traditional trade restrictions on our business. In today's global economy, it no longer makes sense for our country to cling to the regulatory relics of bygone eras that restrict the export of domestic crude oil. The U.S. Government does not restrict the export of gasoline or refined fuels or other domestic energy sources such as coal. In fact, 2011 marked the first time in over 60 years that the U.S. was a net exporter of fuels. Hard-working Americans and businesses would be much better served if our government would take steps to remove existing

barriers that distort domestic oil markets and provide disincentives for incremental domestic production.

Since much of the domestic light-type crude oil grades like the Bakken that are contributing to the U.S. energy renaissance are very high quality, they're actually processed most efficiently at less complex refineries that are specifically designed to handle these low sulfur grades. Following the restructuring of the U.S. refining industry, many less complex refineries best suited to efficiently process our domestic high-grade crude are located overseas.

Matching the various grades of crude oil, the refineries best able to process them maximizes the available supply of refined products. By exporting our high-quality domestic crude to the overseas refiners whom value it most, refiners from Free Trade Partner countries like Japan and Korea that have struggled to source crude oil in the wake of Iranian sanctions, we can reduce our trade deficit, while also increasing the fuel supplies the American consumer requires. To reduce costs at the pump and on the monthly heating and cooling bills, it makes economic sense to let the marketplace, not the Federal Government, determine where these barrels should be processed.

In conclusion, I would like to reiterate that maintaining your support for the industry and opening borders for crude oil will: 1) lower energy costs to American consumers and businesses; 2) promote job growth in the domestic energy sector; 3) improve our Nation's balance of trade; 4) raise tax revenue through GDP growth; and 5) improve national security and global influence.

Last, I would like to sincerely thank you again for giving me the opportunity to share with you today the perspective of the U.S. independent producer. I look forward to addressing any questions you may have. Thank you.

[The prepared statement of Mr. Hume follows:]

PREPARED STATEMENT OF JEFFREY B. HUME, VICE CHAIRMAN, STRATEGIC GROWTH INITIATIVES, CONTINENTAL RESOURCES INC., OKLAHOMA CITY, OK

Chairman Wyden, Ranking Member Murkowski and Members of the Committee, my name is Jeff Hume. I serve as Vice Chairman of Strategic Growth Initiatives for Continental Resources, an Oklahoma City-based independent oil and gas producer where I have worked for the past 30 years. It's an honor to address you on the important subject matter at hand. Hopefully my testimony today will provide more insight on the chapters our company and other independent producers are writing in this amazing domestic energy turnaround story.

Just to clear one thing up before we get started, I noticed in the purpose statement for this oversight meeting that the word "boom" is used to describe the current growth in U.S. domestic oil production. Indeed, total petroleum liquids production in our country has accelerated tremendously in recent years. In fact, the U.S. has recently surpassed Russia and is running neck to neck with Saudi Arabia in the rankings as the world's largest producer of petroleum liquids.[1] However, often times when I hear the word "boom," it's used in reference to an era like the dot-com bubble or some other wild business cycle that inevitably ended in a "bust." This just is not the case with respect to the recent gains in U.S. oil production.

A much more accurate way to describe the current rise in domestic production would be to use the word "renaissance," as this remarkable "re-birth" of the U.S. onshore oil industry is being driven by sustainable technological developments such as horizontal drilling. These revolutionary advancements have enabled companies

[1] Source: EIA International Energy Statistics. Production of Crude Oil, NGPL, and Other Liquids in 2012. http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=5&pid=55&aid=1&cid=regions&syid=2012&eyid=2012&unit=TBPD. Accessed July 11, 2013.

like Continental Resources to unlock vast resource plays located deep underground, and produce oil from formations that were previously inaccessible using traditional methods. And, the best news of all is that this 21st century "renaissance" is moving us closer to the goal of North American energy independence. When we reach this goal—and are no longer an energy "debtor" nation—we will have bolstered national security, fortified our leadership position at the global negotiating table, and provided Americans with much-needed relief in the form of high-paying job opportunities and savings at the pump.

The Company

Our Company was established as a small business in 1967 by Harold Hamm, with assets consisting of a single pump-truck and one employee in search of the American dream. From these humble beginnings, Continental Resources has grown to become the largest producer and leaseholder in the massive Bakken oil play in North Dakota/Montana and one of the Top 10 producers of petroleum liquids in the United States. In addition to the Bakken, Continental has operations in several other states including Oklahoma, South Dakota and Colorado.

The same entrepreneurial spirit and "can do" attitude on which Continental Resources was founded remains ingrained in our company culture. Today, our well-site teams can literally drill two miles straight down, shift to horizontal mode, drill another two to three miles sideways, and hit a target the size of a loaf of bread. Yes, these truly are exciting times in the energy business. Each day at Continental, we witness the assumptions underlying "peak oil" theories crumble under the power of creative minds and pioneering technology.

At Continental, this same ingenuity is being used to improve workplace safety and reduce the environmental impact of our activities. We pioneered the use of ECO-Padsr, a design in which multiple horizontal wells are completed from a single drilling pad to work around sensitive areas and reduce our surface footprint. This type of drilling is typically more expensive than conventional vertical techniques, but as a result we have fewer rig movements and our operations end up being much less intrusive.

Continental Resources' success in discovering and developing light-tight shale oil plays around the country has not only lessened our Nation's dependence on foreign oil, but just as importantly, it has helped stimulate our domestic economy by creating high-paying jobs for Americans and adding tax revenue at multiple levels of government. According to the Bureau of Labor Statistics, the unemployment rates in North Dakota and Oklahoma, the two states where our Company is most active, were the lowest and fifth lowest nationally in 2012.[2]

The Current Market

Today, crude oil is indisputably a global commodity. Our Nation and the world have changed remarkably since U.S. crude oil export restrictions were enacted in the 1970's. The conditions that originally justified the establishment of "Short Supply Controls" in the wake of the 1973 Arab Oil Embargo are no longer indicative of how petroleum supply and distribution channels function. It is now common to see oilfields in nearly every continent being jointly developed by companies from multiple countries. This broad-based international ownership structure greatly diminishes the likelihood of future oil embargos crippling our Nation and economy, as the political interests of the producers are diverse.

During this same period, the refining industry has evolved significantly. Every oil refinery in the U.S., or the world for that matter, is configured differently. At inception, each facility was designed and constructed to efficiently process a base slate of one or more foreign or domestic crude oil grades, often times sourced locally or from affiliated fields overseas. However, over the years, as refinery crude supplies, product price differentials and environmental regulations changed, units were added or mothballed in response to prevailing and forecasted economic conditions. The current "restructuring of the U.S. refining and distribution system" mentioned in this hearing's purpose statement is a good example of this.

As an American, I'm proud to say the U.S. has some of the most sophisticated and complex refineries in the world. Billions of dollars of investments have enabled our domestic industry to efficiently convert lower-priced heavy-sour crude oil and bitumen imports into low-sulfur fuels. But as Chairman Wyden noted in his March 2013 letter to the EIA, efficiency gains and growth in aggregate U.S. refining capacity have been accompanied by a nearly 25 percent reduction in the number of refin-

[2] 2012 data sourced from the Bureau of Labor Statistics' "Regional and State Unemployment (Annual) News Release." http://www.bls.gov/news.release/srgune.htm. Accessed July 11, 2013.

eries in operation over the past decade.[3] This has resulted in a greater marginal impact of a single domestic refinery on the supply of gasoline. Planned maintenance "turnarounds" as well as unplanned weather-related events are now more impactful than ever.

Looking Ahead

In today's environment, two good ways to lower the prices Americans pay for gasoline and fuels are to support additional domestic production on both private and government lands and to find creative ways to make supply and distribution chains more efficient.

Supporting a strong domestic oil production industry is critical for the health of our economy, as it creates jobs and produces a valuable product for consumption or export. It is this growth in production activity over the past several years that has contributed to a drop in U.S. reliance on imported oil.[4] It has also added high-paying jobs and spurred production in the Nation's large petrochemical industry. Supporting this point, a report issued in October 2012 by IHS Global Insight[5] found that:

- Employment attributed to upstream unconventional oil and natural gas activity will support more than 1.7 million jobs in 2012, growing to some 2.5 million jobs in 2015, 3 million jobs in 2020 and 3.5 million jobs in 2035.
- In 2012, unconventional oil and natural gas activity will contribute nearly $62 billion in federal, state, and local tax receipts. By 2020, total government revenues will grow to just over $111 billion. On a cumulative basis, unconventional oil and natural gas activity will generate more than $2.5 trillion in tax revenues between 2012 and 2035.

Not only are these factors positive economically, but from a national security standpoint, supporting domestic oil production is beneficial because it enables us to control our sources and uses of petroleum in a moment of crisis and decreases the likelihood of being drawn into future regional conflicts in geopolitically unstable, petroleum-exporting areas.

It's worth noting, however, that the energy business is very capital intensive, and these figures just mentioned are predicated upon the maintaining of current legislation. Without current law regarding intangible drilling costs (IDCs) and percentage depletion,[6] producers would not be able to generate the capital necessary for the continued growth in domestic drilling and production activity. A recent study by Woods Mackenzie[7] suggests that repealing producers' deduction for IDCs in 2014 could result in a 15-20 percent drop in annual domestic drilling, meanwhile curtailing over $400 billion of investment from 2014 to 2023. Consequently, 65,000 jobs per year would be lost in the oil and gas industry. To me, those figures provide powerful evidence for the need to maintain support of the oil and gas industry as a very positive contributor to our economy and American way of life.

I'd also like to mention briefly the role of trade restrictions in our business. In today's global economy, it no longer makes sense for our country to cling to regulatory relics from bygone eras that restrict the export of domestic crude oil. The U.S. government does not restrict the export of gasoline or refined fuels or other domestic energy sources such as coal; in fact, 2011 marked the first time in over 60 years

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[3] Chairman Wyden letter to Adam Sieminski of the EIA dated March 11, 2013.http://www.energy.senate.gov/public/index.cfm/2013/3/wyden-asks-eia-for-gasoline-market-data-to-explain-recent-price-spike. Accessed July 11, 2013. References Antony Andrews, et al., The U.S. Oil Refining Industry: Background in Changing Markets and Fuel Policies, Congressional Research Service, December 2012.

[4] Bureau of Economic Analysis, "U.S. Trade in Goods (IDS-0182)." Accessed July 12, 2013.

[5] Source: IHS. "Unconventional Oil and Gas Production Supports More Than 1.7 Million U.S. Jobs Today; Will Support 3 Million by the End of the Decade, IHS Study Finds," October 23, 2012. http://press.ihs.com/press-release/commodities-pricing-cost/unconventional-oil-and-gas-production-supports-more-17-millio. Accessed July 12, 2013.

[6] IDCs represent typical and ordinary business expenses within the oil and gas industry. This provision is not a tax subsidy or loophole. IDCs permit a portion of the costs of drilling a well to be deducted fully in the year those costs are incurred, rather than being capitalized over several years. Percentage depletion is akin to typical depletion taken by other industries, except that the depletion is available throughout the economic life of a well because of the depleting nature of oil and gas

[7] Study by Woods Mackenzie for the American Petroleum Institute. "Study: 190,000 Jobs Lost in First Year if Drilling Cost Deduction Is Repealed." http://www.api.org/news-and-media/news/newsitems/2013/july-2013/study-190000-jobs-lost-in-first-year-if-drilling-cost-deduction-is-repealed. Accessed July 12, 2013.

that the U.S. was a net exporter of fuels.[8] Hard-working Americans and businesses would be much better served if our government would take steps to remove the existing barriers that distort domestic oil markets and provide disincentives for incremental domestic production.

Since much of the domestic light-tight crude oil grades like Bakken that are contributing to the U.S. energy "renaissance" are very high quality, they are actually processed most efficiently at less complex refineries that are specifically designed to handle these low-sulfur grades. Following the restructuring of the U.S. refining industry, many less-complex refineries best suited to efficiently process our domestic, high-grade crude are located overseas. Matching the various grades of crude oil with the refineries best able to process them maximizes the available supply of refined product. By exporting our high-quality domestic crude to the overseas refiners whom value it most—refiners in Free Trade Partner countries like Japan and South Korea[9] that have struggled to source crude oil in the wake of Iranian sanctions—we can reduce our trade deficit while also increasing the fuel supplies the American consumer requires. To reduce costs at the pump and on the monthly heating and cooling bills, it makes economic sense to let the marketplace, not the Federal Government, determine where these barrels should be processed.

CONCLUSION

In conclusion, I would like to reiterate that maintaining your support for the industry and opening borders for crude oil export will:

1. Lower energy costs to American consumers and businesses.
2. Promote job growth in the domestic energy sector.
3. Improve our Nation's balance of trade position.
4. Raise tax revenue through GDP growth.
5. Improve National security and global influence.

Lastly, I would like to sincerely thank you again for giving me the opportunity to share with you today the perspective of a U.S. independent producer. I look forward to addressing any questions you may have.

The CHAIRMAN. Very good. Mr. Klesse.

STATEMENT OF WILLIAM R. KLESSE, CHAIRMAN OF THE BOARD AND CHIEF EXECUTIVE OFFICER, VALERO ENERGY CORPORATION, SAN ANTONIO, TX

Mr. KLESSE. Thank you, Mr. Chairman, and Senator Murkowski.

I am the Chairman of the Board and CEO of Valero Energy Corporation. We are an independent petroleum refiner with assets that include 13 U.S. refineries of various size and cost structures, with a combined throughout capacity of approximately 2.3 million barrels per day; we are an ethanol producer; we are a renewable diesel producer, and we have a wind farm. We have a network of pipelines, terminals, branded and non-branded wholesale customers. As an independent refiner, Valero does not explore for or produce crude oil or natural gas. Rather, we purchase these and related fee stocks to manufacture refined products such as gasoline, jet fuel, diesel and many others.

Refining is a global business and refined products are fungible and easily transported because the marketplace is global. Domestic refiners compete against international refineries, as well as each other. Despite the drop in U.S. gasoline and diesel demand, and the addition of global refining capacity that has been added, U.S.

[8] Barbara Powell, "U.S. Was Net Oil-Product Exporter for First Time Since 1949," Bloomberg article dated February 29, 2012. http://www.bloomberg.com/news/2012-02-29/u-s-was-net-oil-product-exporter-in-2011.html. Accessed July 12, 2013.

[9] In 2012, we imported 68 thousand barrels per day of refined product from these two countries. Source: EIA Data, "U.S. Imports by Country of Origin," http://www.eia.gov/dnav/pet/pet___move___impcus___a2___nus___ep00___im0___mbblpd___a.htm. Accessed July 12, 2013.

refiners have maintained high utilization that allowed them to produce excess gasoline and diesel fuel that then can be exported. This is a benefit to the U.S. economy, the American worker and the consumer.

The invisible hand of the market itself determines prices, with supply and demand adjusting until markets clear. Our cost position acts as a floor and costs vary among companies, individual refineries and even within a refinery. Prices are very visible in the commodity exchanges around the world where anyone can buy and sell benchmark crude oil, natural gas refined products. Refiners such as Valero are in a position of being price takers, rather than price makers. Refiners like Valero do not set retail prices. Most retail stores are operated by marketing companies or individuals that set their own price. The price of crude oil represents by far the largest component of gasoline prices. Retail gasoline prices currently are composed of 67 percent crude oil, 14 percent refining, 12 percent taxes, 8 percent distribution and marketing. On an average of $3.61 per gallon, only 50 percent is attributable to refining, while $2.40 is crude oil. Even without any refining benefit, we would still have crude oil over $3 per gallon. We are in a world of $100 crude oil. We do not expect a significant drop this summer.

What is keeping prices from rising higher is the increase in U.S. and Canadian crude oil production and, certainly, some uncertainty about economic growth around the world. However, the U.S. remains a crude oil importer. Crude prices clearly reflect movements in the global marketplace and prices that we pay must be high enough to attract those barrels to our market. American refineries are essential to our economy. The industry employs 108,000 people and many, many more in other jobs. Think about all the people that our industry influences and touches.

There are other factors affecting retail prices, some which can be affected by government, some which cannot. Despite the high cost of labor and regulations in the United States, increased natural gas production has resulted in much lower prices and is allowing our industry to be competitive, especially in the Atlantic Basin. A very careful and balanced approach to LNG export policy is important for refiners. We also believe it's important to have crude oil come to the United States where the jobs are; that's why we support the Keystone Pipeline.

But today, the most important thing that's affecting us is the Renewable Fuel Standard. Valero is the third largest corn-ethanol producer, but the Renewable Fuel Standard is out of control. It is broken. RINs are going up probably as we speak; I'm told they're over a dollar, $1.30 here per RIN gallon. The RFS must be fixed. This cost is just skyrocketing. It was OK when the first law was passed in 2005, but when the new law, or the revised law in 2007, the RIN program was not revised. We have announced that this is going to cost Valero $750 million this year, and with the RIN price at the numbers we're talking about now, it'll be much higher. We support and believe that ethanol will be part of the fuel mix in this country, but the RFS is broken. There is no cellulosic to speak of. Any other advanced ethanol has to be imported. This is not in the interest of our country.

Thank you very much for allowing me to speak, and we're very proud to be part of this panel.

[The prepared statement of Mr. Klesse follows:]

PREPARED STATEMENT OF WILLIAM R. KLESSE, CHAIRMAN OF THE BOARD AND CHIEF EXECUTIVE OFFICER, VALERO ENERGY CORPORATION, SAN ANTONIO, TX

My name is Bill Klesse, I am the Chairman of the Board and CEO of Valero Energy Corporation. Valero is a Fortune 500 company based in San Antonio, Texas. We are the world's largest independent petroleum refiner, with assets that include 13 U.S. refineries with a combined throughput capacity of approximately 2.3 million barrels per day, ethanol, renewable and wind energy facilities, a network of pipelines, terminals and branded and unbranded independent wholesale customers.

The Current Environment for Refining In the U.S.

As an independent refiner, we do not explore for or produce crude oil or natural gas. Rather, we purchase crude oil, natural gas, and related feedstocks as inputs in a sophisticated manufacturing process to produce familiar refined products such as gasoline, jet and diesel fuel, and other petroleum products. Prices of these products are a result of a complex set of factors such as international markets, input prices, labor, transportation, and other costs. Independent refiners such as Valero cannot determine consumer prices. Indeed, the "invisible hand" of the market itself determines prices with supply and demand adjusting until markets clear. It is a global market as products are fungible (specifications can vary) and easily transported. Refined products move to the highest priced areas. Over time, prices between markets can reflect unique specifications and locations, but will move to freight costs and logistics access.

The U.S. is the largest, most sophisticated market for refined petroleum products in the world with New York Harbor being a pricing point and the U.S. Gulf Coast a huge physical supply market. The modern oil and gas industry has been providing energy for Americans for nearly 150 years. During this time, the industry has proved cyclical and seasonal. No new refinery with significant operating capacity has been constructed since the 1980s, while the total number of refineries has decreased by half, overall capacity has increased from 16,859,000 barrels-per-calendar-day then to 17,823,659 barrels-per-calendar-day with an annual utilization rate of about 89 percent today.[1] As the number of U.S. re 1 fineries has declined, the operating capacity complexity of the remaining refineries has been increased to keep up with worldwide demand. Imports and exports also influence market prices and prices are very visible in the commodity exchanges around the world where anyone can buy and sell benchmark crude oil, natural gas, and refined products.

The refining industry was hit hard by the recent recession. Much of the financial news regarding U.S. refining was uniformly negative since the beginning of the recession in 2008 through last year. Rising crude oil prices, declining demand and ever-changing regulations led to weak margins for refiners, even causing several East Coast refineries to shut down.[2] While crude prices remain high, and demand is still down about 10 percent today compared to pre-recession levels, the outlook for refiners has improved significantly due to the increase in North American natural gas and crude oil production which are giving the industry competitive advantages in the global market.

Valero in particular has sought to benefit from the revolution resulting from increased domestic shale gas and oil production. Refining is energy intensive, and Valero consumes about 700 million cubic feet a day of natural gas. In fact, energy is the largest component of a refinery's variable operation costs. Additionally, natural gas liquids are an important ingredient in creating finished products from crude oil, and the current supply dynamics have reduced the costs of these feedstocks. As shale oil production has increased, larger volumes of crude oil from highly productive basins like the Bakken and Eagle Ford have replaced imports for the domestic refining industry.

The marketplace for crude oil, natural gas and refined products is global, as products can easily be produced and transported across the world. Domestic refiners, therefore, compete against international refiners as well as each other. Despite the drop in domestic demand and additional global refining capacity constantly being added, U.S. refineries have maintained high utilization rates that allow them to

[1] U.S. Energy Information Administration.

[2] Oil & Gas Journal. US Refining Outlook Rosier than it Seems. December 3, 2012. http://www.ogj.com/articles/ print/vol-110/issue-12/processing/us-refining-outlook-rosier-than.html

produce excess gasoline and diesel fuel that can be exported. This is a benefit to the U.S. economy as the jobs and value added are here in the U.S.

The important point is that any policies making it more difficult to refine in the U.S. are contrary to the public interest. There are things that the industry and regulators cannot control, such as the prices of crude oil, feedstocks and utilities. However, there are things, such as regulations and taxes, which regulators can control. Reducing those controllable costs will help bring consumer prices down and improve further the competitiveness of the U.S. refining industry to be able to export excess refined products.

Relationship between Refining, Consumer Price and Supply

As I noted, the process by which consumer prices for refined products, including gasoline, are set is very complex. The "invisible hand" of the market balances supply and demand in the way it does for other familiar products and commodities. The costs of production cannot be calculated by a simple equation and varies not only among companies but even within the individual process units of a single refinery. Ultimately, because of the wide range of variables affecting gasoline prices are outside of the control of a refiner, and because of the competitive and robust size of the U.S. market, refiners such as Valero are in position of being price takers rather than price makers and use linear program computer models to optimize a refinery.

It has long been recognized that the price of crude oil plays a major role in determining the cost of refined products. Crude oil represents by far the largest component of gasoline prices, and it is important to remember that crude oil prices are completely out of independent refiners' control and are clearly set by the global market, adjusted for quality and location. Retail gasoline prices currently are composed of about 67 percent crude oil costs, 14 percent refining costs and profits, 12 percent taxes and 8 percent distribution and marketing costs and profits. Of a recent average retail gasoline price of $3.61 per gallon, only 50 cents can be attributed to refining, while $2.40 would be attributed to crude. Even if refiners could somehow make fuels at absolutely no cost, and did not make any profits, gasoline would still cost well over $3 per gallon today.

Despite the recent rise in domestic crude oil production, oil prices overall have not fallen significantly. The U.S. remains a net crude oil importer, so crude prices clearly reflect movements in the global marketplace as the prices paid must be high enough to attract the imported crude supply to America.

There are other factors affecting retail product prices, some of which can be affected by government policy. According to the Energy Information[3]Administration (EIA), the wide range of factors that combine with the price of crude to set the retail price for gasoline include:[4]

Different gasoline formulations required in different parts of the country

Over the years, federal and state governments have required that refiners produce a range of specialized gasoline blends. Neutral third parties such as the Government Accountability Office (GAO) have long recognized that the rising number of required fuel blends results in a variety of additional costs for refiners that increase the retail price of gasoline.[5] As the GAO has explained:

> Many experts have concluded that the proliferation of these special gasoline blends has caused gasoline prices to rise and/or become more volatile, especially in regions such as California that use unique blends of gasoline, because the fuels have increased the complexity and costs associated with supplying gasoline to all the different markets.[6]

Transportation, distribution, and marketing costs

A major variable impacting retail gasoline prices are the costs associated with transportation and distribution of crude oil and gasoline. The product supply infrastructure involves virtually all aspects of transportation infrastructure, touching on pipelines, barges, ships, terminals, rail, trucking, and storage tanks.[7] Permitting and siting delays connected to the construction of new pipelines and other infra-

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[3] Energy Information Administration. "Frequently Asked Questions." http://www.eia.gov/tools/faqs/faq.cfm? id=3&t=10

[4] Energy Information Administration. "Factors Affecting Gasoline Prices." http://www.eia.gov/energyexplained/ index.cfm?page=gasoline___factors___affecting___prices

[5] GAO, Motor Fuels: Understanding the Factors That Influence the Retail Price of Gasoline (May 2005) http:// www.gao.gov/assets/250/246501.pdf

[6] http://www.gao.gov/assets/120/111642.pdf

[7] GAO, Increasing Globalization of Petroleum Products Markets, Tightening Refining Demand and Supply Balance, and Other Trends Have Implications for U.S. Energy Supply, Prices, and Price Volatility, at 2 (Dec. 20, 2007) http:// www.gao.gov/assets/280/270682.pdf

structure can drive up retail prices and make gasoline prices more volatile because of inevitable supply disruptions related to equipment problems, weather events, or other unpredictable and uncontrollable events.[8]

The specific location of individual retail outlets

Gasoline prices are highly variable based upon specific location. As the GAO has explained, "Retail gasoline prices can vary from one region of the United States to another, between and within states and cities, and even within neighborhoods."[9] Proximity to refineries, regulation by all levels of government, and competition in local markets all combine to have significant impacts on retail prices in ways that cannot be controlled by refiners. Most retail outlets are operated by independent business people. They set their retail price.

Taxes

One of the most important variables related to retail gasoline prices are taxes imposed by federal, state and in some cases, local governments. The GAO has reported that "differences in gasoline taxes help explain why gasoline prices vary from place to place in the United States."[10]

The market for non-gasoline products

Refineries cannot produce only gasoline and diesel. The refining process results in a significant portion of each barrel of crude oil becoming products other than transportation fuels.[11] The actual yield of refined products depends on refinery processes and type of crude processed. The production and marketing of these products, which typically sell at a gross margin loss compared with the price of crude oil, has to be offset by the sales of profitable products. While low-cost natural gas has benefited refiners operating and feedstock cost, it has also resulted in lower margins on natural gas liquids and petrochemical feedstocks that the refinery produces. However, the net benefit is positive.

Importance of the U.S. Refining Industry: Economic Benefits

America's refineries are an essential part of the U.S. economy. According to a 2012 report by the American Petroleum Industry (API), the refining sector directly employs approximately 108,000 American workers throughout the country and also employs four times that many workers in support industries. These are high-paying jobs (average annual income of $94,500), filled by highly skilled American workers across the country. New, large scale refineries, with a typical refining capacity of approximately 450,000 barrels per day, employ an average of 1,500 refinery workers and 1,400 contracted employees.[12] Valero and its subsidiaries directly employ approximately 8,300 employees in the U.S.

The refining sector literally fuels America's economy. Refiners manufacture gasoline, diesel fuel, home heating oil, jet fuel, and other refined products and petrochemicals—vital inputs to almost every sector of the economy. Most people know refineries make fuels, but the refineries also provide Americans with essential products created from petrochemicals used in business and everyday life, such as plastics and polymers used in computers, medical equipment, wind turbines, solar panels, cosmetics and so much more. Refining is necessary to process and upgrade crude oil. Without refineries to process crude oil, we would be left without the basic building blocks of our national economy. Additionally, by doing this manufacturing domestically, billions of dollars flow into the U.S. economy, supporting many other American jobs and families.

The U.S. refining industry affects employment in a number of different ways. The obvious example is in the creation of construction jobs for workers and jobs at the refinery as refineries are upgraded and maintained. However, hundreds of jobs are also created during the equipment manufacturing and fabrication process. Refineries are often the major source of employment in cities throughout the nation, providing jobs for engineers, equipment specialists, operators, laboratory technicians, maintenance personnel, security officers and, administration, computer and other

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[8] Id. at 9-10.

[9] GAO. Motor Fuels: Understanding the Factors That Influence the Retail Price of Gasoline. May 2005 at 36 http:// www.gao.gov/assets/250/246501.pdf

[10] Id. at 5, 42.

[11] Id. at 1.

[12] American Petroleum Industry. Fact Sheet: Importance of a Strong Refining Industry. February 24, 2012. http:// www.api.org//media/Files/Oil-and-Natural-Gas/Refining/Domestic-Refining-Study-Facts-Key-Points.pdf

staff positions[13] The oil and natural gas industry contributed substantially to the nation's recovery from the recent economic downturn, accounting for 3 percent of net job creation since 2009.[14]

The refining industry also directly and indirectly contributes greatly to the U.S. GDP, and provides tax revenue. The income, sales, use, and property taxes paid by the industry provide much revenue to federal, state, and local governments. At state and local levels, much of this tax revenue directly benefits citizens because this money is often used for funding schools and building roads. Refineries also help the U.S. economy through their continual capital expenditures, wages, interest and dividend payments, charitable contributions and local support. Without a strong domestic refining industry, the U.S. would risk significant direct and indirect job loss, threatened economic security, and weakened global competitiveness. Valero has invested in its refineries and its people, significantly. Valero's capital spending has been one of the highest, if not the highest, in the U.S. refining industry.

The U.S. refining industry also has the ability to export products overseas, which in effect elevates the nation's status as a strong competitor in the global economy. The U.S. has gone from a net importer of petroleum products (including finished petroleum products and gasoline blending components) in 2005, to a net exporter in 2012.[15] The ability to export refined products has kept marginal refineries open, ultimately benefiting consumers, our economy, workers and communities while enhancing our balance of trade.

Importance of the U.S. Refining Industry: Energy Independence and National Security

While Valero's locations and technology have put it in an ideal position to benefit from the increased North American oil and natural gas production, Valero is also an active participant in international crude markets—enabling it to benefit from a balanced and pragmatic portfolio of inputs. In this same spirit, we recognize the importance of the oil sands developments under way within the borders of our close ally Canada. Valero supports construction of the Keystone XL Pipeline and believes it will be in the strong energy security and economic interest of the U.S. and will bring a specific quality of crude suited for many U.S. Gulf Coast refineries to the Gulf Coast market.

Energy Efficiency and Environmental Improvements

Since 1990, the refining industry as a whole has spent over $128 billion on environmental improvements.[16] Though the industry has greatly expanded during this time, environmental emissions have decreased over the last 20 years. This decrease in emissions comes despite increasingly stringent refined product specifications, and an overall increase in refinery production of gasoline and jet and diesel fuels. Processing heavier and sour crude that have been available to the market has required more processing.[17]

Petroleum refining is an energy intensive industrial process, but the industry has made record improvements to lessen its environmental footprint. Environmental stewardship is a core value at Valero. As an example, we have spent approximately $525 million to build a state-ofthe- art flue-gas scrubber, one of the world's largest, at our Benicia refinery in California. This expenditure reduced sulfur dioxide emissions by 95 percent and nitrogen oxide emissions by 55 percent.[18] Valero has also spent $2.6 billion at its refineries on environmental upgrades that further reduced emissions during the last six years. Under a comprehensive Energy Stewardship Program, Valero refineries reduced energy consumption per barrel of throughput by 12 percent between 2008 and 2012 which has reduced our green house gas emissions.

The refining industry is constantly adapting to changing times and is leading the way in the development of renewable fuels, and Valero is playing an active role in this innovation. Valero acquired 10 state-of-the-art ethanol plants, which operate under our subsidiary Valero Renewable Fuels Company, LLC, making Valero the

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[13] Wood Mackenzie, 2011.

[14] American Petroleum Industry. American Made Energy-Report to the Platform Committee. 2012. http:// www.api.org/policy-and-issues/policy-items/american-energy//media/Files/Policy/American-Energy/American- Made-Energy___HiRes.ashx

[15] American Fuel & Petrochemical Manufacturers. Annual Report. 2013. http://www.afpm.org/uploadedFiles/ Content/About___AFPM/AFPM___2013___Annual___Report.pdf

[16] Wood Mackenzie, 2011.

[17] Thomas P. Nelson, "An Examination of Historical Air Pollutant Emissions from US Petroleum Refineries," November 29, 2012. http://onlinelibrary.wiley.com/doi/10.1002/ep.11713/pdf

[18] Donna Beth Weilenman. Refinery to test new scrubber. The Benicia Herald. December 4, 2010. http:// beniciaherald.me/2010/12/04/refinery-to-test-new-scrubber/

first traditional refiner to enter the ethanol production market in a significant way. Also, Diamond Alternative Energy LLC, a Valero subsidiary, produces renewable diesel fuel from recycled animal fat and used cooking oil in partnership with Darling International Inc. at a 10,000-barrel-per-day unit at the St. Charles Refinery in Louisiana that just became operational.[19]

Valero's environmental efforts have consistently been recognized. In 2013 Valero's McKee Refinery received the Texas Environmental Excellence Award for the company's wind farm that reduces reliance on conventional power sources.[20] Additionally, Valero's St. Charles Refinery was recognized by the Louisiana Department of Environmental Quality and the Louisiana Chapter of the Air and Waste Management Association for its catalytic cracker conversion project that reduced overall facility air emissions and eliminated thousands of tons of waste catalyst generated annually.[21]

The Unique Dynamic of Renewable Fuels

One of the most challenging factors facing the fuels market place is the implementation of the federal Renewable Fuels Standard (RFS). As a company, Valero has met the challenge of the RFS by becoming a market leader in the production of alternative transportation fuels. We are currently the third largest corn ethanol producer in the U.S. and have recently begun the production of renewable diesel fuel, as mentioned.

Whether or not one supports alternative fuel production, policymakers are right to be concerned with the impacts on consumer gasoline prices caused by the way in which the RFS is currently implemented. As the Committee is well aware, obligated parties under the RFS, refiners and importers, but not blenders, are required to demonstrate compliance with their renewable volume obligation (RVO) through the submission of renewable identification numbers (RINs). Unfortunately, the RINs market has caused significant unintended consequences. With the original 2005 law and its volumes, RINs were necessary for flexibility and the ability to track the program. When the law was revised in 2007 and the renewable volumes greatly increased, combined now with much lower than expected gasoline demand, RINs have become a huge cost and fairness issue. Also, in the past two years, the RINs market has been beset by allegations of fraud that has questioned the Environmental Protection Agency's (EPA) ability to administer the RFS program and resulted in increased compliance costs for obligated parties-most of which are passed on to consumers.

Most importantly, as U.S. gasoline demand declined from 2007 and as the renewable fuels mandate volumes increase, some U.S. refiners—those that are large merchants and wholesale, spot sellers—find themselves in an unintended predicament of either reducing gasoline production, exporting more gasoline at discounted prices, or buying renewable fuel credits (RINs), which soon may not even be available because the market is going infeasible. If the option of buying RINs doesn't exist because none are available or because of very high pricing, the domestic supply will be reduced. It's hard to believe that when Congress passed the Energy Independence and Security Act of 2007, a possible outcome was to reduce U.S. gasoline supplies and increase gasoline prices. However, as a refiner and an ethanol producer, that is exactly the potential outcome we find ourselves in today. No one expects that U.S. gasoline demand will rebound strongly and to begin to grow again, and there are physical constraints on using higher blends of ethanol in gasoline including the lack of car warranties to approve those blends. As a result, there simply aren't enough gallons of gasoline in which to put all of the required gallons of ethanol—and that has driven the price of corn ethanol RINs from $0.05 in late 2012 to as high as $1.16 recently.[22] Also, there is no cellulosic ethanol and advanced ethanol has to be imported.

At Valero alone, we anticipate cost increases of some $500 to $750 million this year just as a result of volatility in the market for RINs. Unfortunately, this cost will not add one more gallon of fuel into the market. It is nothing more than a feder-

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[19] Nicolas Zeman. Valero's Renewable Diesel Plant Nears Start-Up. ENR Louisiana & Texas. April 22, 2013. http:// texas.construction.com/texas—construction—projects/2013/0422-valero8217s-renewable-diesel-plant-nears-startup. asp

[20] Texas Commission on Environmental Quality. Texas Environmental Excellence Awards 2013. May 2013. http:// www.tceq.texas.gov/publications/pd/020/2013-NaturalOutlook/texas-environmental-excellence-awards-2013

[21] St. Charles Herald Guide. Valero spends $600 million on environment. May 7, 2008. http:// www.heraldguide.com/details.php?id=4017

[22] See Mario Parker. Gasoline Price Inflated by Ethanol in Oil Boom: Energy Markets. Bloomberg. March 21, 2013. http://www.bloomberg.com/news/2013-03-21/gasoline-price-inflated-by-ethanol-in-oil-boom-energymarkets.html

ally mandated cost to each gallon of transportation fuel that may be passed on to the consumer.[23] At the outset of the RFS, EPA found in its regulatory preamble that RIN's cost would be negligible. This estimate has turned out to be profoundly incorrect as the program approaches an infeasible situation, expected in 2014.

Some have suggested, including the EPA, that the refining sector should move the percentage of ethanol blended from 10 percent to as high as 15 percent, a blend called E-15. While Valero supports ethanol and is a leading producer, experts have repeatedly noted that the E-15 blend is not warranted for use by 95 percent of cars on the road today. E-15 reduces engine life and prompts fuel pump failures and consumer misfuelings. American Automobile Association (AAA) even called on EPA "to suspend the sale of E-15 until motorists are better protected."[24] There are also issues with boats, lawn mowers, motorcycles and other small engines. Greater reliance on higher ethanol blends is not the way to go, and would likely undermine consumer confidence in alternative fuels. Plus, we must all consider the effect corn ethanol in fuel has had on world food prices.

There is also the issue of refiners and importers—but not blenders—being obligated parties under the RFS. Thus, a very unlevel market has been created with winners and losers being picked within the same market place—in other words, who is getting the RIN value. Basically, it is a zero sum business in corn ethanol RINs.

No matter what one's view on ethanol and other alternative fuels is, it is time to revisit the current implementation of the RFS in order to allow the orderly movement of renewable fuels into the fuel supply in a responsible manner that protects consumers and small businesses. The oil supply picture has changed, the basis of the original legislation has changed, the RFS should be repealed and new legislation developed.

Implications of Outages

Some observers, particularly in the West, have questioned the role of refinery outages in consumer prices. For environmental and safety reasons, it is necessary every few years to shut down an operating unit for a "turnaround."[25] Generally, turnarounds are scheduled for lowdemand seasons with weather considered for efficient turnaround execution. Supply arrangements are made to cover for lost production, and there is currently surplus refining capacity in the United States. But unforeseen problems can complicate even the best plans, resulting in localized supply concerns. Clearly, as refineries have become larger, unplanned outages because of mechanical problems have caused increased priced volatility seen by the consumer.

The Federal Trade Commission has monitored the petroleum industry for years, including during the aftermath of Hurricane Katrina, for possible collusion and market manipulation. They found:

> no evidence to suggest that refiners manipulated prices through any of these means. Instead, the evidence indicated that refiners responded to market prices by trying to produce as much higher-valued products as possible, taking into account crude oil costs and physical characteristics. The evidence also indicated that refiners did not reject profitable capacity expansion opportunities in order to raise prices.[26]

The bottom line is that refiners take measures to limit the effect of unit outages on inventory and supply. These include increased production of alternate units, continued production from partially shut down units, import of alternate supply, and stockpiling of inventory leading up to a turnaround or outage. These steps are crucial to avoiding a major disruption in supply from a single outage. When there are regional shortages caused by hurricanes or other factors affecting refinery production, one area where regulators can help is by quickly providing Jones Act waivers that would increase the number of available ships, so that fuel supplies can quickly be moved from unaffected parts of the country.

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[23] See Bradley Olson. Drivers risk $13B gas-price hike as ethanol charge grows. Bloomberg. March 19, 2013. http:// fuelfix.com/blog/2013/03/19/drivers-risk-13-billion-gas-price-hike-as-ethanol-charge-grows/

[24] See AAA CEO Urges Suspension of E15 Gasoline Sales in Testimony to Congress, AAA Public Relations. February 26, 2013. http://newsroom.aaa.com/2013/02/aaa-ceo-urges-suspension-of-e15-gasoline-sales-in-testimonyto- congress/

[25] Managing Plant Turnarounds and Outages. CED Engineering, at 1-2

[26] William e. Vocacic, FTC Commissioner, p. 15

Addressing Obstacles with Price Impacts

Fix the RFS

Within the context of the current RFS, it is clear that we must fix its implementation through the RINs market. Though not directly under this committee's mandate, RINs pricing is affecting gasoline prices. I applaud this Committee's attention to this issue and urge Congress to take action. As explained above, circumstances in the RINs market have changed dramatically since the mechanism was first established. Due to reduced gasoline demand, the ethanol blend wall, instances of RIN fraud, and other factors, there are not enough gallons of gasoline to blend with ethanol when marketing E-10 and E-85. This has led to higher prices and substantial uncertainty in the gasoline market. The RFS needs to be completely redone.

Valero has long worked cooperatively with state and federal regulators on implementation issues associated with the RFS. But now it is time to re-examine the RFS. What is the purpose of the RFS now? Remember there is no cellulosic ethanol available and what might come to market is very limited and totally uneconomic.

Develop a Reasonable Energy Exports Posture

A reasonable natural gas exports policy can maximize energy security and can protect consumer interests. But unfettered exports of natural gas and maybe someday, crude oil—raw materials to which American workers and American manufacturing can add significant value—may have significant unintended consequences and will raise costs.

Similarly, policies that increase U.S. refining costs may make us less competitive for exports. Policies that are too restrictive towards gasoline exports could undermine or even close marginally profitable refineries. The U.S. refining industry is a very efficient, but as all manufacturing, is faced with high labor and regulatory costs. Low priced natural gas offsets these costs and keeps us competitive. Valero urges a balanced and sensible approach to natural gas exports.

Enhance Domestic Energy Production

We live in extraordinary times for the U.S. energy sector. The rapid increase in production of domestic crude oil and natural gas is the most significant development that I have seen in my more than four decades in the energy business. According to the most recent figures from the EIA, oil from shale now accounts for 30 percent of total U.S. production and natural gas from shale is now responsible for 40 percent of total production.[27] We have turned the clock back 20 years considering imports and production of oil and for natural gas, production is higher than it has ever been.

Like many major domestic manufacturing industries, the refining sector is energy intensive. In addition to lower operating costs from lower-priced natural gas, the availability of vast new supplies of crude oil to refineries on the U.S. coasts has made these plants more competitive. This increase in competitiveness and profitability in the refining sector ultimately benefits consumers in the form of lower gasoline and diesel prices. To jeopardize this development with burdensome one-size-fits-all federal regulations would be foolhardy and harmful to America's economy and American workers.

Establish a Predictable Regulatory Framework

Refinery operations are subject to extensive environmental regulations. Refiners are among the most regulated industry in the country, and U.S. refineries are already among the cleanest and most efficient in the world. A reasonable approach to regulation is one that both improves the environment while allowing the industry to remain competitive. A host of recent actions by EPA, referred to as the "regulatory swamp" due to the close proximity of their compliance targets and high costs, with very limited benefits, will create a highly unpredictable regulatory environment for our industry. These include:

- Proposed Tier 3 Gasoline and Diesel Standards—
- Greenhouse Gas Rules and Permitting
- Finalized National Ambient Air Quality Standards (NAAQS) for Particulate Matter
- Finalized Mercury Air Toxics Rule—Finalized Emission Standards for Boilers
- Final New Source Performance Standards (NSPS) for Oil and Gas Production
- Finalized Greenhouse Gas Standards for Cars and Light Trucks
- Final National Emissions Standards for Hazardous Air Pollutants at Petroleum Refineries

[27] See Shale-Gas Estimate Rises, Tennille Tracy, Wall St. Journal (Jun. 10, 2013) available at: http://online.wsj.com/ article/SB10001424127887324634304578537801148740028.html

- Proposed Uniform Standards for Storage Vessels, Transfer Operations, Equipment Leaks, Closed Vent Systems, Control Devices
- Pending reconsideration to the NAAQS for NO2, SO2, and Ozone
- Pending NSPS and emission guidelines for refineries

Valero has estimated that its costs alone for compliance with the Proposed Tier 3 standards will be between $300 million and $400 million and will raise the cost of manufacturing gasoline a couple of cents per gallon. It will also increase our green house gas emissions because of the additional processing. That said, we support clean burning fuels.

In addition to EPA, other regulatory agencies and states have pursued independent regulations. For example, California's Low Carbon Fuel Standard (LCFS) and statewide capand- trade program were issued as part of the state's Global Warming Solutions Act. The LCFS in particular does little to achieve environmental objectives while discriminating against crude sources to the detriment of California consumers. These rules pick winners and losers among the refining industry in place of letting market forces operate as impacts reflect the individual refinery configurations and your access to specific crude oils.

Environmental laws and regulations are becoming more stringent and new environmental laws and regulations are continuously being enacted or proposed. The impact of these rules on the sector is real. One report noted:

> As these regulations increase capital expenditures, and subsequently raise costs of operations they continue to pressure the economic sustainability of refinery operations, which under the current low margin environment can increase the risk of refinery closures and consequential job and economic loss. Overall, the regulations tend to create unintended consequences that duly disadvantage the US domestic refining industry relative to other refining centers of the world. The risks of this imply that companies could thus move operations to other countries with less stringent controls, increasing domestic manufacturing shutdowns, with implicit employment and tax revenue loss as opportunities are created overseas.[28]

This is not just a hypothetical. A 2011 report by the Department of Energy found that the cumulative burden of federal regulations was a significant factor in the closure of 66 domestic petroleum refineries from 1990 to 2010.[29] In addition to increasing the cost of gasoline, additional regulations "may lead to additional job losses for America, weaken the U.S. economy, make America more reliant on nations in unstable parts of the world for vital fuels and petrochemicals, and ultimately endanger our national security."[30]

Avoid Tax Policy Changes with Unintended Consequences

Tax reform is a timely topic that is garnering increasing attention from Congress. Valero is currently subject to extensive tax liabilities, and changes to tax law and regulations will directly affect our businesses. We support reforms that will promote domestic competitiveness, investment, and job creation. This includes lower effective tax rates on manufacturers, and maintaining accounting methods like "last-in, first out" and the Section 199 deduction for manufacturing to stimulate economic activity at home. For companies like Valero that have overseas operations, we need provisions in the tax code that allow us to repatriate foreign earned income that we want to reinvest or distribute to our investors, most of whom are American. A fair tax code for domestic refiners ensures a healthy refining sector, benefitting the consumers and businesses that rely upon our products.

The increased crude oil and natural gas production in North America is creating huge opportunities for a U.S. manufacturing resurgence. On behalf of Valero Energy, I thank you for the opportunity to share our views.

The CHAIRMAN. Thank you very much, Mr. Klesse.

Mr. Gilligan, welcome.

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[28] Wood Mackenzie, 2011.

[29] U.S. Department of Energy. March 2011. http://www.epa.gov/otaq/fuels/renewablefuels/compliancehelp/smallrefinery-exempt-study.pdf

[30] Written Statement Of American Fuel & Petrochemical Manufacturers. United States House Of Representatives Committee On Homeland Security Subcommittee On Counterterrorism And Intelligence. "The Implications Of Refinery Closures For U.S. Homeland Security And Critical Infrastructure Safety." March 19, 2012 http:// homeland.house.gov/sites/homeland.house.gov/files/Testimony percent20-percent20Drevna.pdf

STATEMENT OF DAN GILLIGAN, PRESIDENT, PETROLEUM MARKETERS ASSOCIATION OF AMERICA, ARLINGTON, VA

Mr. GILLIGAN. Chairman Wyden, Senator Murkowski, distinguished members of the committee, thank you for the invitation to be here today.

I'm Dan Gilligan. I serve as President of The Petroleum Marketers Association of America. PMAA is a federation of 48 State and regional trade associations representing 8,000 petroleum marketing companies nationwide, the majority of which are small businesses as defined by SBA. These companies are very diverse, but they all have one thing in common: they all bring to market liquid fuels such as gasoline, diesel, heating oil, ethanol, biodiesel, jet fuel and kerosene. Our member companies are engaged in the transport story to the sale of refined products on both the wholesale and retail level. They supply gasoline to convenience stores, diesel to truck stops, lubricants to industry and heating oil to millions of customers. Not only are these companies primary suppliers of fuel, they also own and operate over 80,000 retail facilities. They are also specialists in serving farmers, railroads, marinas and airports with the fuels they need.

Petroleum marketing companies do not benefit from high gasoline or diesel prices. Because they operate in such a transparently competitive environment, higher wholesale prices must be absorbed by retailers until street prices catch up. In order to remain competitive, retailers usually offer the lowest price for gasoline to generate volume and customer traffic in the store. When prices are unusually high, customers often reduce their store purchases and some retailers struggle with credit line limits.

Most PMAA member companies are rack buyers. In the industry, wholesale product is loaded at terminal racks and there are approximately 1,200 terminals in the U.S. Companies permitted to load product must have credit standing and a plethora of State, local and Federal licenses and permits. I will focus most of my testimony on what factors influence wholesale rack prices and how they impact petroleum marketers.

When examining the EIA data over the past 15 years, it's crystal clear that crude oil price benchmarks (WTI) are the primary drivers of wholesale gasoline and diesel prices. Because of their importance, PMAA has been and remains an ardent support of CFTC regulations to improve transparency in futures markets.

It is sobering to note that for every dollar increase in crude oil prices per barrel increase, that translates into a $2 billion daily increase for gasoline and diesel prices on U.S. motorists.

Additionally, PMAA supports completion of the Keystone Pipeline. We think the pipeline is important because it would diminish OPEC's cartel power to dictate crude prices. Further in the event of a conflict in the Middle East, we'll be thankful to have crude oil supplies readily available from Canada.

The second driver of refined product prices are environment laws and regulations. With over 30 boutique fuel prices, or fuel recipes, bottlenecks can develop that dramatically increase the prices at the pump on a regional basis.

Of course, most of you are aware of the escalating debate ongoing in Congress about the Renewable Fuel Standard. Because gasoline

demand has been weak, refiners have few options to meet the ethanol mandate in 2014, so I'm not sure how it will affect prices.

There has been much written and said about E15, but you need to know that E15 cannot meaningfully help solve the blend wall problem in the short term. We estimate there are 700,000 gasoline dispensers in use in the U.S. and only 5,000 have been approved for E15, and I'm only talking dispensers. There are also underground tanks and underground lines that have not been approved for E15. It will require many years and lots of money to upgrade 160,000 gas stations to handle E15; one estimate I saw was $3 billion. Many of our member companies have significant investments in ethanol blending and would love to offer E15, but they simply cannot easily resolve the liability infrastructure problems.

A few months ago, a major investment bank on Wall Street predicted ethanol RINs will go to $3 next year, and that will likely significantly increase gasoline prices over what they would normally be. We are urging the EPA administrator to adjust the ethanol mandate as needed to ease potential economic harm.

In April 2007, several refineries in the Midwest, all serving the same region, were closed for maintenance. The price shocks in Minnesota, South Dakota and North Dakota were so severe, Senator Dorgan authored an amendment to the 2007 energy bill for EIA to have a coordinator to improve communications. It is now 6 years later and Congress has not appropriated funds for that position. Ironically, just 2 months ago, the same region was hit with a similar situation. For most of May, motorists in North Dakota, South Dakota, Minnesota paid 40 to 80 cents a gallon more as a result of the refinery problems. We hope you will support funding.

Last, I have to mention credit card fees. Interchange fees imposed on gas stations is not a cents per gallon charge, but a percentage of the total. When Minnesotans were paying $4.50 a gallon in May, if they were using their Visa credit card, they were likely paying 11 cents a gallon to Visa. Now the Federal gasoline tax is 18.4 cents, but you've got to build and maintain roads with that. Visa gets 11 cents a gallon for what? To make matters worse, Visa charges interchange fees on Federal excise taxes, so they get a cut on that as well. We continually believe credit card fees need to be addressed.

Thank you very much.

[The prepared statement of Mr. Gilligan follows:]

PREPARED STATEMENT OF DAN GILLIGAN, PRESIDENT, PETROLEUM MARKETERS ASSOCIATION OF AMERICA, ARLINGTON, VA

Chairman Wyden, Senator Murkowski and distinguished members of the committee, thank you for the invitation to testify before you today. I appreciate the opportunity to provide some insight into factors impacting motor fuels prices.

I serve as President of the Petroleum Marketers Association of America (PMAA). PMAA is a federation of 48 state and regional trade associations representing more than 8000 petroleum marketing companies nationwide, the majority of which are small businesses as defined by SBA. These companies are very diverse but all have one thing in common, they all bring to market liquid fuels such as gasoline, diesel, heating oil, ethanol, biodiesel, jet fuel and kerosene. Our member companies are engaged in the transport, storage and sale of petroleum products on both the wholesale and retail levels. They supply gasoline to convenience stores, diesel to truck stops, lubricants to industry and heating oil to millions of customers. Not only are these companies primary suppliers of fuels they also own and/or operate over 80,000

retail facilities in the U.S. They also are often specialists serving farmers, railroads, marinas and airports with the fuels they need.

The U.S. motor fuels production and distribution system is extremely complex and is therefore misunderstood and inaccurately characterized by many. I am hoping we can provide some unique insights to the committee today. An example of misunderstanding we deal with every day relates to gas station ownership. Over the past 12 years, the major integrated oil companies have dramatically reduced their direct retail operations and have sold those businesses to petroleum marketing companies. Of the 160,000 U.S. retail gasoline locations, over 94 percent are now owned by independent businesses. When I joined PMAA in 1998, 70 percent of the Shell stations in the U.S were owned by Shell. Today nearly all Shell stations are owned by independent petroleum marketing companies.

Petroleum marketing companies do not benefit from high gasoline or diesel prices. Because they operate in such a transparently competitive environment, higher wholesale prices must be absorbed by retailers until street prices catch up. Thus, rising gasoline prices not only burden motorists, but petroleum marketers as well. In order to remain competitive, retailers usually offer the lowest price for gasoline to generate volumes sold and customer traffic inside the convenience store. When gasoline prices are unusually high, customers often reduce their purchases of convenience items. Additionally when prices are high, some retailers struggle with credit line limits.

Another factor most PMAA member companies have in common is most are "rack buyers". In the industry, wholesale product is loaded at "terminal racks" and there are approximately 1200 terminals in the U.S. Access to the terminal racks is quite restricted. Companies permitted to load product at terminals must have a plethora of state, local and federal licenses and permits. Also, they must have credit terms with refiners which is crucial for trade to function.

Because PMAA member companies are "rack buyers", I will focus most of my testimony on what factors influence wholesale rack prices and how they impact petroleum marketers and consumers.

1) The Price of Crude Oil

The price of crude oil is the primary driver of wholesale gasoline and diesel prices accounting for 67 percent of the price per gallon in May 2013.

A recent phenomenon in the oil markets is the price spread between the Brent crude oil contract and the light sweet WTI crude oil contract. Historically, the West Texas Intermediate (WTI) contract was the dominate price benchmark for the world, but since 2011, the North Sea Brent crude oil contract has taken over as the dominate benchmark. The sweeter, light crude WTI oil contract delivered in Cushing, Oklahoma was $2—$3 higher compared to the Brent contact and now it's common to see the Brent contract price $10—$20 above the WTI contract, although, in recent days that spread has narrowed to less than $5.

Because Bakken and Eagle Ford oil shale developments are delivered to Cushing, Oklahoma, they put downward price pressure on the WTI contract, but only have a modest impact on the world's oil prices because the WTI crude oil is landlocked and doesn't have an outlet to the world oil market. However, this doesn't take away from the fact that the U.S. must continue to pursue domestic oil production to prevent future oil price shocks and limit OPEC's power to dictate price.

As I mentioned earlier, crude oil prices often directly correlate to rack prices. Since crude prices are the prime factor, PMAA believes it is a duty of the U.S. government to make sure crude futures markets are honest markets with high levels of transparency. We believe both the WTI and Brent contracts can be vulnerable to excessive speculation. Since some of the U.S. market is likely priced off of Brent, the Commodity Futures Trading Commission (CFTC) should be examining the price discovery and fundamentals of the Brent contract. The graph* below shows the spread between WTI and Brent. Only until 2011 did the massive spread start occurring.

Congress also directed the CFTC to pass rules limiting certain commodities traders' size in energy commodities traded on and off exchanges where energy commodities are traded daily. The goal was to prevent investors from flooding cash into commodities and inflating prices. Large purchases of crude oil futures contracts by speculators have, in consequence, created an additional paper demand for oil which drives up the prices of oil for future delivery. This has the same effect that additional demand for contracts for the delivery of a physical barrel today drives up the price for oil on the spot market. Basically, a futures contract bought by a speculator has the same effect on demand for a barrel that results from the purchase of a fu-

*All graphs have been retained in committee filse.

tures contract by a petroleum marketer. The very definition of cash-settled contracts as "look-alikes" means that what occurs in the financially-settled markets directly affects what occurs in the physical market.

Final implementation of the CFTC's position limit rules was to have gone into effect on October 12, 2012 (for spot month position limits). However, on October 1, 2012, the U.S. District Court of DC ruled in favor of the Plaintiffs (International Swaps and Derivatives Association, etal) on the new speculative position limits rule. PMAA, the New England Fuels Institute (NEFI) and other members of the Commodity Markets Oversight Coalition filed an amicus brief in support of the CFTC's efforts to appeal the position limits ruling. PMAA cautiously supports the Commission's final rulemakings on margin/capital requirement for OTC swaps and registration of unregulated exchanges which will reduce leverage in the marketplace that will benefit end-users and other market users from excessive price volatility and extreme price increases at the terminal rack. The final CFTC rulemakings will give end-users better price information because it will force swaps dealers to real-time reporting which will bring competition to the swaps markets.

Additionally, PMAA has joined with other petroleum industry organizations in urging the President to immediately approve the Keystone XL pipeline which will contribute towards limiting OPEC's cartel power and ability to dictate price. Further, in the event of geopolitical conflict, we will be thankful to have the supply from our friends in Canada.

2) Environmental Regulation (including the Renewable Fuels Standard "RFS")

There are over 30 boutique fuels in the United States. Boutique fuel blends in states differ including reformulated gasoline (RFG) and fuels with different levels of low Reid-Vapor-Pressure (RVP) ranging from 7 psi to 8—15 psi in standard conventional gasoline. Some states mandate RFG blended with ethanol (an oxygenate) while some states mandate low-RVP fuels blended with ethanol. As a result, these boutique fuels requirements create supply botttlenecks, and, in most circumstances, supply shortages foster higher prices.

Additionally, passage of the "Energy Independence and Security Act of 2007" (EISA) was designed to spur the development and production of these alternative fuels, most notable of which is the 36 billion gallon renewable fuels standard (RFS). Under the EISA, blenders, primarily refiners and terminal operators earn marketable credits for each gallon of ethanol they blend into gasoline. The credits are traded among refiners in order to meet their annual renewable fuel volume blending mandates established by the EPA.

Lately, the value of ethanol credits have increased in value and a number of factors play into this recent rise. As the ethanol blendwall approaches due to the barriers of E15, RIN values have skyrocketed because obligated parties are buying all of the available RINs to comply with the law. Eventually, refiners could resort to exporting gasoline or cutting back production to fall within the parameters of the RFS blending mandate, so they don't violate the law. Actions like this could lead to rack price chaos unless EPA lowers the corn-based ethanol mandate which PMAA supports lowering the level achievable with an E10 blend and reasonable growth for E85. PMAA does not oppose E15 but advises marketers to obtain knowledgeable legal and regulatory counsel before offering E15 at wholesale or retail.

The biggest barriers to E15 include:

- Gasoline retail infrastructure equipment is certified to dispense and store up to 10 percent ethanol by Underwriters Laboratories (UL). Without UL approval, very few retailers will offer E15.
- Auto manufacturers extend warranties on existing vehicle fleets up to 10 percent ethanol. Most have not been willing to amend their warranties to handle blends above 10 percent because tests have shown E15 could damage engines, fuel pumps and other system components. This position did not change after EPA approved E15 for 2001 and newer vehicles.
- PMAA is also concerned that if an owner of a pre-2001 vehicle misfuels with E15, the retailer would be held liable for damage to engine and emission system components.

3) Regional refinery utilization and/or outages

Recent planned and unplanned refinery outages have also impacted rack prices. Scheduled maintenance at the BP Whiting Refinery in Indiana and at the ExxonMobil Joliet Refinery in Illinois (which both are now back up and running) has played a role in decreasing the supply of gasoline and increasing costs in the North Central region of the country. Furthermore, unplanned outages at HollyFrontier refineries in Cheyenne, Wyoming and El Dorado, Kansas and the

Citgo LeMont Refinery in Illinois have contributed to the tightening of supply and higher rack prices. It's unfortunate that unplanned and planned outages occurred simultaneously, but there are ways to alleviate this occurrence. Currently, federal anti-trust laws prevent refiners from communicating with each other, so in other words, refiners don't know when another one will have scheduled maintenance performed. Section 804 of the "Energy Independence and Security Act of 2007" Coordination of Planned Refinery Outages, assigned the Energy Information Administration (EIA) Administrator to review information on refinery outages from commercial reporting services and determine what affects they have on price, production, retail and wholesale supply shortages and disruptions while giving the Secretary of Energy the authority to encourage reductions of the quantity of refinery capacity that is out of service at any time. However, due to lack of EIA funding, the EIA terminated this program. PMAA supports dedicated funding for the EIA to restart this program to improve industry and government communications and planning.

In 2012, East Coast refinery closures also had an impact on rack prices. Because those refineries had to buy light, sweet crude oil imported from Africa and the North Sea that was priced at a premium to the WTI contract, those refineries were put at a competitive disadvantage. Additional factors included declining demand for refined products, cumbersome environmental regulations and permitting processes which made refiners' plans to maintain or expand production capacity more difficult than necessary.

4) Pipeline disruptions

Rack prices are also impacted by refined product pipeline disruptions. Our nation's pipelines do a great job of getting product where it is needed but pipeline equipment sometimes fails or needs maintenance. If pipelines reduce service for any reason, regional shortages can develop. For instance, following Hurricane Katrina, the Colonial pipeline which consists of more than 5,500 miles of pipeline delivering a daily average of 100 million gallons of gasoline, home heating oil, aviation fuel and other products to key terminals and distribution centers along the East coast was taken offline after losing electricity to power pumps.

5) Regional national disasters

Hurricanes Katrina and Rita showed how vulnerable the United States is to natural disasters and Superstorm Sandy only reinforced the need to have effective planning before, during and following a disaster. Because the sequence of events following a natural disaster are often similar in terms of access to fuel supplies, PMAA has organized a task force that is examining the bottle necks and making recommendations to federal and state governments to streamline the process. Weather forecasting has become extremely accurate in modern times. We usually know where and when a storm will hit and some waivers could be implemented before the storm and not days later. Federal, state and local governments are in the position to alleviate supply disruptions during a disaster by waiving RFG and RFS requirements, weight limits, regional fuel specifications, IRS fuel tax regulations specific for dyed/undyed products, regional hours of service waivers among additional waivers that are needed to ensure sufficient flow of product during emergencies.

Additional Factors that Influence Retail Motor fuels prices

1. Credit/Debit Card Fees

Credit card companies and card issuing banks impose unjustified costs on gasoline and diesel consumers. They often demand payment of 2-3 percent interchange fees on motor fuel transactions. In many cases, the card companies and banks make more off selling a gallon of gasoline than a retailer. While debit card fee reform was addressed in the Wall Street Reform Act (P.L. 111-203) under the Durbin amendment, credit card interchange fees keep escalating. In 2012, interchange fees were the second largest expense item for motor fuels retailers costing retailers $11.1 billion.

PMAA was pleased with passage of the Durbin amendment to limit debit card interchange fees. However, the Federal Reserve's final rule to implement the law fell short of our expectations even though the Fed's biannual report on interchange fees found that the average cost to process a debit transaction was five cents. Prior to the Durbin amendment, debit interchange fees averaged 44 cents, and now, since the Durbin amendment was passed, they average 21 cents. The Merchants Payments Coalition (MPC) noted that the report proved that the Fed's final rule was flawed and the cap on debit card fees should be reduced. Much more needs to be done to bring down interchange fees and promote relief to consumers, particularly excessive credit card interchange fees which the Durbin amendment did not address.

2. Taxes

The Federal Government imposes a tax of 18.4 cents on each gallon of gasoline, and the States levy an average tax of 22 cents on each gallon. This does not account for all State and local taxes, such as sales taxes, which can range from 7.5 to 37.5 cents per gallon across States.

Conclusion

It remains important for the U.S. to adopt policies that will reduce the power of OPEC and to increase U.S. job opportunities and strengthen the U.S. economy. Increased domestic production of crude and realistic renewable fuels mandates are key policy initiatives the U.S. should pursue as we move towards energy independence in the future. However, not even all alternative energy sources combined will provide the amount of energy required to run a $15 trillion annual economy until far in the future. For the next 100 years, we believe traditional sources of domestically produced crude oil will be needed to maintain the nation's economic and national security.

Again, thank you for the opportunity to testify before the Committee today. I'll be happy to answer any questions you may have at this time.

The CHAIRMAN. Thank you very much.

Let's go now to Mr. Plaushin.

STATEMENT OF CHRIS PLAUSHIN, DIRECTOR, FEDERAL RELATIONS, AAA, HEALTHROW, FL

Mr. PLAUSHIN. Thank you, Chairman Wyden, Senator Murkowski, members of the panel.

As the Nation's largest motoring group, when gas prices rise, we hear from drivers who are increasingly frustrated and who often to AAA for explanation. For more than a dozen years, AAA has provided an accurate and comprehensive resource, AAA's Fuel Gauge, which tracks national, State and local gas prices. Additionally, AAA educates the public on steps they can take to get more miles out of a gallon of gasoline. We view our role as arming consumers with factual information and unbiased perspective. Unlike others that frequently comment on the gasoline pricing, AAA has no involvement in the regulation, refining, shipping, blending or sale of gasoline. We seek to educate consumers on the factors that result in price swings and urge policymakers to find solutions that will result in more stable and more predictable prices.

AAA has called on the Federal Government policymakers and other industry stakeholders to work to make sure that gasoline prices and supplies are stable and less subject to large fluctuations.

It's difficult for many Americans to predict, understand and ultimately adjust to price changes that are regional, sudden and dramatic, as has often been the case in recent years. There are a host of factors that can impact the price at the pump. They range from the local variety, a pipeline disruption in Wisconsin, or heavy storms in the Great Plains, as we experienced this year; global variety, such as the unrest we've seen in Egypt this year. Factors range from the expected, seasonal demand changes, shifts in summer and winter blending requirements, and to the unexpected, hurricanes and refinery outages and other geopolitical tensions.

The result of these myriad factors is a new normal. The days of a national pump price below $3 is likely a thing of the past, and State and regional price spikes that see retail prices move sharply in a span of days are now all too common. The national average hasn't been below $3 per gallon since 2010, but since that date, motorists in 16 different States have registered a 1-week spike of at least 25 cents.

Looking at 2013, the national average price for a gallon of gasoline on January 1 was $3.29, and this is the highest ever to begin the year, but they've also peaked earlier and lower than previous years. In 2011, the peak was $3.98 on May 5; in 2012, the peak was $3.94 on April 5. This year, the peak came at $3.78 on February 28, and following that, the national average declined steadily to the recent low of $3.47 on July 7, but as we have seen, wholesale gasoline prices have followed crude oil prices higher in recent weeks. The prices at the pump in the majority of States is again on the rise, and barring an unforeseen market development, is likely aimed higher through the end of the summer driving season into mid-September.

The rise and fall of the national average during the first half of 2013 was obscured by the high degree of State and regional price volatility, most notably on the West Coast and in the Midcontinent. In both of these cases, even as national average price of gasoline was falling, refineries that were offline for planned or unplanned maintenance meant a tightening of regional supplies and subsequently, sharply higher prices for drivers. While pump prices in these markets did drop sharply as production came back online, motorists are understandably frustrated and squeezed, and these dramatic price swings underscore the volatility that has become all too familiar in recent years.

Unfortunately, there is no silver bullet solution to the high prices or market volatility that consumers are experiencing. The Federal Government should adopt a national energy policy which combines increased production, the efficient use of traditional and alternative fuels, elimination of lengthy roadblocks to the development of new sources of energy, so long as we are not precluding the appropriate level of environmental review.

AAA remains committed to providing our members and the traveling public with accurate prices and fuel conservation tips. While much attention has been given to the production side of the equation, there is a demand aspect as well. Informing consumers must be a necessary element in any strategy, and how you use your car is just as important as which vehicle you choose to use.

Thank you, Mr. Chairman, for the opportunity today. I look forward to any questions you might have.

[The prepared statement of Mr. Plaushin follows:]

PREPARED STATEMENT OF CHRIS PLAUSHIN, DIRECTOR, FEDERAL RELATIONS, AAA, HEALTHROW, FL

Thank you for the opportunity to testify at today's hearing. My name is Chris Plaushin, and I serve as the Director of Federal Relations for AAA.

AAA is a not-for-profit, fully taxpaying federation of motor clubs in the U.S. and Canada, providing more than 53 million members with travel, insurance, financial and automotive-related services. Since its founding in 1902, AAA has been a leader and advocate for the safety, security and mobility of all travelers.

The price of gasoline is a primary concern of U.S. motorists and for more than a dozen years AAA has provided an accurate and comprehensive resource—AAA's "Fuel Gauge"—which tracks national, state and local gas prices. Additionally, AAA educates the public on steps they can take to get more miles out of a gallon of gas.

As the nation's largest motoring group, when gas prices rise we hear from drivers who are increasingly frustrated and who look to AAA for explanation.

We view our role as arming consumers with factual information and unbiased perspective. Unlike others that frequently comment on gasoline pricing, AAA has no involvement in the regulation, refining, shipping, blending or sale of gasoline. We

seek to educate consumers on the factors that result in price swings and urge policy makers to find solutions that will result in more stable, predictable prices. AAA has continuously called on the federal government, policy makers, and other industry stakeholders to work to make sure that gasoline supplies are stable and not subject to large fluctuations. Oil is a publically traded commodity and influenced by the ebbs and flows of the market just like any other product subject to the forces of supply and demand.

AAA knows that consumers are frustrated by the pinch of higher retail gas prices. It is even more difficult for many Americans to predict, understand, and ultimately adjust to price changes that are regional, sudden and dramatic, as has often been the case in recent years.

There are a host of factors that can impact the price of gas at the pump. These range from the local variety—a pipeline disruption in Wisconsin or heavy storms in the Great Plains—to the global—violence in the Middle East and North Africa or economic growth in China. They also range from the expected—seasonal demand increases, product shifts or rising global demand—to the unexpected—hurricanes, refinery outages or geopolitical tensions.

The result of these myriad factors is a "new normal" where the days of a national pump price below $3.00 is likely a thing of the past and state and regional price spikes that see retail prices move violently in a span of days are more common. The national average hasn't been below $3.00 per gallon since 2010 and motorists in 16 states have registered a one-week spike of at least 25 cents since that date.

The national average price for a gallon of gasoline on January 1 was $3.29 per gallon—the highest mark ever to begin a year. As has been the case in recent years, prices rose to begin 2013, however they peaked earlier and lower. In both 2011 and 2012 gas prices rose to start the year because of surging oil prices due to unrest in the Middle East and North Africa. In 2011 the national average peaked at $3.98 per gallon on May 5. In 2012 it peaked at $3.94 on April 5 and 6. In 2013 the price peaked at $3.78 on February 28 and 29. From that peak, the national average declined steadily to a recent low of $3.47 on July 7. As wholesale gasoline prices have followed crude oil prices higher in recent weeks, the price at the pump in the majority of states is again on the rise and is likely aimed even higher—barring an unforeseen market-moving development—through the end of the summer driving season in mid-September.

Obscured by the relatively orderly rise and fall of the national average during the first half of 2013 was the high degree of state and regional price volatility due to refinery disruptions, most notably on the West Coast and in the Midcontinent. In both of these cases, even as the national average price of gasoline was falling, refineries that were offline for planned or unplanned maintenance meant a tightening of regional supplies and subsequently sharply higher prices for drivers. While pump prices in these markets did drop sharply as production came back online, motorists were understandably frustrated and squeezed by soaring prices and these dramatic price swings underscored the volatility that has become all too familiar in recent years. The most expensive gas prices in the country are, as of July 12, paid by drivers in Hawaii ($4.32), Alaska ($4.05), California ($3.99), Connecticut ($3.84) and Washington ($3.84). Drivers pay the least in South Carolina ($3.21), Alabama ($3.30), Mississippi ($3.30), Tennessee ($3.32) and Arkansas ($3.35).

Unfortunately, there is no "silver bullet" solution to high prices or to market volatility. Rather it will take a portfolio of polices to best mitigate the periodic uncertainty of gas prices and their impact on consumers.

The federal government should adopt a national energy policy, which combines increased production, the efficient use of traditional and alternative fuels, and the elimination of lengthy roadblocks to the development of new sources of energy—so long as we are not precluding the appropriate level of environmental review.

Going forward, from AAA's perspective, such a plan should strive to seek an effective balance between our need for mobility and independence and our need for increased energy efficiency.

AAA remains committed to providing our members and the traveling public with accurate prices and fuel conservation tips. While much attention has been given to the production side of the equation, there is a demand aspect as well. Informing consumers must be a necessary element in any strategy—how you use your car is just as important as which vehicle you use.

The CHAIRMAN. Mr. Plaushin, thank you.

Mr. Khan.

STATEMENT OF FAISAL KHAN, MANAGING DIRECTOR, CITI RESEARCH, NEW YORK, NY

Mr. KHAN. Thank you.

Chairman Wyden, Ranking Member Murkowski, and distinguished members of the committee, my name is Faisal Khan and I am a managing director at Citigroup, working in the Equity Research Department. My primary responsibilities include the fundamental research and analysis of the integrated oil refining and pipeline industries in North America. I am honored to be here today to discuss this important topic.

The U.S. refining industry has evolved and restructured over the last 20 years. Currently, 70 percent of U.S. refining capacity is owned by the independent refiners compared to 40 percent 15 years ago. The industry has evolved to be one of the largest industrial manufacturing sectors in the U.S. from one simply tied to primary energy production 2 to 3 decades ago. It is characterized by a high degree of competition with both domestic and foreign independent refining companies, integrated oil companies and national oil companies competing to deliver gasoline to the U.S. market. Therefore, gasoline prices in the U.S. remain tied to the global markets, adjusting for the cost of transportation.

There are a number of key trends that have been and continue to develop in the U.S. fuels and primary energy production sectors of North America. First, after peaking during the middle of the last decade, gasoline demand appears to be in secular decline. We estimate we could see gasoline demand reduced by 600,000 barrels a day through the decade, simply from the CAFE standards in place. High sustained oil prices, and therefore, higher gasoline prices compared to earlier in the last decade, is resulting in price elasticity.

Second, while dissolute demand, diesel, jet fuel and heating oil should see constructive global demand growth in the decade, the situation in the U.S. is evolving, with heating oil demand being replaced by cheap natural gas supply, and natural gas beginning to compete with diesel for short-haul trucks and potentially long-haul trucking, we estimate up to 50 percent of long-haul truck sales could be CNG or LNG by 2025, assuming the price difference between natural gas and oil remains in place. This scenario could result in the displacement of roughly 1.8 million barrels a day of diesel demand in the U.S. over the next 15 to 20 years.

Third, on the supply front, both natural gas and oil production are growing in the lower 48. Canadian oil production also continues to grow. We estimate U.S. and Canadian oil production could grow by 5 million barrels a day through this decade. The growth in lower 48 production which began in the middle of 2008 has resulted in significant price discounts on both Canadian and U.S. crude versus global benchmarks of between 20 percent and 40 percent; however, as more logistics capacity has been added, we've seen a moderating of these differentials more recently.

Fourth, the growth in oil supply is resulting in a record build out of pipeline, rail and marine infrastructure to deal with the changing flows of crude oil in the U.S. and Canada. Despite the delay in the Keystone Excel Pipeline, the industry is working around the issue. Crude oil movements by rail have grown exponentially over

the last few years and look to continue to grow. Pipeline bottlenecks in the Midwest and South are being unlocked with new and expanded infrastructure. As more domestic crude arrives in the Gulf Coast by pipeline and other coastal markets by rail, regulations such as the Jones Act increase the cost of delivering crude to U.S. ports and potentially increase the price of gasoline, most notably on the Eastern seaboard. The result of increased crude by rail could result in more safety incidents. According to third party data, rail has 4 times the incident rate than pipelines.

Fifth and still related to supply, the ethanol continues to grow; however, gasoline demand continues to contract in the U.S., pushing the mandate toward the blend wall. As the committee knows, refiners meet their mandate through the RIN system. Currently, there are winners and losers in the RIN market. As we move into next year, we estimate the liability to the industry could grow, pushing RIN prices up and potentially impacting gasoline prices as refiners try to pass on the cost to the RIN through the market. The RIN market is thinly traded with relatively few participants when compared to other commodity markets. Unless the supply of RINs increases, either through more E15 sales or a reduction in the mandate, we see RIN prices continuing to rise into next year.

To sum up our comments, the growth in hydrocarbon production is positive for the U.S. economy. It has put the independent refining industry on the low end of the global cost curve, resulting in a massive increase in exports. Infrastructure is being built out to deal with production growth, resulting in job growth and higher economic activity. The crude oil and products market appear to be functioning normally and providing the right incentives, which we estimate will push the U.S. into energy independence by the end of the decade. Regulatory hurdles such as the delay in Keystone Excel and higher RIN costs add friction to the market. Nevertheless, the industry appears to be able to work around these issues with a higher cost in doing business.

Again, thank you for the opportunity to testify. I look forward to answering any questions you may have.

[The prepared statement of Mr. Khan follows:]

PREPARED STATEMENT OF FAISEL KHAN, MANAGING DIRECTOR, CITI RESEARCH, NEW YORK, NY

Opening Remarks

Chairman Wyden, Ranking Member Murkowski, and distinguished members of the Committee, my name is Faisal Khan and I am a Managing Director at Citigroup working in the Equity Research Department. My primary responsibilities include the fundamental research and analysis of the integrated oil, refining and pipeline industries in North America. I am honored to be here today to testify on how U.S. gas and fuel prices are being affected by the current boom in domestic oil production and the restructuring of the U.S. refining industry and distribution system.

Independent Refiners

Historically, refineries have been considered part of the integrated oil supply chain. As oil was discovered, producers felt the need to integrate their supply with the product market (gasoline and distillate) through refineries and retail stations. However, as the industry became increasingly competitive over the last few decades, there has been less of a need to be integrated. The result has been the emergence of a major independent refining industry.

While the refining industry is clearly attached to the energy industry, the mechanics of the industry are more like other industrial and manufacturing sectors in the US rather than primary energy producers. Generally, independent refiners do

not have control over their input costs and product prices. Refiners are price takers on both ends of the barrel. Their costs, crude oil, are priced in the global market and the products, gasoline and diesel, are similarly priced. We therefore look at the independent refining industry as a major industrial sector that is deeply cyclical and deeply seasonal (seasonality of gasoline and diesel demand). Margins and not the notional price of crude oil drive their profitability.

Industry Background

For almost the entire decade of the 1990's refiners did not make their cost of capital and actually destroyed value for shareholders. There existed a tremendous amount of overcapacity in the system throughout all the 80's and most of the 90's. During this time, capacity was rationalized and demand grew steadily bringing the market into balance by the time of the millennium.

Starting in 2000, global refining capacity began to tighten. Major oil companies began to shed their refineries after major consolidation. Environmental costs also escalated as gasoline specifications became more rigid. During this time, independent refiners grew their market share. In 1998, 40 percent of refining capacity in the US was controlled by the independents. By 2008, this number had grown to 60 percent and today stands at 70 percent following the spin-off and sale of a number of refining assets from integrated and major oil companies.

The refinery shutdowns in the 80's along with growing fuels demand during the 90's in the US, China, Asia, the Middle East and Brazil brought refining supply and demand into balance in 2000. However, just as we turned to a new millennium, oil supply began to disappoint as many OPEC countries did not deliver on new supply to the market. Therefore, just as refining was coming into balance, oil prices started to rise, pushing gasoline prices to levels that had not been since the late 70's.

During most of the last decade (2000-2010), refiners earned healthy margins as overall global refining utilization approached 90 percent (2006). Generally speaking, the industry requires 15 percent extra capacity for adequate supply of fuels to take into account major turnarounds and downtime in the industry.

The high utilization rate was a result of solid growth in gasoline and distillate demand during this decade (2000-2007) resulting in solid refining margins in 2004, 2005 and 2006. The high margins were a direct market signal to national oil companies, major integrated oil companies and independent refiners to bring more capacity to market. In this effort, there began a push to expand capacity across the entire world with the US, Asia and Middle East building new capacity. At the same time, renewable fuels such as ethanol began to enter the supply pool through the renewable fuels standard (Renewable Fuels Standard as part of the 2007 Energy Bill passed in December 2007). So on the supply side, we began adding more refining capacity and ethanol supply just as the world was about to go into a major recession.

On the demand side, the high price of oil (hitting nearly $150 per barrel in 2008) became a tax on the consumer resulting in some price elasticity in 2007-2008 (wholesale gasoline prices were $3.52 per gallon in the middle of 2008 or about $4.25 a gallon at the pump). Furthermore, increased CAFE standards in the US and demand for more fuel efficient cars from global consumers became a headwind for demand. We currently estimate gasoline demand could contract by a further 600 mb/d through the end of this decade just using the current CAFEs tandards.

With the world in the midst of a major recession in late 2008, all of 2009 and part of 2010 (wholesale gasoline prices dropped to $1.00 per gallon in early 2009 or about $1.75 per gallon at the pump), increased supply of refined product from new capacity and ethanol caused the industry to fall on difficult times with many questioning whether some companies would remain solvent.

In 2010, 2011 and for part of last year, refiners began shutting down older, less competitive refineries in order to improve the supply demand balance of refined products in the global markets. Capacity was shutdown in the US, Europe and Japan. Even today capacity continues to be shut in Japan, Australia and North America. Furthermore, the delay in new refining capacity in Latin America, the shutdown of European refining capacity and a solid economic recovery in Latin America caused refined product (both diesel and gasoline) exports out of the US to surge.

The recent surge in exports has certainly opened a new avenue of business for domestic refiners. For most of the last decade (2000-2007), product exports from the US to other parts of the world remained fairly range-bound between 900mb/d to 1.2mmb/d. Imports of refined product were in fact much higher at 2.1mmb/d. However, following the great recession and the increase in fuel efficiency in the US, our country had too much refining capacity and these refineries needed to find other markets for their product or risk being shutdown. At the same time, the market ex-

pected refining capacity in the US to get rationalized because newer capacity in Asia was threatening to push more refined products into the US. However, lower natural gas prices and therefore cheaper hydrogen enabled US refineries to move down the global cost curve to become more competitive. The US is now exporting between 2.6-2.9mmbls/d of refined products—more than doubling exports to the rest of the world. Last year, product imports were 640mb/d.

The Hydrocarbon Production Boom in the US & Canada

US Production

The discovery of shale gas in the US during the last decade by US independent oil and gas companies resulted in robust natural gas supply growth over the last several years. These new discoveries were the result of a technology shock. New methods in natural gas extraction resulted in a significant increase in supply and therefore a large reduction in domestic natural gas prices. During most of the last decade, natural gas prices in the US were higher than that of Europe (2000-2010). This changed with the discovery of shale gas which made US energy intensive industries highly competitive, refining included. We estimate natural gas supply could grow 10 percent-15 percent through the decade.

The technology advancements in shale gas began to spill over into oil in the last five years. The industry figured out how to access oil from shale and tight formations more economically. This technology combined with high sustained oil prices resulted in increased oil production from unconventional sources of oil. Oil production has now grown by 2.8 mmbd since bottoming out at 4.4 mmbd in 2008. The Bakken is a clear example of the technological break through with production growing from 300 mbd to 780 mbd over the last few years. The Eagle Ford in South Texas, the Niobrara in Colorado, the Utica in Ohio, the Permian in New Mexico and Texas and finally the Monterey in California are all shale formation and/or basins that are or could contribute to the continued growth in oil production. We estimate total US crude oil production could reach 9.0 mmbd by the end of this decade (currently 7.3 mmbd).

Canadian Oil Production

Over the last several years, oil production in Canada has grown while Canadian refinery demand has remained flat, driving increasing exports into the US, mainly into the Midwest. In the next 18-36 months, heavy-sour Canadian crude should make its way via new pipelines to the US Gulf Coast in increasing abundance, while a surplus of heavy-sour crude from Canada should move from the US Midcontinent to the US Gulf Coast. We estimate this increased supply from Canada will put pressure to back out medium and heavy crude oil imports from Saudi Arabia, Iraq, and Kuwait in the Middle East as well as Venezuela, Colombia and Mexico in Latin America. In order for the Middle East and Latin America to maintain market share in the US, they may have to discount their crude to remain competitive.

We estimate Canada could grow liquids (oil and NGLs) production from nearly 3.5 mmbd today to 6.5mmbd by the end of the decade. Canada's liquids production is a mix of oil sands, sythentic, conventional, shale and natural gas liquids. Oil sands is the main source of Canadian production growth through the decade. We expect oil sands production will contribute about 200 mb/d of growth every year for the next 10, perhaps 20, years. Canadian oil sands production could grow +1.9-mmb/d to 3.7-mmb/d from the end of 2012 to 2020. Infrastructure bottlenecks were impacting producer economics for most of 2012 and early this year, however, the discounts on Canadian crude have narrowed more recently with the ramp up of rail volumes out of Western Canada and seasonal downtime.

Takeaway capacity from Canada into the US has been challenged with the delay of Keystone XL and other pipelines running at below capacity from the Canadian border to the Midwest. However, producers appear to be shifting their production to rail and have been more aggressive lately in signing up for alternate pipeline takeaway capacity both in the US to debottleneck the Midwest and Midcontinent as well as move crude East through a partial conversion of the Canadian Mainline (natural gas). While a potential pipeline from Alberta to the Pacific has always been a goal of producers and pipeline developers, it appears political friction between British Columbia and Alberta could put those aspirations on hold forcing more crude to move:

1. by rail to the Canadian coastal markets for export;
2. into the US Midcontinent through the debottlenecking of pipeline capacity (not including Keystone XL); and
3. by a new pipeline to the Canadian East Coast (Mainline conversion).

Based on this analysis, the markets appear to be working around the delay in Keystone XL. Therefore a delay of the pipeline is unlikely to affect crude oil production growth out of Canada.

Crude Oil Production Growth Impact to Oil Markets

With the sustained growth in crude oil from the lower 48 and continued production growth in Canada, the markets were caught off guard in 2011 and 2012. There was not enough logistics takeaway capacity (both pipeline and rail) to evacuate all the crude being produced in the interior US and Canada. Furthermore, the delay in infrastructure to move Canadian crude to the Gulf Coast only exacerbated the situation. Much of this new production ended up in inventory in Cushing and other facilities through PADD II (Petroleum Administration for Defense Districts).

During 2011 and 2012, only 250 mbd of pipeline takeaway capacity (Cushing to Gulf Coast) was added to alleviate the bottleneck against 1.5 mmbd of production growth (US crude oil production). The combination of crude oil production growth and the lack of logistics capacity resulted in interior US crude oil benchmark pricing (WTI—West Texas Intermediate) trading to substantial discounts to international Benchmark oil prices (such as Brent oil, priced in Northwest Europe).

At the peak of the bottleneck, the benchmark US interior crude oil price (WTI) traded at $28 per barrel discount to waterborne prices (Brent). Canadian crude price discounts actually faired much worse at over $40 per barrel versus similar waterborne crudes.

With pipelines taking longer to get done, rail quickly picked up the slack with producers and refiners now moving nearly 400,000 car loads (annualized for 1Q'13) of crude oil this year compared to 9,500 car loads in 2008 (according to the Association of American Rail Roads). Producers and pipeline owners have been working on new projects to alleviate the bottlenecks. Large pipeline companies have been working with Canadian producers to find new ways around the constraints that existed in 2011 and 2012. Smaller US pipeline companies have been working with producers in the lower 48 to move crude to the Gulf Coast. These projects are just starting to contribute to crude oil being evacuated to the coastal markets resulting in the continued reduction in crude oil imports. From 2005 to 2013, US imports of crude oil have nearly been cut in half (graph below*).

All figures have been retained in committee files.

The refining industry has seen a massive shift in its crude purchases. The industry used to move crude by tanker from international sources and then by pipeline into the interior US. Almost all this international crude has stopped moving into the Midcontinent, Midwest and Rockies refining systems. It has been replaced by domestic and Canadian crude. Pipelines that used to run crude from the Gulf Coast to the interior US have had to be reversed and many existing pipelines now run at reduced capacity.

The benefits of these crude discounts mostly flowed to interior US refining capacity which makes up about 20 percent of total US capacity. However, as we've seen more recently, these discounts have compressed. Market signals allowed producers, refiners and pipeline developers to bring more logistics capacity to market.

With more crude now hitting the Gulf Coast from the interior US by pipeline, differentials are starting to collapse. Canadian crude is also making its way to the Gulf Coast by barge and in small quantities by pipeline. With international crude prices holding firm, interior US benchmarked crude have finally caught up in the last nine months moving from $88 per barrel in 4Q'12 to $105 per barrel last week. International benchmark crude oil prices are actually down. At these prices, we continue to see US and Canadian producers highly incentivized to grow production. Citi's view is that continued growth in North American oil production will put pressure on international benchmark prices.

In Citi Research's view, pipeline and tanker shipping constraints, such as the Jones Act, only serve to slow down the influence of US oil production growth on the global oil markets. Furthermore, the higher shipping costs of Jones Act tankers has the effect of increasing gasoline prices particularly in the Northeast where product imports are critical in meeting demand. In our view, pipelines and tankers continue to be the safest and most efficient means to deliver crude to market with rail used as a medium to deliver crude from stranded locations or to refineries that may not have access to pipeline or port capacity.

Aside—Shipping crude or product from the US Gulf Coast to ports on the East or West Coast falls under the Jones Act, which would require that the goods be carried on US flag vessels, constructed in the US, owned by US citizens and crewed by US citizens and permanent residents. There are very few US flagged vessels available for these purposes.

According to the Manhattan Institute of Policy research, moving crude by rail and truck have much higher incident rates than pipelines. Rail has almost 4x the incident rate and road has almost 40x the rate of pipelines.

Crude Oil Exports

With US imports of crude oil continuing to fall, we are already starting to see the constraints on the refining complex's ability to absorb all the light sweet crude being produced in the US. Over the last two and half years we have seen price discounts on domestic crude oil of over 20 percent as a result of volumetric constraints on the logistics systems. However, we could be entering a period of quality constraints as US refiners reach their maximum intake of light sweet crude. We believe we are seeing this in the Gulf Coast where Eagle Ford crude is now being shipped from Corpus Christi to Eastern Canada.

We estimate the Canadian Northeast has the ability to consume up to 800 mb/d of US light sweet crude. Crude can be shipped from the US to Canada by a non-Jones Tanker. Furthermore, because Canadian crude has no export constraints, producers are most likely to export crude out of Canada at better netbacks rather than compete with US crude that will be shipped to the Canadian Northeast at discounts to global benchmarks.

Other export outlets potentially exist to Mexico and to countries with which the US has free trade agreements with. Singapore and Korea are countries the US has a free trade agreement with and have large refining industries.

Gasoline and Distillate Markets

With crude oil production clearly on a trend to grow, the question has often been asked: Why is all this production growth not driving down gasoline prices? Since the US still imports crude oil and exports refined product, US refined product prices are connected to global gasoline and diesel markets (minus transportation). In addition, crude oil prices in the US are likely to remain linked to global markets minus the cost of transportation and logistics. We estimate it would take several more years for the US to reach crude oil independence without significant substitution affects.

For the last few decades, global product prices have remained linked with prices in Asia generally being higher than that of the US and Europe.

With US gasoline consumption continuing to decline, excess gasoline production has been moving increasingly to Latin America. Given the limited amount of new refining capacity coming on line, we see the US continuing to deliver more gasoline to Latin America. Over the last ten years, product demand in Latin America has grown by over 150 mb/d per annum.

Higher exports are a critical ingredient to the vitality of the US refining industry. As we've discussed, US refiners now have significant advantages when compared to their global counterparts. Lower natural gas prices in the US relative to the rest of the world and growing crude oil production put US refineries on the high end of the global margin curve. Of the 500 refineries across the world that we detail on the margin curve below, the vast majority of US assets show up in the top quartile.

Crude Oil and Refined Product Market Threats

The rise in crude oil prices and therefore refined product prices over the last decade have resulted in global oil consumption reaching 10 percent of global GDP, which represents one of the highest levels we've see in more recent history.

The higher cost of crude and advent of new technology is resulting in the substitution of natural gas and electricity for crude oil in the US. We see this in the chemical industry where naphtha is being substituted out of the US chemical crackers in favor of ethane and propane (derivatives of natural gas production). US chemical manufactures now show up on the bottom of the cost curve.

We are also seeing a substantial amount of heating oil (distillate) demand destruction in the Northeast and Mid-Atlantic where home owners are switching from heating oil to natural gas. This momentum has the potential to substantially reduce the almost 500mbd heating oil market that exists in the US today.

The other clear threat to the refining industry is the substitution of natural gas and electricity in the transportation sector. We are starting to see heavy duty vehicles move to natural gas. Citi estimates 50 percent of all refuse trucks sales are now CNG vehicles. And while the long haul trucking fleet has seen very little penetration by natural gas vehicles, Citi estimates up to 50 percent of heavy duty vehicle sales could be LNG and/or CNG by 2025. This assumes the current price difference between natural gas and oil carries forward into the next decade. Under this scenario, up to 1.8mmbd of distillate demand could be displaced.

We view the market penetration of natural gas into the light duty vehicle fleet to be somewhat limited. However, we do see an opportunity for electric vehicles to make up 3 percent of global vehicle sales by the end of this decade. Plug-in vehicles could make up another 3-4 percent of vehicles sales by 2020. Next generation electric vehicles could raise this market share.

The Impact of Regulation on the Industry

There are a number of key regulatory issues that have an effect on the refining industry. These issues include:

4. Environmental costs. This may include the cost of compliance with changing gasoline and distillate specifications, emissions standards and carbon costs.
5. Government Mandates. This includes the renewable fuels mandate and cost of renewable identification numbers.
6. Construction Permits. This includes permits to build pipelines and expand or retool refining capacity; and
7. Trade and shipping restrictions. This may include crude oil export permits and the Jones Act.

Environmental costs

Many of the fuel specification changes over the decade are now fully capitalized in the current assets of the US refiners. Many other countries are also following some of the US standards. The cost of carbon is an unknown quantity for the industry. The state of California is moving forward with its low carbon fuel standard (LCFS) program. Carbon credits in California have more than doubled over last year trading near $70/ton. This is a much higher price than Europe and could threaten the competitiveness of the industry.

Government mandates

The renewable identification numbers (RINs) has taken the industry by surprise this year. 2013 ethanol (D6) RIN prices have increased from 7 cents/gal in early March 2013 to $1.10/gal this month. Blenders are hitting the "blend wall" but are still required to fulfill the RFS obligations which are higher than the "wall". The RFS-2 (the latest targets from 2007 legislation) mandates 13.8-bn gal (900-k b/d) of ethanol be blended into the gasoline pool in 2013. But with US gasoline demand at 8.7-m b/d in 2012 and declining due to higher vehicle efficiency standards, this places the blend wall at around 870-k b/d (13.4-bn gal).

We believe the RFS mandate had envisioned increasing gasoline demand. However, higher vehicle efficiency standards in the US are at odds with the RFS mandate. As we get closer to 2014, the RIN liability is likely to grow and it is not clear if higher RIN prices will be passed along to the retail gasoline price.

Current penalties for non-compliance are high at $32,500 per day per RIN. Refiners have some flexibility to carry a 20 percent deficit into the following year. One solution could be to increase the availability of E15 or E85 (increasing RIN supply), however the wide adoption of a new fuel might be difficult given the potential corrosion issues to model year cars built before 2001 (11/4/10 EPA report and www.epa.gov/otaq/regs/fuels/additive/e15) and product liability issues associated with retail distribution. Currently 20 retail stations provide E15 in 6 states out of 121,000 retail gasoline stations across the entire US. According to Citi Research's Agriculture analyst, corn inventories are expected to reach surplus levels for crop year 2013/2014, which would result in the cost of ethanol being much lower than gasoline (all else being equal) providing a market incentive for additional E15 stations.

We believe there are currently both winners and losers in the RIN market today, which is mitigating the impact of the RIN cost to the consumer. However, we envision a situation next year when refiners and marketers exhaust the RIN "bank". Under this situation, the entire market would be short RINs. Under this scenario, RIN prices would most likely be passed along to the consumer and wholesale gasoline prices in the US could be higher than the rest of the world. Therefore without the addition of more RINs to the market, the price of RINs could soar resulting in higher gasoline prices in 2014.

Our research shows that higher RIN prices this year will impact the profitability of refiners by between 5-15 percent. Refiners that do not blend their own gasoline production are clearly most at risk.

Aside—Buying and selling of RIN credits revolves around three distinct counterparties in what is a highly illiquid and esoteric over-the-counter (OTC) market. Obligated parties (OP)—refiners and importers—that are subject to statutory requirements set by the EPA are the largest components of market trading (physical and paper). Pure blenders that mix ethanol or biodiesel with traditional fuels are an-

other source of RIN demand (physical and paper). Non-commercials are newer market participants which speculate on price direction and to a degree might be construed as 'liquidity providers' willing to hit a bid or lift an offer in an otherwise one-sided market (paper).

Construction Permits

The two issues refiners and pipelines are dealing with are permits for new pipeline construction and CO_2 permits to increase or retool refining capacity to absorb more light sweet crude into refineries' crude slates.

The Keystone XL pipeline is a new pipeline project that has faced unprecedented delays. I have covered the pipeline industry for 12 years and I have never seen such a long delay in pipeline construction as we have seen for Keystone. In our opinion, the delay in Keystone will not stop crude production growth in Canada and the US. The decision to delay Keystone only allows other mediums of transportation such as rail, barge and trucking to be more widely used. Furthermore, the delay only forces producers to look at alternate pipeline routes to deliver crude to market. As more Canadian crude gets delivered to the coastal markets, it will enter the global market and the US could lose a dedicated supply source. Finally, as more crude ends up on the rail systems of North America, the law of numbers suggests we are only likely to see more incidents. We believe the unfortunate incident that we observed in Quebec is a reminder of the consequences of moving increasing amounts of crude by rail.

Trade restrictions

As crude oil production grows and fuels demand subsides in the US, we at Citi Research believe Congress may very well have to address the issue of crude exports. Separately, the Jones Act has clearly become an impediment to moving new US crude to the coastal refineries that could use it. It also has the affect of increasing gasoline and diesel prices in the US because of the added cost of transportation. Moving crude and products from the Gulf Coast to the West Coast and East Coast requires the use of Jones Act tankers. The cost of moving crude by Jones Act tanker could be 3.0x to 6.0x the price of using non-Jones Act tankers. As we previously discussed, Canadian East Coast refineries are now delivering crude from the Gulf Coast to Canada's Northeast at much lower rates than tankers that could deliver crude to the US Northeast.

Closing Remarks

Thank you for the opportunity to testify before you today on these important issues. I look forward to answering any questions you may have.

The CHAIRMAN. Thank you very much, Mr. Khan. I want to thank all our witnesses. We have had 10 Senators come in and out on a hectic morning, so we're just going to go back and forth and I believe it's going to be possible to just keep things going.

Let me start with the question of why the lower cost of new oil supplies is not being passed on to the consumer. I want to start with you, Mr. Sieminski, using a chart from the Energy Information Administration.

The chart shows that, on average, 67 percent of the cost of a gallon of gas at the pump is the cost of the oil that goes into it, and for diesel, that's 62 percent. Now the second chart that I want to hold up shows what industry leaders call the crack spread. That's the difference in price between what a refiner pays for crude oil and the price a refiner gets for selling the gas and the diesel fuel it makes. Now this chart was based on an analysis that was done for the committee and I ask unanimous consent to insert this Congressional research service analysis in the record without objection, and that will be done.

The CHAIRMAN. Now the refineries in the Midwest and the Rockies, what are called Pad 2 and Pad 4, which have access to the lowest cost oil from North Dakota and Canada, have the biggest margins: $39 a barrel compared to $14 a barrel on the East Coast or $25 on the West Coast. Those are the annual averages. In some

months, for some refiners, the spread in Pad 2 and Pad 4 has been considerably higher, in the $40 and $50 range, roughly a dollar a gallon, 42 gallons, of course, in a barrel of oil. So we are talking about record-level refining margins. Let me repeat that, record-level refining margins, and while they are not all profit, certainly, a lot seems to be, though the flipside of this part of the story is that lower crude oil costs from these new sources of production aren't being passed through to the consumer.

So Mr. Sieminski, to begin, why aren't consumers seeing the benefits of these lower crude oil prices when two-thirds of the cost of a gallon of gas is the cost of the oil that is used to make it?

Mr. SIEMINSKI. Senator, the purpose of that graphic of the gasoline pump is to try to provide some illustrative knowledge to any user of EIA's data as to how the price of gasoline has to include the cost of inputs like crude oil and ethanol, as well as refining and distribution margins and State, local, and Federal taxes, so we try to provide some breakdown for that.

If you come back to the basics of your question, virtually every group that I know that's ever studied product markets believes that product prices are being set in the global market, so the price of gasoline in a sense is a global price, it's not a local or regional price in the U.S. So what that means is that if there are lower crude prices in the Midwest region of the U.S., that is going to be reflected in refining margins, as your chart illustrates. So what the difference in price does allow is some ability of those refiners to begin to upgrade their facilities to do things like make better use of the light sweet crude oil that's being produced. One thing that I do want to say is that I think consumers are benefiting from the growth in domestic oil production; the 2 million barrels a day or so that we've seen just in the last few years has added to global supplies. Increases in oil production from any source around the world, including from the United States, tend to hold oil prices down. In your opening remarks, you talked about prices having reached $147 a barrel back in 2008. I think that it's fair to say that spare capacity in OPEC, which was very low back in that time period, is rising because of increased U.S. oil production; that means that international oil prices are lower and consumers are probably benefiting, and if they were $21 lower, that would be 50 cents a gallon of gasoline lower in prices that consumers are benefiting, if you could say that international prices are $20 lower.

The CHAIRMAN. My time is about up, Mr. Sieminski. Let me perhaps just ask it in this context: having been on this committee for a long time, we've always been told that the price of gas is related to the price of oil. My sense is, based on this kind of evidence that we're seeing, that may no longer be necessarily the case.

Mr. SIEMINSKI. It's related to the international price of oil.

The CHAIRMAN. We're going to be asking about that in the context, because my time is up, about Keystone as well. I just am troubled with the basic proposition that really questions what we've been told around here, and that is when you have new oil supplies the consumer at the pump is supposed to benefit, and we're not seeing that in too many instances and we'll explore that.

Senator Murkowski.

Senator MURKOWSKI. Let me just continue on that vein because in my opening statement, I alluded to the belief that increased American oil production or domestic production here, which I mentioned, is up 30 percent over the past 5 years, has reduced or at least restrained prices at the pump; we can speculate as to what it might be, but it's been my contention that we've at least been able to hold it down.

Mr. Sieminski, you have clearly indicated that you would agree with that statement. I'd ask the rest of you if you agree with where I'm coming from on it; do any of you think that supply is irrelevant to the market price that we're seeing? Any disagreement there? OK, I will take that as assent.

Let me ask about the issue of what we're seeing with these spiking RIN prices. I think a lot of us are concerned about what we're seeing here. I've written several letters to the EPA about the issue, asking for some kind of a plan of action, or at least a background on what has prompted this rise.

Mr. Klesse, in your comments, you mentioned that Valero may see $750 million increase this year alone due to the spike in RIN. I guess I'd ask you, I'd ask Mr. Khan as well, because you have mentioned this: you say that the RFS is broken, that it's out of control, Mr. Klesse. Mr. Khan, you have mentioned that the RIN prices at 35 cents a gallon could cut refiner's margins by 5 percent to 15 percent this year. Explain to the committee, if you will, where we are going with prices to, not only to the refiners, but ultimately then, to the consumer if we are not able to get this under control, to use your terminology, Mr. Klesse. Mr. Khan, if you would also comment.

Mr. KLESSE. So the obligated party under the program is refiners and importers. As was mentioned, gasoline demand has been falling, so now it's flat, but down a lot from the 2007 law. So because we're the obligated party, we can only blend up to E10; that's the accepted in the marketplace, car warranties; it is a well-accepted product. We do have some E85 in the market; however, when the law was passed, the amount of ethanol is going up and it is increasing every year. Because we're at E10, you cannot—in the amount of gasoline in the marketplace—you are not able to blend to the mandated volume. Now we are an obligated party as importers.

Blenders are not the obligated party. Blenders generate the RIN. So you have the situation where we are a large merchant spot market seller of gasoline. Because we do that, we have then to have a RIN because we have a renewable volume obligation. We have to go by that. Blenders generate the RIN. To level the playing field, it should move to blenders should be the obligated party, it would be a level field; however, that would still not solve this difference between a mandated volume and the blend wall, and then going to E15 just does not make any sense for the consumer; car warranties do not approve it, so you would be asking us, besides the pump question and other questions, to sell a product that actually is not approved by the car warranties.

Senator MURKOWSKI. Let's go to Mr. Khan.

Mr. KHAN. Thank you.

There are 2 pieces of legislation that are causing this situation to happen; the first is the RFS mandate, which initially envisioned higher gasoline demand for the foreseeable future, so we were able to increase the amount of renewable fuels into the gasoline pool. The CAFé standards envision sort of declining gasoline demand, so you have 2 opposing pieces of legislation that are causing what we call a short position to take place in the RIN market. So as we get into next year and as we've passed the blend wall, what we end up seeing is this increasing short position and liability that refiners end up with, and that in theory can be passed along to the retail buyer of gasoline as refiners try to pass on the cost of RIN in producing gasoline into the market.

Senator MURKOWSKI. My time is expired, but Mr. Khan, have you updated your numbers to reflect the impacts that we can see if the RIN remains at the current price of above a dollar?

Mr. KHAN. No, we haven't, so in our testimony, we stated that it could impact the earnings of the refiners that we cover by 5–15 percent—that was at a much lower RIN price. Certainly, RIN prices have moved up; those costs could certainly move much higher than what we have in our numbers.

Senator MURKOWSKI. Thank you. Mr. Chairman.

The CHAIRMAN. Thank you, Senator Murkowski. I believe we have time to get into questions or our next senator, Senator Baldwin. As I say, we're just going to try to keep this going. Senator Baldwin.

Senator BALDWIN. Thank you, Mr. Chairman, and I want to start by thanking you, Mr. Chairman and Ranking Member Murkowski for such a warm welcome to the committee. I'm delighted that my appointment to this committee has coincided with 2 hearings that, last week and this week, that are so incredibly relevant to my home State of Wisconsin.

On the topic of today's hearing, it's particularly timely for people that I represent in Wisconsin. Residents of Milwaukee saw gas price changes over 60 cents per gallon during the month of June. I want to go into a little bit more depth on a topic that a number of you referenced in your formal testimony of refinery outages.

The Energy Information Administration has attributed the recent price hikes in the Midwest to refinery outages. Analysis by the Federal Trade Commission concluded that the planned shutdown of a refinery adds 2 to 7 cents per gallon to the price of gasoline and in the event that it's an unplanned outage of a refinery, it can be twice that amount.

We also know that recent planned outages put an unnecessary squeeze on prices when multiple refineries go offline at the same time, as has happened in the Midwest. Meanwhile, the impact on consumers who are planning their budgets, their tight budgets, month to month, planning on their travel needs, and businesses that are trying to predict their expenses, this is extremely disruptive to them. We've heard through testimony and discussion of these temporary outages that they were the result of a lack of information, a lack of transparency, and I think we should be able to do better. So I'd like you to perhaps touch it in greater depth than you did in your opening testimony of what information gathering and planning can be done in a transparent way to make sure

that consumers aren't bearing the cost of these kind of refinery outages, the planned ones that we saw earlier this year. I know there is policy in the 2007 Act that the information collection has stopped in recent years, there's issues of funding for that role; if you could please elaborate, I know that my constituents are eager to hear.

Can we start with you, Mr. Sieminski.

Mr. SIEMINSKI. Sure. Thank you, Senator Baldwin.

First of all, you're absolutely right, and back to Senator Wyden's concerns about gasoline prices, EIA found recently in a study that we published on our Today in Energy page that gasoline prices for consumers are reflecting the highest percentage of their budget that they have all the way back to the 1980s, so it's a very high price that consumers are paying and it definitely is impacting their budgets.

On the Federal Trade Commission study, what the FTC found was that the length of time, that planned outages tend to occur in the spring and fall when margins are typically low, the length of time since the last plant turnaround is generally associated with more unplanned outages, so if you try to delay repairs to meet the exigencies that come up, it can make things worse. It's pretty clear that outages have an impact on gasoline prices and it's worse when utilization rates are high.

EIA was asked by law to develop a report from commercially avilable information on planned refinery outages, so we had a report that we did twice a year just ahead of the turnaround seasons in February and in the fall. What we found was that that report, although it helped provide some information, really wasn't sufficient to enable consumers or anybody else to manage the pricing situation. We had to stop doing that because of a huge budget cut that EIA suffered in 2011 and we just had to rank the things that we were doing in priorities, and if we could do an analysis of planned and unplanned outages, I think it would help us understand the markets better. I'm not sure that it would completely address the situation of dealing with the volatility that's inherent in markets like these.

The CHAIRMAN. Here's where we are: we have 3 of us who need to vote. I want to say, I'm going to work with the Senator from Wisconsin; she's making a very logical point about transparency and information sharing. Senator Barrasso is going to try to get a question or 2 in and he needs to vote, and we'll just see if we can keep this going and I thank my colleagues.

Senator Barrasso.

Senator BARRASSO. Thank you very much, Mr. Chairman, and I have a number of questions. Perhaps with your permission, Mr. Chairman, I'll be allowed to submit these for the record.

But I did want to ask Mr. Klesse, because you cited problems associated with the Renewable Fuel Standard, I've introduced legislation that actually repealed the entire Renewable Fuel Standards. You and Senator Murkowski both mentioned the higher RIN prices related to the fact that the Renewable Fuel Standard requires refiners to blend biofuels, specifically cellulosic ethanol, that is not in large scale commercial production and until refiners brought the EPA to court, the agency was levying fines on refiners for failing to blend a product that wasn't available.

Could you just spend a little bit of time, how Valero arrived at the position that Congress should now repeal the Renewable Fuel Standard?

Mr. KLESSE. I do support that. We should repeal and start over. The situation is completely changed, as was highlighted on the panel. Gasoline demand, energy security, it's entirely changed.

Senator BARRASSO. You have a specific level of, I believe, additional credibility on this because of Valero having a number of different components of your markets.

Mr. KLESSE. Yes, and we are the third largest ethanol producer, and we actually do believe ethanol will continue to be part of the fuel mix; it's just this continuing drumbeat for more and more products that are nonexistent and if you think about it, there are implications. If we went to E15, it's going to corn-based driven, which sure, works in our interests, but there is some responsibility for food prices around the world.

Senator BARRASSO. Thank you, and I regret, I'm going to run and vote, too. There's only 2 minutes remaining and if we could just stand adjourned until Chairman Wyden returns. Thank you.

[Recess.]

Senator CANTWELL [presiding]. The Senate Energy Committee will come to order. As our colleagues are returning from a vote, we're going to go ahead and start the hearing, restart I guess I should say, and thank you all for being patient for the vote, and Senator Franken is next and we'll let you go with your line of questioning. Senator Franken.

Senator FRANKEN. Thank you, Senator.

First, I think it's been pointed out in testimony, there are many reasons for gas price volatility. Senator Baldwin brought up refinery closures; I think the Chairman gave me a bit of a shout out on keeping an eye on that, the need for more data on that, to be able to monitor that data, to coordinate those, so what happened in Minnesota didn't happen. There's geopolitical issues, hurricanes, speculation, supply demand factors, and I don't think it's fair to blame the Renewable Fuel Standard, which is the backbone of our renewable energy policy, and I don't think it's the time to attack the RFS when a number of cellulosic plants are expected to come online. The policy is helping to wean us off foreign oil and I think that is a good thing.

Speaking of weaning us off of foreign oil, Mr. Sieminski, you testified, and so did Mr. Hume, to the dramatic growth in oil production in this country over the last several years. Can you tell us how much of this increase from onshore production is coming from shale and related type geological formations?

Mr. SIEMINSKI. Senator, we think that virtually all of the growth is coming from light sweet crude oil production that's being produced from the shale formations.

Senator FRANKEN. I think Mr. Hume would agree, and you spoke of this renaissance in oil production. Can you tell us whether hydraulic fracturing and horizontal drilling are the primary tools that you use to fracture these geological formations to get the hydrocarbons out?

Mr. HUME. Yes, Senator Franken. The greatest thing that's made the changes is horizontal drilling. We've been fracture-treating

wells since before I was born. I grew up in Oklahoma and they were driving frack trucks in front of my home when I was very young, so hydraulic fracturing is not new, but horizontal drilling is, and it's allowed us to economically access low permeable rocks. It started with the shale, with the gas, and now we're in the tight carbonates and sandstones where we're finding this light tide oil and we have very repeatable opportunities to continue growing this source for the next 10 to 20 years and beyond.

Senator FRANKEN. I'd like to point out to my colleagues that the reason we are seeing—and we all go back and read the testimony, we read the record very thoroughly, all the members—the reason we're seeing the dramatic increase in production is because as early as the 1970s, the Federal Government invested in the research and development that led to hydrofracking. Some of my colleagues frequently criticize the government's role in developing new technology, but as it turns out, the Federal Government played a huge role in developing the technology that is being used today in the Bakken Formation and in other areas.

The Federal Government supported research and development of this technology as far back as the 1970s for the Eastern Gas Shales Project, and in fact, microseismic imaging, a critical tool used in fracking, was originally developed by Sandia National Laboratory, a Federal energy laboratory, and horizontal drilling as well.

That's what we have been experiencing; that's the reason for this renaissance, is it not?

Mr. SIEMINSKI. That is correct.

Senator FRANKEN. Mr. Hume, can you tell me what fraction of shale oil resources in the Bakken Formation happen to reside on non-Federal lands, roughly speaking?

Mr. HUME. I think it's a very small portion is on Federal lands; I would estimate less than 20 percent. The majority of the acreage that we hold is on private lands.

Senator FRANKEN. I think that's consistent with the data from the Center for Western Priorities, which found that around 90 percent of all onshore shale oil and mixed oil and gas resources are found under non-Federal lands, so the reason we're seeing a bigger increase of production on private and State lands is really because that's where the majority of the shale resources are and that was technology, again, that was developed by the Federal Government.

I see my time is up and I'll—back to Chairman Cantwell.

Senator CANTWELL. Thank you, Senator Franken, and I want to thank the Chairman and the Ranking Member for holding this hearing, it's a very important issue, and for all of you being here today.

Obviously, high gas prices on the West Coast and supply and demand issues is something I've spent a lot of time on, my office has spent a lot of time on, and here we are again with prices approaching $4 per gallon in Washington State, and it is starting to—when it gets to that point, it starts to eat into our economic growth. So up 9 cents in the past week, Washington State prices are among some of the highest in the Nation—27 cents above the national average—and a new report by McCullough Research confirms that, something we suspected all along, that during the past year, West Coast gasoline prices have ceased to follow the crude oil price. I

mean, I think my constituents would get it if there was a supply and demand formula that they could follow here, but they can't follow one, so I'd like to enter into the record the report to illustrate some of the peculiar behaviors on the West Coast petroleum markets over the last year.

The report also underscores the need for continued real oversight and investigation of refinery shutdown announcements. We found last year that in a West Coast refinery fire that everybody said, oh, well, this is the cause of the spike, when in reality, data showed that refineries weren't offline, but actually, were still emitting, which raised a lot of questions about who is actually following these markets and the transparence. I believe that EIA should play an even bigger role.

But what we need to know now is what's caused these recent spikes. On October 1, a seemingly minor problem at Exxon Mobil's Torrance refinery led to an almost instantaneous increase in wholesale prices in California, adding up 50 cents in less than a week; a power problem that only briefly interrupted operations is supposedly blamed for one of the highest price spikes in a decade. Now I guarantee you, when the implosion happened in the Gulf, if prices would have spike that much, the Nation would have taken action, and so my question is, when these prices spike to this level—in both cases, crude oil prices were either level or falling and during the highest price spike, inventories were either increasing or remaining at a historic 5-year averages—so we're not following supply and demand here. My constituents very much want to see more transparency there. Mr. Plaushin, in your testimony, you mentioned the high degree of volatility due to refineries, and Mr. Gilligan, you cited reasons, but just as these shutdowns seem to be hitting the press, what do you think we need to do to get more transparency in the market?

Mr. GILLIGAN. We supported Senator Dorgan's amendment in 2007 to try to get EIA more involved in communicating about refineries, scheduled maintenance and outages. You know, really, it's the unplanned outages that really tear up the market. I think in the upper Midwest, there were 2 or 3 refineries that were down for maintenance, and generally, that was understood, but then all of a sudden, you had, I think, a serious problem—a BP refinery in Whiting and then you had another refinery outage and all of a sudden, you had a catastrophe on your hands.

We think we need to take baby steps to see what can be done to improve communication and planning so that people are more aware of what potential problems could be, so we're ready to sit down and talk with you and committee staff about what kind of things EIA might be able to do to help everyone accommodate those changes, the outages that are scheduled.

Senator CANTWELL. I mean, do you think that the country would have stood for, if we had the Gulf implosion and everybody being shut down, 10 other refineries in the United States saying, "Oh, I had planned maintenance, so I'm going to go down." Do you think we would have put up with that?

Mr. GILLIGAN. I think to some extent, and certainly Valero knows more about that than I do, but there's a life safety issue without it; they have to go down for maintenance or they could risk injury

to their employees if they don't do the right—so you have to weigh that into it; it's not that simple and it can be very complicated.

Senator CANTWELL. Four or 5 refineries going down at the same time?

Mr. KLESSE. First off, Valero announces its turnarounds, planned turnarounds. We announce them, actually for the financial community, because they're very interested in them. There are also services that actually aggregate them and put them together, but I think your question was addressing more of—we have a spot situation and all of a sudden, the market's moved dramatically, and it's actually the expectation. Supply and demand is there, but it's the expectation, so when Torrance, in your example, had an issue or—and I'm not sure what's actually happened in Washington. When you have these issues because refiners are larger today, we have inventory in the system, but there's immediate expectation in the wholesale markets that then goes through to the retail markets of how long are they going to be down. Because this is a commodity, we're largely in balance in the system, so when some of the supply comes off, the expectation is going to be tighter and all of a sudden, you get prices moving, and then if you'll notice, over time, depending on getting it there, the prices come back down.

Senator CANTWELL. I think it's one of America's most important commodities and probably least regulated. Hamburger probably has more regulation on it than gasoline, and yet, the fact that this price spike can happen without real supply and demand issues is a problem that we have to address, and I see the Chairman has returned, but Mr. Khan, I wanted to mention, the fact that you bring up the Jones Act as something of a price increase, Citigroup has been under investigation and paid penalties, both for fraud in the mortgage market and is now under investigation by the FSA for manipulation in gas prices, and the fact that you come here and blame the Jones Act as some reason why we have high gas prices is just amazing to me.

Thank you, Mr. Chairman.

The CHAIRMAN [presiding]. Thank my colleague.

Senator STABENOW. Thank you very much, Mr. Chairman, and we thank each of you for your testimony.

I want to talk a little bit about biofuels as Chair of the Agriculture Committee, and I'll also just start by saying do I make the assumption that all of you would say free market competition is a good thing? Anybody disagree with that? OK. That competition brings prices down? That's how our free market system works and what we're trying to do in part is get more competition into the marketplace and we have a real dilemma going on, I think. On the one hand, the tax structure hasn't been competitive because we've seen oil incentives that started in 1916, they don't have deadlines, we don't renew them with a tax extender bill and every year, it's an ongoing effort, so we can plan and invest, it's served us well in an industrial economy, served my great State of Michigan well. I'm sure I would have supported those things; not the same thing on either biofuels or wind or solar or other technologies in terms of certainty, so you can invest and plan and so on for the future.

What I see on the biofuels end and what I struggle with is, on the one hand, we see tax incentives that have been there almost

a hundred years on oil; we see in the public interest, competing issues around CAFE, fuel economy, we want to bring fuel efficiency up, we want to bring the use of gasoline down; it's working, there's less gasoline, less demand for gasoline. We're trying to get more competition in in biofuels on behalf of the public, yet there's no pumps, and who owns the stations in order to get the pumps?

We're told that the Renewable Fuel Standard doesn't work; the cost of RIN is certainly going up; not enough demand, but yet, we can't get more use and more competition because the infrastructure is owned by folks that, I mean, in all fairness, why would you want the competition, right? It's your job to control the market and not have competition, so we're at odds here on how do we move forward on all of this. So, I would just say for the record, I mean, it's important to note that since 2005 when the Renewable Fuel Standard was created, 75.8 billion gallons of ethanol has been added to the gas supply; it cuts demand for foreign crude oil and gasoline; biofuel production reduced the need for imported oil by 462 million barrels last year alone; it seems to me, that's in the public interest, understanding all of these other issues, blend wall, what's happening and so on.

So, Mr. Klesse, I would just start with you because you've said that Valero is currently investing in renewable fuels and alternatives, and I'm wondering both what role you see these technologies in the company's future, but also, given your interest in biofuels, are you encouraging station owners to install biofuel blender pumps?

Mr. KLESSE. Of course, we would, but we own no stations, so we don't own any; they're all owned by independents—I'm not sure of the percentage that are small, individual or small companies, but they're not the big oil companies that own the gas stations—they're not.

Senator STABENOW. What would you say to encourage then? In order for us to get the infrastructure for real competition, to give this a chance to really show whether or not it works and what the public thinks and so on, I mean, how would you suggest that we move forward on infrastructure to make sure that we can have the pumps?

Mr. KLESSE. I'm not sure I understand exactly your goal, but if you'll let me——

Senator STABENOW. Sure.

Mr. KLESSE. We already have E10 in about 95 percent of all the gasoline sold in the United States, so 10 percent ethanol. We are a big ethanol producer; we encourage that, we support it and we do it. It's our customers though for that 5 percent that don't do it, they don't feel like their customers, the ultimate consumer, wants it. We support E85; we'll gladly blend for people E85. We are not supportive of E15 for all the reasons that have been stated: car warranties, pumps, everything that goes with it, and over time, we'll see what happens.

Senator STABENOW. No, I understand——

Mr. KLESSE. OK.

Senator STABENOW. I understand from my own industry there are concerns. I have to say——

Mr. KLESSE. But Valero is very much in it and we are very supportive of renewable diesel as well.

Senator STABENOW. Let me just say, Mr. Chairman, with E15, it's interesting—and I appreciate because our industry is very concerned about it—but I'm a NASCAR fan and when I go out to NASCAR, they drive on E15 and you should hear those guys talk about efficiency of E15 and what it does in terms of their performance on the track and so on, so it's very interesting.

Mr. KLESSE. Lots of octane; you have a lot of——

Senator STABENOW. Lots of octane. That's right.

I guess my question is, I mean, it seems to me, we have a real dilemma, and maybe let me ask Mr. Gilligan, on flex-fuel vehicles and on pumps and so on, if we had more flex-fuel vehicles, if we had blender pumps so that drivers could choose a lower cost fuel; I mean, do you think it would be a good idea if we had more of that and how would you suggest that we bring these fuels to market in a more efficient way?

Mr. GILLIGAN. Certainly, it's been a limit to E85 to have the population of flex-fuel vehicles so disparate; they're so spread out, it doesn't make sense for a retailer to put in a E85 location if there aren't a lot of vehicles in his marketplace for it.

Second, E85 customers notice that they have to fill up twice a week because of the reduced gas mileage, so that hurts E85.

One other thing that I want to stress, too, about infrastructure is we spend a lot of time talking about dispensers, making dispensers capable of E15; we're concerned about all the stuff under the ground—the underground storage tanks, the piping, the glues that were used, how will those perform with a higher level of ethanol? We need more information about that. EPA is working on it. EPA and the Petroleum Equipment Institute are building a data base list of equipment that they say can handle E15. The problem for a retailer is he may not know what he has underground; he may not know what piping was put in 20 years ago and he may not be able to determine if it's compatible, so it's a real tangled web of issues.

One estimate I saw is it would take about $3 billion to get a large portion of the gas stations able to dispense 15, E15. It certainly can't come from the convenience store owner; I think the average net profit of a convenience store is about $40,000 a year; you can't make the math work to spend $300–400,000 in renovations when you're really close on the bottom line. So it's a perplexing problem, but we're committed to finding solutions, but they're not apparent yet.

Senator STABENOW. Mr. Chairman, I know technically my time is up, but with the 2 of us just here, I'm going to just take another moment if you don't mind for a comment and just say, I know this is perplexing, but when we sit back from where we sit and we talk about where the money goes, where the tax incentives go, where the public interest is.

I appreciate that we've had a industry that's dominated, we've incentivized it, talking about picking winners and losers, we picked a winner, you won; you know, it's a very important industry, but when we look at where we go in the future. I mean, there are options for us on how we incentivize real competition at the pump,

and when we do tax reform and we look at one industry that has had unrestrictive tax incentives, others that limp along, can't invest, no dollars in incentives to do the kinds of things you're talking about; it's no question that a convenience store is not going to be in a situation to do that, but we've invested a lot of tax money, and continue on certain kind of industries, in certain areas where folks are doing very, very well—the top end, the top 5 oil companies—I think we could redirect some of that to help some of those folks and it's in our interest to create competition and make the Renewable Fuel Standard work in a way that doesn't create this situation you're talking about, but it does involve thinking more broadly, Mr. Chairman, about consumer interest and competition, and I'm all for competition and I'm anxious, as I know you are, to make sure that we have the opportunity for lots of different choices on fuel at the pump, and I think that's our challenge.

The CHAIRMAN. Your leadership on this, Senator Stabenow, has been extremely important and there's no question that this relates to marketplace forces; this ought to be something that brings together Democrats and Republicans, to have these choices, and I'm interested in working with you.

Let me ask you gentlemen, again, about how we might help the consumer now; not some other time or have a big long fight in the Congress, but how we might help the consumer now with these price spikes that we're seeing, and price spikes that were related to these refinery outages.

Mr. Klesse, to your credit, you're talking about how you all share that kind of information, you're interested in doing it. What if we just said when there was a planned or unplanned refinery outage, you had to report that in real time? I mean, it seems to me that could provide some measure of relief to the consumer. What do you think of that, Mr. Klesse? Just require it, a reporting requirement.

Mr. KLESSE. For planned, obviously, there would be a publication and so people would know that these are planned. They do happen in the spring and fall, they're usually scheduled; many of these get scheduled a year in advance for planned, and it has to do with safety, equipment, we do risk-based analysis, we do all these kind of things.

Now an unplanned, obviously, it's unplanned, and that means something happened right now and then this particular unit within a refinery goes offline. As far as reporting it, I can assure you, the industry press picks it up immediately, and all the commodity markets.

The thing the Administration could do today to help prices——

The CHAIRMAN. Right.

Mr. KLESSE. Is getting a hold of RINs. RINs are out of control, and we at Valero, we're trying to pass them through, and when you take a $1.30 RIN gallon, you go to E10—that means there is 13 cents a gallon that is trying to be passed through in the marketplace because as I said, that is a huge amount of money in aggregate.

The CHAIRMAN. We are going to spend a lot of time looking at the RINs issue. Suffice it to say, we do need to get our arms around this refinery outage issue, and I know Exxon Torrance was picked up by the press and it wasn't done accurately, so it strikes me that

this is something that could be done that would actually provide some real relief to the consumer, and Mr. Sieminski, I want to kind of walk through EIA's role on this.

Now in 2007, the Congress directed EIA to track refinery outages and flag those that would have a significant impact on supply. In 2011, before you arrived, the Energy Information Administration stopped tracking the refinery outages. Why was that done and what would need to happen, Mr. Sieminski, to get that restored?

Mr. SIEMINSKI. Senator, in 2011, EIA's budget was cut overnight by $15 million, roughly 15 percent of our budget, and we had to very quickly prioritize the reports and analysis and data collection activities that we were engaged in, so we looked at the refining planned outage report, which was being done twice a year, and our conclusion was that private services that had been referred to earlier here were doing some of that and, given unplanned outages were the problem, that our money could be best spent doing other things that Congress has mandated.

For example, recently, we've been reporting on Iran's production under the sanctions activities that Congress——

The CHAIRMAN. Let me save some time here. Isn't protecting the consumer a priority, too? I mean, I just described misleading information that got out, expensive, misleading information. Why isn't protecting the consumer a priority there as well, particularly with something that strikes me as quite modest? I mean, we've had some pretty ferocious debates here in this committee over the years about price controls and burdensome requirements and the like; this seems to me a very modest step to make markets more transparent, to try to help the consumer in real-time—how much would this cost for you to get back in the consumer protection business?

Mr. SIEMINSKI. Several million dollars a year.

The CHAIRMAN. All right. I'm going to follow this up and I'm going to walk through the sort of list of activities that you all have——

Mr. SIEMINSKI. Senator, I absolutely agree with you that more transparency in the data and analysis is essential; I wouldn't have taken the job at EIA if I didn't believe that, and I'd be happy to work with you on these issues.

The CHAIRMAN. We'd like to and I want to really work with you looking at the context of the entire budget. I mean, certainly over the years, there have been antitrust and competition issues associated with refiners sharing information about maintenance and production schedules, but that's why the Congress brought you all in, and now we're seeing, particularly in the Midwest, what I think is the conventional wisdom in the energy business, which is why I walked through the charts with you, being turned on its head. I mean, people consistently in this committee have been told that the price of gas is related to the price of oil, doesn't seem to necessarily be true, and it certainly looks to us that the inability to get real-time information with respect to these issues, and particularly, outages, is an important one.

So let me now turn to the question of exports, and let's bring up, staff, if you would, chart number 7.

Now we'll bring Mr. Sieminski, Mr. Klesse and Mr. Khan into it. This is a chart that our staff produced from Energy Information

Administration data that was provided on refinery capacity. So there's been a reduction in the number of refineries in the United States, although new investment in those remaining refineries has actually resulted in increased U.S. capacity; this comes at a time when the U.S. has demand for gas that has been declining. Now a number of analysts argue that the United States has surplus refinery capacity. Exports of refined products have been increasing dramatically, aided by relatively lower crude prices and lower natural gas prices, which give our refiners a cost advantage. U.S. refiners are exporting roughly 2.8 million barrels of product a day. The United States is even exporting refined products to Venezuela. The charts from the EIA show, again, the increase in gasoline and diesel exports, especially from the Gulf Coast. Now, for you all, to what extent do you see U.S. exports of gasoline and diesel continuing?

Again, this goes back to a question for the consumer. The consumer is saying, as Senator Baldwin says, as I hear from Oregonians consistently, we're looking for some relief at pumps here in the United States, and yet, you all show up at these hearings in Washington, DC, talk about more and more exports—tell us to what extent you see U.S. exports of gasoline and diesel continuing and/or expanding—and we can bring at least Mr. Sieminski, Mr. Klesse and Mr. Khan into this, but any of you witnesses who choose to comment are welcome to do so.

Sieminski.

Mr. SIEMINSKI. Senator, we are forecasting that exports of products are likely to continue as crude oil production rises. It's, I think, worthwhile to point out that if refiners, by exporting surplus products, that is, in excess of what the U.S. demand is, it allows refiners to run at higher rates, and higher rates generally tend to mean that other products are being produced that consumers want and presumably at lower prices, to the extent that products enter the global marketplace, gasoline, diesel fuel, it would tend to limit global price increases. As I said earlier in my testimony, I believe that product prices in the U.S. are largely being set in the global markets. To the extent that the U.S. is contributing supply to the global markets, it is probably helping keep global prices lower than they would otherwise be.

The CHAIRMAN. I think if it was cut and dried as you've described, Mr. Sieminski, motorists and people pulling up to these pumps where they feel they're getting clobbered would feel a lot better, and that's why, I think, there's a bit more to the story than your description.

Let's go to Mr. Klesse.

Mr. KLESSE. OK, if we take gasoline first, sir, the U.S. imports gasoline into the East Coast and we're exporting out of the Gulf Coast, primarily to Latin America and going down to South America and Brazil. The U.S. is still a net importer of gasoline by a very small amount.

On diesel fuel, we have a lot of excess capacity. The U.S. market is about 3.7 million barrels a day and the industry is exporting over 800,000 barrels a day. There is not U.S. demand for the diesel.

Now, these products are being drawn away in the U.S. Gulf Coast spot market by higher prices offered by these countries. If

you think about it, about half of the diesel fuel is going to South America; the other half is going to Europe, and they are paying the price because they actually have to pay freight on top of that to get the price.

Where do I think they're going? I think it's imperative for the U.S. refining industry, with the outlook of U.S. demand, that we continue to export.

The CHAIRMAN. Let us have your colleague, Mr. Khan, let's bring you into this.

Mr. KHAN. Mr. Chairman, we used to be a large exporter-importer of gasoline and now we're approaching a net neutrality in gasoline imports and exports. Latin America demand continues to grow; the last 10 years, demand has grown by about 150,000 barrels per day per year in Latin America, so a lot of the excess production that U.S. refiners produce is now being shipped to South America and to Europe.

Taking these raw materials such as crude oil and manufacturing them into higher-value products such as gasoline and diesel, we think is good for the U.S. economy. It increases our relative import-export balance in the United States

Higher prices in the U.S. are also resulting in new investment, so we do see some refineries investing in increased capacity to produce more fuels in places where we are seeing some shortages from time to time.

The CHAIRMAN. Yes, I think that part of what I'm hearing are descriptions of activities that are good for refiners and I question whether it's good for consumers, and that's, I think, part of the debate.

Let me go to you, Mr. Gilligan, on the question of crude prices and benchmarks. One of the other issues that was raised in the Congressional Research Service analysis that was done for us is that usual price benchmarks like West Texas Intermediate or Brent, one of the major international benchmarks, of course, don't accurately reflect the actual cost of crude oil to refiners; refiners are often paying less than the benchmark. In some cases, like in the Midwest and the Rockies, they have been paying a lot less. The European Union is reportedly investigating how oil producers may have been involved in manipulating these Brent oil prices. How do your members know whether or not they're paying a fair price for the products you buy if the benchmark doesn't reflect the actual cost of oil in the market?

Mr. GILLIGAN. It's an excellent question and it sort of ties to some of the thoughts that I had in the earlier discussion. I think in some of your earlier comments, you're trying to make a nexus between gas prices and the prices refiners pay for crude; that's not the nexus that exists. The nexus as I see it is the nexus to the benchmark, WTI and Brent; that is, at least in the last 2 or 3 weeks, we've seen sizable increases in WTI and Brent, and those are what are showing up at the wholesale rack. So we know—refiners have to be competitive. Petroleum marketers, we have our computer screens and we look at all the terminals in the area and Valero has to make sure that their spot price is competitive with Exxon and with Chevron and their other competitors, so they're going to move to the lowest spot price, which then sort of affects

all the other prices in the terminal. Those markets are fairly transparent, but I do think it's important to note that it's WTI and Brent that basically is what we believe drives prices, not so much the price that refiners pay for the product.

The CHAIRMAN. Would any of you others like to add an additional point on the question of the benchmarks?

Mr. GILLIGAN. I would go on to stress that that's why we continue to push for both European and United States—a good regulation of the futures markets, to make they're honest markets.

The CHAIRMAN. Gentlemen, here's my take of where we are.

The market in the oil business has changed and changed dramatically, and too often, and particularly when I asked you the questions early on, Mr. Sieminski, about why the lower cost of new oil supplies is not being passed on to the consumer, you gave me the answer that we have heard for years and years, and basically sort of defies what the industry has been saying, and what I'd like to do is find a way, and we're going to be following up with all of you, to work in a bipartisan way to come up with some practical approaches to try to help consumers who are still getting hammered. They're getting hammered today at the pump. You heard Senator Baldwin talking about it at a time when their newspapers are filled with stories about how there are new oil supplies and the consumer is saying, "How is going to get to me?" Mr. Sieminski, I've got to think that there is some affordable way in real-time to get people information about these refinery outages, and I'm going to work with you with respect to your budget, and suffice it to say, those of you in the industry, and following it, I hope you'll come forward with your ideas for changes that will reflect a very different marketplace because when you go through the charts that I've gone through today and the ones that we had prepared with the data from the Congressional Research analysis, we were pointing to hard information about record-level refining margins—nobody's saying every bit of it's a profit; certainly, a significant part of it is, but there isn't any question that the lower crude oil costs from the new sources of production are not getting through, not getting through, to the consumer's wallet at the pump and that is why people are asking these questions that you've had today, and this will not be the last time we will be at it, and certainly, Mr. Klesse, you've made a number of good points. I note the fact that you all, also, report information about outages; we're going to be looking at the RINs issue; I have some real questions about whether the renewable fuel targets can be hit, so there are a number of questions here to look at. But I do want us to take steps that can help the consumer now with price spikes that are clearly working a hardship on working class people and small businesses and the consumer, and it's one of the things that Democrats and Republicans have said they want different about energy policy. It's always been the consumer's been an afterthought, and the consumer is no longer going to be an afterthought, and you've heard that from Democrats and Republicans.

We'll keep the record open because a number of Senators would like to ask questions. We'll allow all of you to offer additional viewpoints.

The CHAIRMAN. I thank you for your patience on a busy morning here in the Senate, and with that, the Energy and Natural Resources Committee is adjourned.

[Whereupon, at 12:09 p.m., the hearing was adjourned.]

APPENDIXES

APPENDIX I

Responses to Additional Questions

RESPONSES OF CHRIS PLAUSHIN TO QUESTIONS FROM SENATOR MURKOWSKI

Question 1. National Energy Policy—You mention the need for a national energy policy. In your view, what are the crucial features of a national energy policy that our nation lacks? What issues should an energy policy address that would be or are important to ensuring energy security?

Answer. In short, AAA believes that all options need to be a part of any discussion in developing a national energy policy. The most important measurement to any such policy will be in its ability to provide stability for consumers. As we have seen throughout 2013 consumers have been subject to extreme volatility in retail gas prices, not necessarily as a nation but in regional pockets. AAA charts the rise and fall of the national retail average but we also monitor the prices for metropolitan areas and regions around the country. We have observed the phenomenon of national prices drifting slowly lower as demand for fuel is down and inventories of refined product are plentiful but at the same time some pockets of the country-in particular the Midwest-are subjected to intense price spikes simply because they are a captive audience to refinery issue or other regional disruption. Policymakers should seek a national energy strategy that does not necessarily hold lower prices as its key benchmark but more stable, predictable prices with less fluctuations for consumers.

Question 2. E15 Position—Please summarize AAA's views on E15 for the record of our hearing. Do you advise drivers to use this fuel? At present, how many vehicles have been warrantied to run on E15 by automakers?

Answer. AAA believes that ethanol blended fuels have the potential to provide drivers with a welcome choice at the pump, which supports American jobs, promotes American energy independence and can save Americans money. In order to realize these benefits, it is imperative that increased ethanol blends-or any new fuels-are only brought to market when consumers have been clearly informed and protected. The introduction of E15 gasoline to consumers has failed to meet this obligation.

We recommend that our members, as well as the public refer to the owner's manual to determine whether or not the manufacturer recommends the use of E15. Our automotive engineering experts have reviewed the available research and believe that sustained use of E15 in both newer and older vehicles could result in significant problems such as accelerated engine wear and failure, fuel-system damage and false "check engine" lights for any vehicle not approved by its manufacturer to use E15. Automakers also advise they may void warranties for anyone using E15. Five manufacturers (BMW, Chrysler, Nissan, Toyota and Volkswagen) are on record saying their warranties will not cover fuel-related claims caused by the use of E15. Eight additional automakers (GM, Ford, Honda, Hyundai, Kia, Mazda, Mercedes-Benz and Volvo) have stated that the use of E15 does not comply with the fuel requirements specified in their owner's manuals and may void warranty coverage.

RESPONSE OF CHRIS PLAUSHIN TO QUESTION FROM SENATOR RISCH

Question 1. EPA's proposed percentage bio blending standard for gasoline and diesel combined is 9.63% for the year 2013. The Energy Information Administration (EIA) has told Congress that virtually all ethanol blending with gasoline is at the 10% level. However, EIA has also stated that biodiesel blending is RIN deficient. So if a refiner produces a higher percentage of diesel, there is no possible way to meet EPA's proposed standard unless they buy credits. These credits that used to

cost pennies per RIN gallon now cost over a dollar with predictions that RINs will go over $3.00 in 2014.

Please give us your thoughts on the unfairness and the unintended consequences of the Renewable Fuel Standard.

Answer. Foremost to AAA is the potential impact or consequences of E15 on vehicles and. consumers. If EPA determines that the current RFS targets for conventional biofuels cannot be met without utilizing E15, AAA believes action should be taken to adjust the targets.

Question 1a. What suggestions do you have for changes that will correct this problem?

Answer. AAA would call on Congress to grant the EPA broader authority to reduce RFS targets for conventional biofuels and direct the agency to use this authority to adjust targets that are unachievable or risk severely impacting the prices motorists pay at the pump. A clearly communicated strategy sends a signal to both consumers and markets that Washington has protections in place to prevent unachievable targets and spiking prices for RINS from ultimately resulting in volatile pump prices for American motorists.

RESPONSES OF WILLIAM R. KLESSE TO QUESTIONS FROM SENATOR MURKOWSKI

Question 1. Number of Refineries in the U.S.—In your testimony you note that no new refinery has been built since the 1980s. In your view, is there a need for new refineries in the U.S.? What are the current obstacles to building new refineries?

Answer. As you have noted from my testimony, no new refinery with significant operating capacity has been constructed since the 1980s. Indeed, the total number of refineries has decreased by half. At the same time, overall refinery capacity has increased from 16,859,000 barrels-per-calendar-day then to 17,823,659 barrels-per-calendar-day with an annual utilization rate of about 89 percent today. As the number of U.S. refineries has declined, the operating capacity complexity of the remaining refineries has been increased to keep up with worldwide demand.

Among the obstacles to building new refineries are declining gasoline demand and burdensome regulations. As was noted in the July 16th hearing, U.S. refinery operations are among the most regulated in the country. At the same time, U.S. refineries are among the cleanest and most efficient in the world. A reasonable approach to regulation is one that both improves the environment while allowing the industry to remain competitive.

Question 2. Refinery Outages—Please describe the decision-making process for planned outages, or turnarounds. What factors come into play? What do you do to help protect against supply interruptions? In what circumstances do unplanned outages occur? What can be done to limit supply interruptions?

Answer. For environmental and safety reasons, it is necessary every few years to shut down an operating unit for a "turnaround." Generally, turnarounds are scheduled for low-demand seasons with weather considered for efficient turnaround execution. We schedule turnarounds transparently so all appropriate parties can prepare and ensure that these events are executed quickly and efficiently with minimal market disruption. Supply arrangements are made to cover for lost production, and there is currently surplus refining capacity in the United States. Clearly, unforeseen problems can complicate even the best plans, resulting in localized supply concerns. As refineries have become larger, unplanned outages because of mechanical problems have caused increased priced volatility seen by the consumer.

The bottom line is that refiners take measures to limit the effect of unit outages on inventory and supply. These include:

- Increased production of alternate units;
- Continued production from partially shut down units; import of alternate supply; and
- stockpiling of inventory leading up to a turnaround or outage.

These steps are crucial to avoiding a major disruption in supply from a single outage. When there are regional shortages caused by hurricanes or other factors affecting refinery production, one area where regulators can help is by quickly providing Jones Act waivers that would increase the number of available ships, so that fuel supplies can quickly be moved from unaffected parts of the country.

Question 3. Delayed RFS Rules—At the time of this hearing, EPA still had not finalized its 2013 RFS rule, for volume obligations, even though it is mid-July of the year in which that rule is meant to apply. What does this delay mean-not least in terms of certainty-for your company?

Answer. As you are aware, Valero is an obligated party under the RFS. As such, we have to carefully plan a compliance strategy each year to ensure sufficient renewable identification numbers (RINs) are procured in the most efficient and effective manner possible. Accordingly, any delay or loss of certainty as to our upcoming obligations reduces our ability, and those of other obligated parties, to plan and implement an effective compliance strategy.

More important than any delay, however, is what actions EPA actually takes to remedy the current market situation. As we have stated, we believe the current RFS program is broken and that Congress needs to develop new legislation that reflects actual market conditions, protects U.S. consumers, and actually produces environmental benefits. As this discussion takes place in Congress, EPA should immediately revisit the renewable volume obligations for both 2013 and 2014. These totals should reflect the realities of the marketplace, including the downturn in gasoline demand and the existing levels of advanced biofuel production.

Question 4. Obligated Parties Under the RFS—Your written testimony points out that the "obligated parties" under the RFS-mainly refiners and fuel importers-may make less sense today than when the RFS was originally established.

a. Would it make more sense to designate fuel blenders as obligated parties?

b. Would such a shift be sufficient or insufficient to resolve the larger, structural difficulties with the RFS?

Answer. To be clear, it is our view that it is time to revisit the current implementation of the RFS to reflect the current oil supply picture and other changes in the market. For that reason, the current RFS should be repealed and new legislation developed. As your question points out, one of the problems with the structure of the RFS is the issue of refiners and importers-but not blenders being obligated parties. This produces an unlevel playing field that picks winners and losers within the same marketplace. This system has also been one of the main reasons underlying the current problems in the market for renewable identification numbers (RINs) which have gone from $0.05 in late 2012 to as high as $1.45 recently for corn ethanol.

Placing the RFS obligation on fuel blenders would be one step to addressing the difficulties in the system by allowing the obligation to be placed where renewable fuel actually enters the transportation mix. This would be a welcome development and address part of the current problem but not the whole problem. The fact remains that the economy and the fuels market are not the same as they were in 2007. Congress and the Administration should amend the current program and develop a new system that is reflective of current conditions and protects consumers and small businesses.

Question 5. E15—What are the various hurdles that E15 would need to overcome before it can be deployed and used by American motorists?

Answer. While Valero supports ethanol and is a leading producer, experts have repeatedly noted that the E-15 blend is not warranted for use by 95 percent of cars on the road today. E-15 reduces engine life and prompts fuel pump failures and consumer misfuelings. The American Automobile Association (AAA) even called on EPA "to suspend the sale of E-15 until motorists are better protected." There are also issues with boats, lawn mowers, motorcycles and other small engines. Put simply, E15 has not been demonstrated to be compatible with all gasoline-powered engines. By acting without adequate scientific evidence to approve the use of E15, EPA has created safety and liability concerns regarding the operation of the vehicles and outdoor power equipment used by hundreds of millions of Americans every day.

Defending its actions while recognizing the real-life consequence, EPA stated that they would devise a program that would prevent misfueling of E15 with incompatible engines. However, perhaps the strongest indictment of EPA's certification of E15 for any engine type came from the automakers in a response to a question from Congress in 2011. Without exception, the auto manufacturers responded that use of E15, even in their newest vehicles, would damage engines, void warranties and reduce fuel efficiencies. Very simply, we believe the government should not be promoting a fuel to consumers unit these safety and reliability issues are addressed. The simplest and safest solution is to refine the RFS to avoid the so-called blend wall.

Question 6. The "Regulatory Swamp"—In your testimony, you describe the regulations being issued by EPA as a "regulatory swamp." Could you describe in greater detail what the refining industry is facing right now, and what the cumulative consequences of those regulations could be?

Answer. Refinery operations are subject to extensive environmental regulations. Refiners are among the most regulated industry in the country, and U.S. refineries are already among the cleanest and most efficient in the world. A reasonable approach to regulation is one that both improves the environment while allowing the

industry to remain competitive. A host of recent actions by EPA, referred to as the "regulatory swamp" due to the close proximity of their compliance targets and high costs, with very limited benefits, will create a highly unpredictable regulatory environment for our industry and contribute to a climate where no new refineries come online and those that do exist will struggle to stay online. These actions include:

- Proposed Tier 3 Gasoline and Diesel Standards
- Greenhouse Gas Rules and Permitting
- Finalized National Ambient Air Quality Standards (NAAQS) for Particulate Matter
- Finalized Mercury Air Toxics Rule
- Finalized Emission Standards for Boilers
- Final New Source Performance Standards (NSPS) for Oil and Gas Production
- Finalized Greenhouse Gas Standards for Cars and Light Trucks
- Final National Emissions Standards for Hazardous Air Pollutants at Petroleum refineries

Valero has estimated that its costs alone for compliance with the Proposed Tier 3 standards will be between $300 million and $400 million and will raise the cost of manufacturing gasoline a couple of cents per gallon. It will also increase our greenhouse gas emissions because of the additional processing.

In addition to EPA, other regulatory agencies and states have pursued independent regulations. For example, California's Low Carbon Fuel Standard (LCFS) and statewide cap-and-trade program were issued as part of the state's Global Warming Solutions Act. The LCFS in particular does little to achieve environmental objectives while discriminating against crude sources to the detriment of California consumers. These rules pick winners and losers among the refining industry in place of letting market forces operate as impacts reflect the individual refinery configurations and your access to specific crude oils.

As these regulations increase capital expenditures, and subsequently raise costs of operations they continue to pressure the economic sustainability of refinery operations, which under the current low margin environment can increase the risk of refinery closures and consequential job and economic loss. Overall, the regulations tend to create unintended consequences that duly disadvantage the US domestic refining industry relative to other refining centers of the world. The risks of this imply that companies could thus move operations to other countries with less stringent controls, increasing domestic manufacturing shutdowns, with implicit employment and tax revenue loss as opportunities are created overseas.

This is not just a hypothetical. A 2011 report by the Department of Energy found that the cumulative burden of federal regulations was a significant factor in the closure of 66 domestic petroleum refineries from 1990 to 2010. In addition to increasing the cost of gasoline, additional regulations "may lead to additional job losses for America, weaken the U.S. economy, make America more reliant on nations in unstable parts of the world for vital fuels and petrochemicals, and ultimately endanger our national security."

Question 7. Importance of Keystone XL—In your testimony, you note that "Valero supports construction of the Keystone XL pipeline . . . " Could you expand on its significance to your company, first-and then to our economy and energy security?

Answer. Valero supports construction of the Keystone XL Pipeline and believes it will be in the strong energy security and economic interest of the U.S. and will bring a specific quality of crude suited for many U.S. Gulf Coast refineries to the Gulf Coast market. Valero, as with all independent refiners, buys all of the oil we process. If projects like the Keystone XL Pipeline can make North American produced oil available to our refineries, Valero and other refiners can increasingly rely upon increased North American oil which has the potential to lower prices for consumers. Increased availability of North American oil also means that we won't have to buy more oil from other sources outside the U.S. and Canada. This increases the Nation's energy security and also reduces the need for long-range shipping that increases both costs and greenhouse gas emissions.

Question 8. Impact of Increased Domestic Production-You described the importance of increased domestic production on the outlook for refiners in the U.S. Without this new production, what do you think the refining industry would look like today?

Answer. The outlook for refiners has improved significantly due to the increase in North American natural gas and crude oil production which are giving the industry competitive advantages in the global market. Valero in particular has sought to benefit from the revolution resulting from increased domestic shale gas and oil production. Refining is energy intensive, and Valero consumes about 700 million cubic feet a day of natural gas. In fact, energy is the largest component of a refinery's

variable operation costs. Additionally, natural gas liquids are an important ingredient in creating finished products from crude oil, and the current supply dynamics have reduced the costs of these feedstocks. As shale oil production has increased, larger volumes of crude oil from highly productive basins like the Bakken and Eagle Ford have replaced imports for the domestic refining industry.

Like many major domestic manufacturing industries, the refining sector is energy intensive. In addition to lower operating costs from lower-priced natural gas, the availability of vast new supplies of crude oil to refineries on the U.S. coasts has made these plants more competitive. This increase in competitiveness and profitability in the refining sector ultimately benefits consumers in the form of lower gasoline and diesel prices. To jeopardize this development with burdensome one-size-fits-all federal regulations would be foolhardy and harmful to America's economy and American workers.

RESPONSE OF WILLIAM R. KLESSE TO QUESTION FROM SENATOR UDALL

Question 1. As many of my colleagues here on the committee have heard me say again and again, I believe that Colorado is truly a model for the United States in its pursuit of a balanced approach to domestic energy development. As we work toward achieving true energy self-reliance through expanded domestic oil development, it is important that we do so in a manner that is safe and responsible. So my question for the industry is: as oil and gas exploration, production and refining continues to expand in the United States, what is the industry doing to develop new methods and technologies to ensure that our air remains clean, our water is fresh and our communities are safe?

Answer. Valero also believes in a balanced approach to energy policy in the United States. While we have discussed the critical role the company plays in U.S. energy security, we take our environmental obligations equally as seriously. Since 1990, the refining industry as a whole has spent over $128 billion on environmental improvements. Though the industry has greatly expanded during this time, environmental emissions have decreased over the last 20 years. This decrease in emissions comes despite increasingly stringent refined product specifications, and an overall increase in refinery production of gasoline and jet and diesel fuels. Processing heavier and sour crude that have been available to the market has required more processing. Petroleum refining is an energy intensive industrial process, but the industry has made record improvements to lessen its environmental footprint. Environmental stewardship is a core value at Valero. As an example, we have spent approximately $525 million to build a state-of-the-art flue-gas scrubber, one of the world's largest, at our Benicia refinery in California. This expenditure reduced sulfur dioxide emissions by 95 percent and nitrogen oxide emissions by percent.

Valero has also spent $2.6 billion at its refineries on environmental upgrades that further reduced emissions during the last six years. Under a comprehensive Energy Stewardship Program, Valero refineries reduced energy consumption per barrel of throughput by 12% between 2008 and 2012 which has reduced our greenhouse gas emissions. The refining industry is constantly adapting to changing times and is leading the way in the development of renewable fuels, and Valero is playing an active role in this innovation. Valero acquired 10 state-of-the-art ethanol plants, which operate under our subsidiary Valero Renewable Fuels Company, LLC, making Valero the first traditional refiner to enter the ethanol production market in a significant way. Also, Diamond Alternative Energy LLC, a Valero subsidiary, produces renewable diesel fuel from recycled animal fat and used cooking oil in partnership with Darling International Inc. at a 10,000-barrel-per-day unit at the St. Charles Refinery in Louisiana that just became operational.

Valero's environmental efforts have consistently been recognized. In 2013 Valero's McKee Refinery received the Texas Environmental Excellence Award for the company's wind farm that reduces reliance on conventional power sources. Additionally, Valero's St. Charles Refinery was recognized by the Louisiana Department of Environmental Quality and the Louisiana Chapter of the Air and Waste Management Association for its catalytic cracker conversion project that reduced overall facility air emissions and eliminated thousands of tons of waste catalyst generated annually.

RESPONSES OF WILLIAM R. KLESSE TO QUESTIONS FROM SENATOR BARRASSO

Question 1. The spot prices for certain Renewable Identification Numbers (RINs) recently reached an all-time high. Under the Renewable Fuel Standard (RFS), refiners must obtain RINs to verify the amount of biofuels blended into gasoline and diesel. Since January 1, 2013, the spot prices for RINs have increased over 1500 percent. You testified that "the RINs market has . . . resulted in increased compliance

costs. most of which are passed on to consumers." Would you expand upon how the RFS impacts the price of gasoline and diesel?

Answer. As the Committee is well aware, obligated parties under the RFS, refiners and importers, but not blenders, are required to demonstrate compliance with their renewable volume obligation (RVO) through the submission of renewable identification numbers (RINs). Unfortunately, the RINs market has caused significant unintended consequences. With the original 2005 law and its volumes, RINs were necessary for flexibility and the ability to track the program. When the law was revised in 2007 and the renewable volumes greatly increased, combined now with much lower than expected gasoline demand, RINs have become a huge cost and fairness issue. Also, in the past two years, the RINs market has been beset by allegations of fraud that has questioned the Environmental Protection Agency's (EPA) ability to administer the RFS program and resulted in increased compliance costs for obligated parties-most of which are passed on to consumers.

Most importantly, as U.S. gasoline demand declined from 2007 and as the renewable fuels mandate volumes increase, some U.S. refiners-those that are large merchants and wholesale, spot sellers-find themselves in an unintended predicament of either reducing gasoline production, exporting more gasoline at discounted prices, or buying RINs, which soon may not even be available because the market is going infeasible.

At Valero alone, we anticipate cost increases of some $600 to $800 million this year just as a result of volatility in the market for RINs. Unfortunately, this cost will not add one more gallon of fuel into the market. It is nothing more than a federally mandated cost to each gallon of transportation fuel that may be passed on to the consumer.

At the outset of the RFS, EPA found in its regulatory preamble that RIN's cost would be negligible. This estimate has turned out to be profoundly incorrect as the program approaches an infeasible situation, expected in 2014.

Question 2. You testified that "some U.S. refiners.find themselves in an unintended predicament of either reducing gasoline production, exporting more gasoline at discount prices, or buying renewable fuel credits (RINs), which soon may not even be available because the market is going infeasible." Would you explain how the RFS encourages refiners to produce less gasoline or export gasoline at discounted prices?

Answer. As U.S. gasoline demand declined from 2007 and as the renewable fuels mandate volumes increase, some U.S. refiners-those that are large merchants and wholesale, spot sellers-find themselves in an unintended predicament of either reducing gasoline production, exporting more gasoline at discounted prices, or buying renewable fuel credits (RINs), which soon may not even be available because the market is going infeasible. If the option of buying RINs doesn't exist because none are available or because of very high pricing, the domestic supply will be reduced. It's hard to believe that when Congress passed the Energy Independence and Security Act of 2007, a possible outcome was to reduce U.S. gasoline supplies and increase gasoline prices. However, as a refiner and an ethanol producer, that is exactly the potential outcome we find ourselves in today. No one expects that U.S. gasoline demand will rebound strongly and to begin to grow again, and there are physical constraints on using higher blends of ethanol in gasoline including the lack of car warranties to approve those blends. As a result, there simply aren't enough gallons of gasoline in which to put all of the required gallons of ethanol-and that has driven the price of corn ethanol RINs from $0.05 in late 2012 to as high as $1.16 recently. Also, there is no cellulosic ethanol and advanced ethanol has to be imported.

Question 3. You testified that EPA is in the process of imposing a number of new regulations on American refineries. These include EPA's proposed "Tier 3" gasoline and diesel regulations. You explain that EPA's Tier 3 regulations alone will cost Valero between $300 million and $400 million and will raise the cost of manufacturing gasoline a couple of cents per gallon. You also cite a Wood Mackenzie report which states that EPA's regulations may "increase the risk of refinery closures and consequential job and economic loss." Would you discuss in greater detail the impact that EPA's regulations are having on American refineries and consumers?

Answer. Refinery operations are subject to extensive environmental regulations. Refiners are among the most regulated industry in the country, and U.S. refineries are already among the cleanest and most efficient in the world. A reasonable approach to regulation is one that both improves the environment while allowing the industry to remain competitive. A host of recent actions by EPA, referred to as the "regulatory swamp" due to the close proximity of their compliance targets and high costs, with very limited benefits, will create a highly unpredictable regulatory envi-

ronment for our industry and contribute to a climate where no new refineries come online and those that do exist will struggle to stay online. These actions include:

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This is not just a hypothetical. A 2011 report by the Department of Energy found that the cumulative burden of federal regulations was a significant factor in the closure of 66 domestic petroleum refineries from 1990 to 2010. In addition to increasing the cost of gasoline, additional regulations "may lead to additional job losses for America, weaken the U.S. economy, make America more reliant on nations in unstable parts of the world for vital fuels and petrochemicals, and ultimately endanger our national security."

Question 4. You testified that "unfettered exports of natural gas . . . may have significant unintended consequences and will raise costs." You also state that "[p]olicies that are too restrictive towards gasoline exports could undermine or even close marginally profitable refineries." You go on to say that "[t]he U.S. refining industry is a very efficient, but as all manufacturing, is faced with high labor and regulatory costs. Low priced natural gas offsets these costs and keeps us competitive." (emphasis added).

Other manufacturers and industries face high labor and regulatory costs. If the Federal government should limit natural gas exports to offset the refining industry's labor and regulatory costs and keep the refining industry competitive, why shouldn't the Federal government limit exports of refined petroleum products to help other manufacturers or industries offset their labor and regulatory costs and keep these manufacturers and industries competitive?

Answer. Valero is a firm participant in the international marketplace for robust trade in energy commodities. Valero seeks lower-cost and reliable inputs for our refineries, whether from within the United States or from foreign sources. Given recent developments in shale plays, we have frankly benefited from new secure domestic supplies of crude oil and natural gas. Valero then takes those inputs and through the application of American capital, technological know-how, and expert workforce, we transform oil and gas into a broad array of fuels that satisfy domestic and international demands. We believe there is a fundamental difference between manufactured products of the sort refiners make and the raw material inputs into that manufacturing process. Indeed, every multiple Administrations for each party over the last five decades have found that a robust domestic refining sector is critical for national security. That said, Valero is not calling for a prohibition on natural gas exports. We merely raise the question of whether or not the public interest test

already present in current law contemplated unfettered exports without respect to the competitiveness of domestic assets.

RESPONSE OF WILLIAM R. KLESSE TO QUESTION FROM SENATOR RISCH

Question 1. EPA's proposed percentage bio blending standard for gasoline and diesel combined is 9.63% for the year 2013. The Energy Information Administration (EIA) has told Congress that virtually all ethanol blending with gasoline is at the 10% level. However, EIA has also stated that biodiesel blending is RIN deficient. So if a refiner produces a higher percentage of diesel, there is no possible way to meet EPA's proposed standard unless they buy credits. These credits that used to cost pennies per RIN gallon now cost over a dollar with predictions that RINs will go over $3.00 in 2014.

a) Please give us your thoughts on the unfairness and the unintended consequences of the Renewable Fuel Standard.

Answer. As the Committee is well aware, obligated parties under the RFS, refiners and importers, but not blenders, are required to demonstrate compliance with their renewable volume obligation (RVO) through the submission of renewable identification numbers (RINs). Unfortunately, the RINs market has caused significant unintended consequences. With the original 2005 law and its volumes, RINs were necessary for flexibility and the ability to track the program. When the RFS was revised in 2007 and the renewable volumes greatly increased, combined now with much lower than expected gasoline demand, RINs have become a huge cost and fairness issue.

Most importantly, as U.S. gasoline demand declined from 2007 and as the renewable fuels mandate volumes increase, some U.S. refiners- those that are large merchants and wholesale, spot sellers-find themselves in an unintended predicament of either reducing gasoline production, exporting more gasoline at discounted prices, or buying RINs, which soon may not even be available because the market is going infeasible. If the option of buying RINs doesn't exist because none are available or because of very high pricing, the domestic supply will be reduced. It's hard to believe that when Congress passed the Energy Independence and Security Act of 2007, a possible outcome was to reduce U.S. gasoline supplies and increase gasoline prices. However, as a refiner and an ethanol producer, that is exactly the potential outcome we find ourselves in today. No one expects that U.S. gasoline demand will rebound strongly and to begin to grow again, and there are physical constraints on using higher blends of ethanol in gasoline including the lack of car warranties to approve those blends. As a result, there simply aren't enough gallons of gasoline in which to put all of the required gallons of ethanol-and that has driven the price of corn ethanol RINs from $0.05 in late 2012 to as high as $1.45 recently. Also, there is no cellulosic ethanol and advanced ethanol has to be imported.

At Valero alone, we anticipate cost increases of some $600 to $800 million this year just as a result of volatility in the market for RINs. Unfortunately, this cost will not add one more gallon of fuel into the market. It is nothing more than a federally mandated cost to each gallon of transportation fuel that may be passed on to the consumer.

b) What suggestions do you have for changes that will correct this problem?

Answer. No matter what one's view on ethanol and other alternative fuels is, it is time to revisit the current implementation of the RFS in order to allow the orderly movement of renewable fuels into the fuel supply in a responsible manner that protects consumers and small businesses. The oil supply picture has changed, the basis of the original legislation has changed, the RFS should be repealed and new legislation developed.

As the process of developing new legislation moves forward, the Administration can take immediate steps to stem the impacts of the current system on U.S. consumers and small businesses. Without waiting for Congress, the Administration can adjust the renewable fuel volume requirements for 2013 and send a signal to the market as to its intent to do the same in 2014. The Administration can also ask for public comment on structural changes such as: designating fuel blenders as the obligated party in the RFS, establishing a ″safety valve″ that would freeze RIN prices at a certain point to prevent real harm to the economy, etc. These interim measures can buffer some of the current fears in the market as the Congress considers an appropriate mechanism to replace the current, and broken, RFS program.

RESPONSES OF DAN GILLIGAN TO QUESTIONS FROM SENATOR MURKOWSKI

Question 1. Energy Policy Initiatives—In your opinion, what policy initiatives are most important for Congress to pursue to help ensure affordable energy prices here in the U.S., including gasoline prices?

Answer. It remains important for the U.S. to adopt policies that will reduce our dependence on foreign oil. While increased domestic oil production might not lead to lower prices at the pump immediately, this doesn't take away from the fact that the U.S. must continue to pursue domestic oil production on both public and private lands to prevent future oil price shocks and oil price volatility, and to curtail OPEC's market share of the world oil market.

Congress must also expedite approvals for deep water drilling projects, approve the Keystone XL Pipeline, and delay EPA rules implementing Tier 3 gasoline requirements and new ozone standards. If EPA were to finalize rules requiring Tier 3 gasoline and new ozone standards, the rules would force much of the country into non-attainment status which would require refineries to make a lower Reid Vapor Pressure (RVP) fuel and, in many cases, reformulated gasoline (RFG), and both would dramatically increase prices at the pump.

Additionally, PMAA supports efforts to expand gas-to-liquids (GTL) technology which is a process that converts natural gas into clean, reliable diesel fuel. It was developed in the early 1920s and the diesel fuel produced can be used in the existing $500 billion downstream motor fuels distribution system without any costly upgrades. Furthermore, propane already has a distribution system that would cost much less to expand than to basically start from scratch with a CNG infrastructure system. Propane is a safe consumer and employee friendly product that is easy to work with once store personnel are properly trained. In addition, the cost of installing a propane fueling site runs about $20,000-$25,000 versus CNG at a cost of $750,000-$1 million per site. Propane mileage is similar to a vehicle running on E-10 gasoline blend. Congress should enable innovation by promoting all fuel options, especially propane, given how closely it resembles CNG and LNG in fuel quality and CO_2 emissions, and because of its cost-effective motor fuels distribution system.

Question 2. E15/E85-How much does it cost, on average, for a station owner to upgrade his or her infrastructure to accommodate the sale of E15? How about E85?

Answer. To upgrade/retrofit a UST system to sell E10 plus blends, it will cost well beyond the means of an average convenience store owner. PMAA estimates that the average cost to retrofit a retail gasoline station with E15 compliant equipment to be between $375,000 and $425,000 per site. Replacement of piping alone would cost at a minimum $150,000. Such compliance costs would be staggering for retailers and would undoubtedly force many, particularly in those rural areas to close down. Those who could afford a system retrofit would be forced to pass the cost along to customers in the form of significantly higher gasoline prices. E85 costs would be the same since anything above E10 has to be Underwriters Laboratories (UL) certified and most E10 plus UL certified equipment handles both E15 and E85 blends.

Question 3. E15—What are the various hurdles that E15 would need to overcome before it can be deployed and used by American motorists?

Answer. Currently, gasoline retail infrastructure equipment is certified to dispense and store up to 10 percent ethanol by UL. Although UL has expressed "confidence" that most retailers can safely sell up to 15 percent ethanol blended gasoline, they have not actually "certified" existing dispensers, piping or underground storage tanks for such use. This is a major obstacle because several federal regulations, state laws, local ordinances and insurance policies require UL certified equipment.

Retailers who decide to sell E15 could be held liable to pay for cleanup costs if a leak occurs due to the increased ethanol blends, and insurance companies may deny coverage. During the decision to waive portions of the Clean Air Act to allow the use of E15, little consideration was given to the issue of compatibility with existing UST legacy equipment. Statutory jurisdictional considerations notwithstanding, the fact remains that E15 will not be placed in widespread use in the short term until outstanding issues involving equipment compatibility are addressed.

Additionally, auto manufacturers extend warranties on existing vehicle fleets up to 10 percent ethanol. Most are unwilling to amend their warranties to handle blends above 10 percent because tests have shown E15 could damage engines, fuel pumps and other system components. This position did not change after EPA approved E15 for 2001 and newer vehicles. PMAA is also concerned that if an owner of a pre-2001 vehicle misfuels with E15, the retailer would be held liable for damage to engine and emission system components. Appropriately labeled dispensers warning consumers not to dispense E15 into older vehicles will do little to reduce the risk of liability for the retailer.

It is unlikely E85 would satisfy RFS corn-based ethanol blending requirements. E85 is still considered a niche market and many PMAA member companies have yet to offer E85 since there isn't enough E85 compatible vehicles on the road to make a modest return on investment. Furthermore, E85 must be priced lower than conventional gasoline for motorists to receive similar energy content at a competitive price given that ethanol has a lower BTU energy content compared to conventional gasoline.

Additionally, it's worth noting that existing E85 stations in the U.S. were permitted with a waiver from local authorities having jurisdiction (AHJ) (local fire marshals). The waivers tell the retailer that local fire marshals won't enforce compatibility standards against them for selling E85. However, the waiver still doesn't satisfy OSHA requirements. To date, very few E85 dispensers, hoses, nozzles, swivels, breakaways, shear valves, and submersible turbine pumps have been UL certified to handle E85. Both Gilbarco and Dresser Wayne have certified dispensers for E25.

Question 4. E15 Sales—To the best of your knowledge, how many stations around the country are currently sellingE15? What are some of the roadblocks to its wider deployment?

Answer. There only about two dozen stations are selling E15 fuel. As discussed above, several regulatory roadblocks still exist. PMAA believes the biggest E15 setback is lack of UL certification for legacy equipment and general liability regarding misfueling concerns.

Question 5. Waivers—Your testimony briefly discusses the potential benefit of waivers-from the Renewable Fuel Standard, from reformulated gasoline requirements, and other regulations-in the event of regional natural disasters. Historically, have these waivers been granted on a timely basis?

Answer. Historically, waivers haven't been granted in a timely fashion by the federal government. When Superstorm Sandy hit the Northeast, waivers such as hours-of-service (HOS), regional reformulated gasoline (RFG) and RFS waivers were granted, but well after the storm hit. Additionally, regional weight limit waivers, fuel specification waivers, and IRS fuel tax regulations specific to dyed (taxed)/undyed products (non-taxed) impacted the petroleum supply chain. PMAA is currently working with industry and the Obama Administration in speeding up this process to move product during emergencies. The Obama Administration and future Administrations need to waive fuel requirements well in advance of a storm in order to smoothly transport refined petroleum products to an affected region.

Question 6. Refinery Outages—In your testimony, you state that PMAA supports funding for Section 804 of the 2007 energy bill, which authorized EIA to collect information about refinery outages. To be clear, is it fair to conclude that PMAA supports better communication, but not government control over those outages?

Answer. That's correct. PMAA supports better communication between suppliers, petroleum marketers and government officials, but not government control over planned refinery outages. If the federal government could provide planned refinery outage information well in advance to refining companies, PMAA believes it could prevent multiple refinery locations from temporary suspending operations simultaneously, and therefore, prevent supply shocks and higher prices. Refiners can't communicate due to anti-trust laws, so they're unable to know when and where a refinery might have a planned refinery outage.

Question 7. Retail Facilities—In your written testimony, you describe the new face of the retail gasoline industry over the past 10-15 years as having moved from gas station ownership by major integrated oil companies to ownership primarily by small, independent businesses.

a. What impact, if any, has this changed business model had on gasoline prices at the pump?

b. How will this dynamic affect the potential deployment of E15 and E85?

Answer. The price of oil and refined petroleum products are set in the global futures market exchanges (e.g., the Intercontinental Exchange and the Chicago Mercantile Exchange). Speculators and hedgers make bets or guesses on where they believe the oil market is headed depending on geopolitical events, the value of the U.S. dollar, market sentiment and supply and demand. Additionally, U.S. publically traded oil companies only control three percent of the world's oil proven reserves; therefore, their impact on the price of oil is limited.

RFS obligated parties (refiners and importers) are required to blend a certain amount of ethanol into gasoline also known as renewable volume obligations (RVOs). Some refiners such as Valero have invested in ethanol facilities and can produce additional RVOs to sell in the market to other obligated parties who fall short. Thus, the tradable RINs market serves as an incentive for refiners to meet their volume obligations. However, the high cost of RINs is due to refiners hitting the maximum achievable amount that can work with legacy vehicles and motor

fuels dispensing systems (aka E10 blendwall). Therefore, refiners have limited ability to impact the potential deployment of E15 and E85. If E15 were to be "mandated by the market" as upstream suppliers struggling to meet escalating RVOs, PMAA member companies couldn't supply E15 to non-compatible UST systems and pre-2001 vehicles. Given equipment compatibility issues have not been resolved, it could force a system wide retrofit of UST systems that would impose impossibly high compliance costs on retail marketers and could disrupt supply and result in sharp price increases for gasoline at the pump.

RESPONSE OF DAN GILLIGAN TO QUESTION FROM SENATOR UDALL

Question 1. With $4 per gallon gas becoming the norm, the state of Colorado has introduced policies that make it easier for Coloradans to purchase vehicles that run on alternative and more affordable sources of fuel. Do you see increased use of alternative consumer vehicles, like electric vehicles or natural gas vehicles, affecting gasoline prices over the next decade? What is the petroleum industry doing to prepare for these changes in market demands?

Answer. First, PMAA doesn't support federal subsidies for CNG and LNG. Current natural gas prices have allowed for greater investment in natural gas infrastructure especially at truck stops. Second, we are not of the opinion that alternative fuel vehicles are going to be a significant portion of the overall vehicle mix through 2050. CNG and electric vehicles are at a premium over traditional fuel vehicles and with the sparseness of fueling facilities, and given the significant infrastructure costs of CNG compressor stations, it will be a long time before any viable impact will be realized.

Natural gas will certainly impact diesel markets as fleets convert to LNG and refueling facilities for trucks grow. LNG for big trucks is cost effective today, but not currently suitable for light trucks and cars in the near future. Infrastructure costs are very high and fuel tank limits on cars are a big problem for CNG. The newly finalized CAFE standards will ultimately reduce demand; however, reduced demand does not always translate into lower prices at the pump. Global crude oil prices are the primary driver of gasoline prices and global demand for crude will likely continue to grow.

If anything, as natural gas moves out of the regulated environment into an unregulated motor fuels market and with exports of LNG ramping up to serve the MCF Japanese and European markets, CNG/LNG will begin experiencing price parity with traditional fuels. At that point, the life cycle return for the significant differentiation in conversion and new vehicle cost will not be warranted. Electric vehicles currently enjoy tax and incentive benefits but that too will play out. As power plants switch from coal to natural gas, prices will also go up. In the 9-county Front Range area, prices over the next 10 years are anticipated to increase 30 percent due to the legislature encouraging natural gas conversion from coal. CNG is costing some marketers as much as $.75 per gallon to pump due to the peak demand charges for electricity experiencing new record highs.

RESPONSE OF DAN GILLIGAN TO QUESTION FROM SENATOR RISCH

Question 1. EPA's proposed percentage bio blending standard for gasoline and diesel combined is 9.63% for the year 2013. The Energy Information Administration (EIA) has told Congress that virtually all ethanol blending with gasoline is at the 10% level. However, EIA has also stated that biodiesel blending is RIN deficient. So if a refiner produces a higher percentage of diesel, there is no possible way to meet EPA's proposed standard unless they buy credits. These credits that used to cost pennies per RIN gallon now cost over a dollar with predictions that RINs will go over $3.00 in 2014.

a) Please give us your thoughts on the unfairness and the unintended consequences of the Renewable Fuel Standard.

Answer. The reason why ethanol RIN values have increased dramatically is due to refiners hitting the maximum achievable blending threshold allowed in the marketplace (E10). If EPA finalizes 2013 and 2014 RFS ethanol blending volumes that force refiners to blend above an E10 blend, refiners are likely to cut gasoline production, export it or buy even more expensive ethanol RINs which will cause chaos in the retail motor fuels market place. Furthermore, no one anticipated that gasoline consumption would fall dramatically after 2007 which has only moved the ethanol blend wall closer. Given that small business petroleum marketers own and operate approximately 60 percent of all retail gasoline stations nationwide, it's important that they be included in the RFS negotiations this spring and summer.

PMAA is currently concerned about the corn-based ethanol mandate given our concerns with misfueling and UST compatibility concerns, but have no position on the biodiesel mandate.

b) What suggestions do you have for changes that will correct this problem?

Answer. On May 16, 2013, PMAA's Board of Directors voted to support a regulatory fix to the RFS by urging the EPA Administrator to prevent chaos in the retail motor fuels marketplace by adjusting the corn-based ethanol mandate to a level achievable with E10 and reasonable growth for E85. The PMAA Board believes E15 has too many infrastructure, liability and marketplace issues to significantly expand national ethanol blending volumes in the short run. PMAA does not oppose E15 but has advised marketers to obtain knowledgeable legal and regulatory counsel before offering E15 at wholesale or retail.

RESPONSES OF JEFFREY B. HUME TO QUESTIONS FROM SENATOR MURKOWSKI

Question 1. Domestic Production—I appreciate your comments about technological developments providing access to a sustainable source of energy in the U.S., meaning oil and gas resources. Can you please expand on that thought? In your opinion, what are the greatest roadblocks to ensuring access to our vast oil and gas resource base?

Answer. Technological developments, particularly horizontal drilling and hydraulic fracturing, have unlocked resources previously believed to be inaccessible or uneconomical to produce. Hydraulic fracturing was developed by small, enterprising U.S. companies in the 1940s, finding early success stimulating oil wells in our home state of Oklahoma and neighboring Texas. In the 1970s, as Senator Franken correctly noted, DOE-funded research explored ways to tap natural gas resources in shale formations.[1] For example, projects such as the Eastern Gas Shales Project of 1976 studied means to extract gas from the low-permeability Devonian shale plays of the Appalachian Basin. Building upon the industry's prior work on hydraulic fracturing, the micro-seismic mapping and high-volume well stimulation techniques developed under the public-private Unconventional Gas Research Programs laid much of the groundwork for modern drilling practices.

The support provided by the federal government in the 1970s was, by all measures, a tremendous economic success for our country. As noted in a 2001 report by the National Research Council entitled Energy Research at DOE: Was It Worth It? Energy Efficiency and Fossil Energy Research 1978-2000,[2] the collaborative programs resulted in billions of dollars in incremental state and federal tax revenues, trillions of cubic feet of incremental gas supply, and billions of dollars in consumer savings. The relatively small investment in research-$220 million spent in total across several resource areas-has been returned many times over by American industry, resulting in billions of dollars of benefit to the country.

While government and the petroleum industry have partnered effectively in the past, headwinds to further progress remain. Current regulations restricting access to oil and gas exploration on federal, offshore and Native American lands inhibit our Nation's ability to achieve energy independence. As you poignantly noted on the 16th of last month, the livelihood of families living and working along the Kuskokwim River is adversely impacted by a dearth of fuel supplies; yet, these families reside in the backyard of our Nation's largest untapped petroleum reserves. In the collaborative spirit of the 1970s, federal support for production on these restricted lands would prove to be an economic boon to both local communities and the Nation as a whole. Furthermore, by utilizing modern best practices and environmentally-conscious technologies such as Continental's ECO-Padr drilling, U.S. independent producers would be able to unobtrusively develop these vast resource plays while minimizing their collective footprint on the environment.

Question 2. Transporting Crude-As the largest oil producer in the Bakken region-and a producer that has grown tremendously in recent years-I'm curious about your approach to transporting crude to refineries. Does Continental Resources have a preferred method for transportation, whether pipeline, rail, barge, or some other method?

Answer. Continental Resources has adopted a portfolio approach with respect to both the mode of transportation and the various refinery regions we target when selling our crude oil.

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[1] "DOE's Unconventional Gas Research Programs 1976-1995: An Archive of Important Results." National Energy Technology Laboratory, U.S. Department of Energy. January 31, 2007.

[2] National Research Council. Energy Research at DOE: Was it Worth It? Energy Efficiency and Fossil Energy Research 1978-2000. Washington, DC: The National Academies Press, 2001.

In the Bakken, it became clear several years ago that forecasted production would likely ramp up quicker than the region's pipeline take-away and local refining capacity. Since new pipeline construction timelines are measured in years and not months, producers such as Continental were required to develop alternative transportation strategies to move barrels to the market and avoid the prospect of shutting in oil wells.

Fortunately, the Bakken region did have in place an extensive railroad network that had been built originally to move agricultural products, lumber and coal across the country. Since incremental crude take-away capacity was urgently required and railroad loading facilities could be completed in less time than new pipeline systems, Continental used this solution to move much of its oil to the marketplace.

Today, as new pipeline and rail loading facilities enter service, Bakken take-away infrastructure bottleneck issues are being resolved, providing our company additional flexibility to transport the oil we produce to refinery markets throughout America. A significant portion of our Bakken barrels are consumed by coastal U.S. refiners in place of foreign barrels, which helps our national economy and security.Ultimately the decisions made as to where and how our production is sold are driven by the marketplace. Our goal at Continental Resources is to transport our high-quality Bakken barrels to locations where they are needed most, in a safe and efficient manner to keep costs down.

Question 3. Pipeline Infrastructure—Testimony at this hearing discussed the impacts to gas prices from transportation costs to get crude oil to refineries throughout the country. Please describe any issues your company has experienced making sure crude oil gets to market.

Answer. Continental Resources is predominantly a producer of light-sweet crude oil from the U.S. mid-continent and Rocky Mountain regions. Traditionally, much of the high-quality crude we produced was refined in mid-America. But in the past five years or so many billions of dollars have been spent by refiners in the U.S. mid-continent region to displace domestic light-sweet crude demand with less-expensive heavy-sour bitumen or syncrude produced from mines or upgraders in Canada.

Continental responded to these changing regional refinery slates and new competition for pipeline space from bitumen producers north of the border by supporting rail transportation alternatives and committing to new pipeline projects with access to additional markets. As an example, our company is currently the largest supplier of Bakken crude to Puget Sound refiners as they seek alternative domestic crude supplies to replace declining Alaskan North Slope production.

U.S. consumers and businesses benefit from lower gasoline and petroleum product prices when crude oil transportation infrastructure from the well to the refinery becomes more efficient, regardless of where the refinery is located.

Question 4. Production/Tax Hikes—The President and many members of the Senate have proposed significant tax hikes on oil and gas producers. Can you explain what that would mean for your company? How would it impact your ability to explore and produce American resources?

Answer. President Obama's energy tax increase proposal would have a devastating effect by reducing exploration and production investments in domestic oil and gas development across the industry. The result will be reduced domestic energy supplies, a loss of thousands of high paying jobs, an increase in our foreign trade deficit and, ultimately, higher energy prices for the American consumer.

Independent producers, such as Continental Resources, drill 95% of the wells in the U.S. (Independent Petroleum Association of America) and these producers routinely invest more than twice their annual earnings into production activities. Because of the tax treatments currently in place for these domestic producers, the industry has been extremely successful in expanding oil and natural gas reserves in America and driving an economic boom across the country.

During the past several years, our Nation has made significant strides in reducing our reliance on foreign oil. The positive economic effects of this trend are reflected in our improved trade balance, employment and tax revenue numbers. While we believe taxes that target domestic energy producers are counterproductive to achieving energy independence, we think any tax hikes levied on oil and gas producers while our country is in the midst of a domestic energy-fueled recovery would be particularly ill-timed. One specific energy tax proposal that would have the most devastating effect on our recovery would be the repeal of intangible drilling cost (IDC) deductions. This tax treatment, which has been in place for nearly 100 years, allows companies to recover investment costs quickly so they can be reinvested into additional drilling activity. Over the next decade, the loss of IDCs means the loss of 9 billion barrels of oil equivalent production; 10,000 wells; 265,000 jobs; and $407 billion in capital expenditures in the U.S. economy (Woods Mackenzie).

The President's proposed energy tax increases move us away from energy independence, lead to the loss of jobs and investment, and threaten the American energy renaissance that we are currently enjoying.

Question 5. Federal vs. State/Private Lands—I noted in my opening statement that private and state production has soared in recent years, but federal lands have not kept pace. How much production does your company have on federal lands? Is it more difficult to obtain permission to produce there? If so, how so?

Answer. Continental Resources currently produces less than 5% of its oil and gas on federal lands. Wells drilled on federal/public lands require permission in the form of Applications for Permit to Drill (APD's) from the Federal Bureau of Land Management (BLM). These APD's require more paper work than state or private wells in the application process and can take from 120 to 180+ days (compared to 2-3 weeks for state permits) to process and receive permission to drill. These additional filing requirements and the longer application turnaround times discourage development of federal oil and gas reserves compared with similar prospects on non-federal land. The Montana and Dakota BLM offices have been reported to have a backlog of 300-400 APD's on federal lands.

RESPONSE OF JEFFREY B. HUME TO QUESTION FROM SENATOR UDALL

Question 1. As many of my colleagues here on the committee have heard me say again and again, I believe that Colorado is truly a model for the United States in its pursuit of a balanced approach to domestic energy development. As we work toward achieving true energy self-reliance through expanded domestic oil development, it is important that we do so in a manner that is safe and responsible. So my question for the industry is: as oil and gas exploration, production and refining continues to expand in the United States, what is the industry doing to develop new methods and technologies to ensure that our air remains clean, our water is fresh and our communities are safe?

Answer. At Continental Resources safety and responsibility are deeply engrained in our culture. We take seriously our responsibility to work with the public, the government, and others to develop our natural resources efficiently and in an environmentally sound manner, while protecting the health and safety of our employees and the communities where we operate.

We remained focused on:

- Promoting an injury/illness free workplace
- Environmental Protection
- Regulatory Compliance

At Continental Resources we continuously look for ways to improve the compatibility of our operations with the environment. We pioneered ECO-Padr drilling, a technique whereby multiple wells are completed from a single drilling pad, reducing environmental impact on the surface of the land. This type of drilling is typically more expensive than conventional vertical techniques; as a result, however, we have fewer rig movements and our operations end up being much less intrusive. In addition, through proactive strategies in the Bakken field in North Dakota we have been a leader in the reduction of natural gas flaring, achieving a rate a third of the industry average.

Continental employees around the country take great pride in helping to improve the communities in which they live by generously contributing their time, talent and treasure. As an illustration of this spirit, within hours of the recent tornados that devastated communities in the Oklahoma City area where we are headquartered, a successful company-sponsored disaster relief fund was established, and in-house coordinators helped direct employee teams to where their efforts were needed most.

RESPONSE OF JEFFREY B. HUME TO QUESTION FROM SENATOR RISCH

Question 1. EPA's proposed percentage bio blending standard for gasoline and diesel combined is 9.63% for the year 2013. The Energy Information Administration (EIA) has told Congress that virtually all ethanol blending with gasoline is at the 10% level. However, EIA has also stated that biodiesel blending is RIN deficient. So if a refiner produces a higher percentage of diesel, there is no possible way to meet EPA's proposed standard unless they buy credits. These credits that used to cost pennies per RIN gallon now cost over a dollar with predictions that RINs will go over $3.00 in 2014.

a) Please give us your thoughts on the unfairness and the unintended consequences of the Renewable Fuel Standard.

b) What suggestions do you have for changes that will correct this problem?

Answer. As an independent exploration and production company, we believe our place in the petroleum supply chain renders us unqualified to provide an opinion on RINs or a means to improve the RFS. However, we will note that in our "upstream" crude oil production role, we have observed instances where well-intentioned regulations have resulted in market distortions; rules designed to benefit one market or party have had the unforeseen consequence of impairing another. Generally speaking, we favor more open markets to less, as they eliminate opportunities for some participants to exploit artificial distortions for personal gain contrary to the greater public interest.

RESPONSES OF FAISEL KHAN TO QUESTIONS FROM SENATOR MURKOWSKI

Question 1. WTI/Brent Spread—The difference in prices between WTI and Brent crudes has narrowed significantly in recent weeks.

a. What do you expect will be the market-related impacts, if any, of this trend?

b. Do you expect WTI and Brent prices to remain in close proximity, or do you expect them to again diverge in the months ahead?

Answer. The narrowing of the crude differential more recently is a result of infrastructure being put into service to deliver more crude from Cushing and the Permian to the Gulf Coast. This narrowing is resulting in better pricing at the well head in certain producing areas. We believe these higher prices will act as a positive feedback loop into lower 48 production. Furthermore, higher prices also result in higher profits, higher royalties and higher taxes.

We expect WTI and Brent prices to remain in close proximity ($0-$6 per barrel) through the first half of 2014. We believe the differential could widen again in the second half of 2014 as the balance between infrastructure capacity growth and lower 48 production growth changes.

Question 2. Technical vs. Political Risk—When assessing the downside risks to rising U.S. production, how do you as an analyst weigh the differing threat levels from geological/technical concerns on the one hand, and political or "above ground" risks on the other?

Answer. We assess the technical and geologic concerns surrounding oil production growth through state, federal, industry, environmental and academic studies done on hydraulic fracturing, water handling, surface impacts and emissions. In our view, it is in the energy industry's best interests to operate safely, efficiently and responsibly. We monitor these issues closely to ascertain the risks to our production growth estimates.

We assess the "above" ground risks by monitoring the effects of current laws (federal and state), policy and treaties. We also take into account proposed legislation and voter sentiment surrounding US energy production. In our view, the key variables that could affect energy production in the US are tax policy and potential regulation on drilling activity.

RESPONSE OF FAISEL KHAN TO QUESTION FROM SENATOR UDALL

Question 1. Over the past two decades, we've seen fast growth in the use of Compressed Natural Gas (CNG) in transportation as a replacement for diesel in heavy-duty trucks and buses. This is happening in some towns in Western Colorado that have switched some of their city vehicle fleets over to CNG, because it is a cheaper alternative to gasoline when prices are $4 or more a gallon. Do you see the same trends? If so, how might these trends affect the demand, and price, for gasoline and diesel over the next decade?

Answer. We addressed some of the potential for the substitution of natural gas for diesel in our original testimony. We estimate LNG and CNG heavy duty trucks could represent 50% of truck sales in the next ten years. This assumes the price differential between natural gas and diesel on an energy equivalent basis remains unchanged from current levels. In our view, US domestic natural gas has the potential to displace 1.8mmbls/d of domestic diesel consumption by 2025.

RESPONSES OF FAISEL KHAN TO QUESTIONS FROM SENATOR BARRASSO

Question 1. You testified that the Keystone XL pipeline "has faced unprecedented delays." However, you go on to say that "the delay in Keystone will not stop crude production growth in Canada and the U.S." You note that "[t]he decision to delay Keystone only allows other mediums of transportation such as rail, barge, and trucking to be more widely used" and that "the delay only forces producers to look at alternate pipeline routes." Finally, you state that "[a]s more Canadian crude gets delivered to the coastal markets, it will enter the global market and the U.S. could

lose a dedicated supply source." Would you expand upon the importance of Keystone XL in ensuring that Canada remains a dedicated supply source of crude oil for the U.S.?

Answer. We believe the Keystone XL pipeline enables Canadian oil production to be refined in the US rather than being diverted to other countries that may have poor environmental track records. In the long-run, we believe the pipeline reduces the amount of crude that would otherwise be moved by rail and marine vessels. The pipeline also increases the amount of trade between our two countries. Light products manufactured in the US are shipped to Canada in order to facilitate shipping heavy crude on pipelines destined for the US Gulf Coast and the interior US.

Question 2. You testified that "the Jones Act has clearly become an impediment to moving new U.S. crude to the coastal refineries that could use it." You explain that it "has the effect of increasing gasoline and diesel prices in the U.S. because of the added cost of transportation." You go on to say that under the Jones Act, it costs as much as six times what it would otherwise cost to ship crude between U.S. ports. Would repealing the Jones Act help lower gasoline and diesel prices in some regions of the U.S.?

Answer. We do not believe repealing the Jones Act would necessarily reduce gasoline prices across the entire nation. However, a change in the Act to allow non-Jones Act vessels might reduce the cost of moving surplus gasoline and diesel production from the Gulf Coast to the US East and West Coasts. This could result in lower prices for certain coastal markets. Separately, the remaining refineries on the East Coast might be able to lower their crude acquisition costs by using non-Jones tankers to move crude from the Gulf Coast to the East Coast, which would allow these refiners to compete more effectively in the Atlantic basin refining market. Overall, we believe a change in the Jones Act to allow more vessels to move both crude and refined products between US ports reduces the cost of transportation with the potential in passing these cost savings on to consumers and refiners.

Response of Faisel Khan to Question From Senator Manchin

Question 1. Mr. Kahn, you raise an important point in your testimony about crude oil spills, and I want to make sure it's highlighted for the committee. You quote the Manhattan Institute of Policy research as having found that "incidents"—which I take to mean spills or other problems-are 4 times as likely to happen when the oil is transported by rail as opposed to being transported by pipeline. When oil is transported by truck, the likelihood is even higher: we are 40 times more likely to have a spill than if we transport it by pipeline.

I think that's something we should all think about when we discuss whether we should approve the construction of the Keystone XL pipeline.

You also discuss how pipeline companies are trying to find other workarounds to reduce bottlenecks in crude oil transportation, by reversing flows of certain pipelines and other means. Can you comment on what the risks and potential environmental impacts of building a new pipeline might be, as compared to finding these other workarounds? I would think a new pipeline-like the Keystone XL-would be less at risk. Is that the case?

Answer. Building a new pipeline generally requires new rights of ways. However, in many instances, new pipelines can be built along existing utility corridors or on existing rights of ways. The delay in Keystone XL has caused the industry to work around the delay by employing rail and expanding existing systems to deal with the bottleneck. Putting more crude on rail eventually runs into the statistical probability of more safety incidences. Furthermore, putting more crude on existing systems can be efficient; however, one runs the risk of putting pressure on existing systems that have been depreciated over a long period of time. In theory, a new pipeline should be safer than an older pipeline. However, older pipelines that are well maintained and where the owner has made substantial investments to modernize its system can work just as well.

Response of Faisel Khan to Question From Senator Risch

Question 1. EPA's proposed percentage bio blending standard for gasoline and diesel combined is 9.63% for the year 2013. The Energy Information Administration (EIA) has told Congress that virtually all ethanol blending with gasoline is at the 10% level. However, EIA has also stated that biodiesel blending is RIN deficient. So if a refiner produces a higher percentage of diesel, there is no possible way to meet EPA's proposed standard unless they buy credits. These credits that used to cost pennies per RIN gallon now cost over a dollar with predictions that RINs will go over $3.00 in 2014.

a) Please give us your thoughts on the unfairness and the unintended consequences of the Renewable Fuel Standard.

b) What suggestions do you have for changes that will correct this problem?

Answer. The RFS and the CAFé standards are at odds with each other. We do not believe the RFS ever envisioned the decline in gasoline demand that we are seeing today. Never-the-less, a combination of the CAFé standards and changing demographics are likely to continue to result in declining gasoline demand in the US. We believe this trend is generally positive for the US as economic growth is achieved with a decreasing amount of energy intensity.

We believe the RFS does provide a positive benefit for the US economy. It has reduced US imports of gasoline by producing domestic ethanol. However, we do not see the logic in penalizing the refining industry for its inability to blend more than 10% ethanol into the gasoline pool.

Our general view is that both the CAFé standards and RFS are positive for the US economy. However, neither law was designed to penalize the industry for meeting the goals of US energy efficiency and self sufficiency. In this respect, we believe the RFS should be amended to allow more flexibility to deliver ethanol into the gasoline pool.

RESPONSES OF ADAM SIEMINSKI TO QUESTIONS FROM SENATOR WYDEN

Question 1. In 2007, in Sec. 804 of the Energy Independence and Security Act (P.L. 110-140), Congress directed EIA to track refinery outages and flag those that would have a significant impact on supply. In 2011, before you arrived, EIA stopped tracking refinery outages. In your testimony before the Committee, you stated that it would cost millions of dollars to reinstate the refinery outage reporting requirement. Please provide an explanation of that estimate and itemize the activities, personnel, and other costs that would be involved in reinstating a program to track refinery outages as outlined in the Sec. 804.

Answer. Section 804 of the Energy Independence and Security Act directed EIA to track planned refinery outages using data from commercial reporting services. EIA produced the report until May 2011. A major budget reduction enacted midway through fiscal year 2011 led then EIA Administrator Newell to reduce or discontinue a wide range of EIA products.[1] With regard to the semiannual refinery outage report, I understand that the decision was based on the limited value of the report during the cycles in which it was prepared given its exclusive focus on planned outages using commercially available data.

Recognizing the current need for high-quality information on refinery operations in general and refinery outages in particular and its past experience with reporting on planned refinery outages based on commercially available data, EIA is now engaged in developing surveys and other activities that would lead to the tracking of both planned and unplanned refinery outages. Accomplishing this and other necessary work will require some significant alterations in EIA's operations. Specifically, EIA's data collection systems require modernization due to outdated systems and fundamental changes in energy activity . . . EIA's oil data operations are undergoing wholesale changes in order to address the most troubling of these concerns, as opposed to worsening the situation by continuing the 'make do' approach of the past.

While this work proceeds we anticipate that EIA would maintain vigilance regarding petroleum markets using existing EIA data, third-party data sources as may be readily accessible, analyzing current market conditions and proactively communicating issues of concern regarding those markets through Today in Energy, This Week in Petroleum (TWIP), and the Short Term Energy Outlook. This approach provides flexibility through maintaining situational awareness of all energy sectors that extends beyond petroleum refinery outages.

The Department of Energy's budget request for EIA for FY14 includes additional resources in several key areas critical to developing the market insights requested. Specifically, the request includes an additional $2.6 million for energy supply surveys covering all fuels, roughly one-quarter of which would be for the Weekly Petroleum Status Report (WPSR) that each Wednesday provides petroleum supply information through the end of the prior week, $0.5 million to conduct analysis on refining and gasoline markets and expand efforts to better understand linkages between physical energy markets and financial market activity, and $1.9 million for energy

[1] An overview of actions under the 2011 budget reductions are described in EIA's press release, Immediate Reductions in EIA's Energy Data and Analysis Programs Necessitated by FY 2011 Funding Cut, dated April 28 2011. http://www.eia.gov/pressroom/releases/press362.cfm

modeling and analysis, a significant portion of which would be focused on petroleum-related issues.

Question 2. Are any statutory changes to Sec. 804 required for EIA to carry out an effective program or does EIA have sufficient authority under Sec. 804 and its underlying organic authority pursuant to the Department of Energy Organization Act (P.L. 95-91)? For example, Sec. 804 requires EIA to use commercially available sources. Does EIA have authority to obtain information on outages directly from refiners under the Department of Energy Organization Act?

Answer. As discussed in the answer to the previous question, EIA does not believe that semiannual reports focused exclusively on planned refinery outages based on commercially available data, as directed in Section 804 of the Energy Independence and Security Act of 2007 have proven to be very useful information.

As your question suggests, EIA has broad organic authority for energy data collection. Specifically, the Department of Energy Organization Act provides the authority to collect data "relevant to the adequacy of energy resources to meet demands in the near and longer term future for the Nation's economic and social needs." 42 U.S.C. § 7135 (a)(2). EIA believes that this authority would cover collection of information on outages directly from refiners. As indicated in our response to your first question we have recently initiated the development of surveys and forms to collect outage data.

Question 3. Your testimony before the Committee is that U.S. oil prices are set in the global market, but that hasn't been the case for most of the past two years. According to a recent Wall Street Journal article (U.S. Oil Prices: Don't Call It a Comeback, July 11, 2013), WTI has been trading at an average discount to Brent of over $16 a barrel. The WTI/Brent spread has been reported upon numerous times by EIA itself. If U.S. crude prices were truly set in the global market there wouldn't be a significant difference between the U.S. benchmark and the major international benchmark. How do you explain the large differential between the benchmark prices and your view that U.S. prices are set in a global market?

Answer. U.S. crude oil prices reflect worldwide supply and demand conditions and like other crude oil streams they reflect the quality characteristics and specific transportation logistics that affect the cost of moving crude oil to refining centers and its value to the refiner in producing highly-valued products. Crude oil prices are quoted for a specific grade of crude oil at a specific location WTI prices are quotes for a light sweet grade of crude delivered at Cushing, Oklahoma. For many years, only a minimal differential existed between the price of WTI and Brent crude, which is similar in quality to WTI and had a similar cost of transportation from the location where prices were quoted (Cushing for WTI, Sullom Voe in Scotland for Brent) to the U.S. Gulf Coast, the nation's major refining center where both WTI crude and comparable seaborne crudes such as Brent were processed.

This historically small spread between WTI and Brent prices, however, began changing in 2009 due to the rapid growth in domestic crude production. This growth overwhelmed the pipeline logistics system used to transport WTI crude to Gulf Coast refineries. It therefore became necessary to transport the incremental portion of this crude by much more expensive methods, such as barge, truck, or rail. A refiner on the Gulf Coast, however, still had the option to substitute Brent crude for WTI based on its delivered cost. In order for Gulf Coast refiners to use WTI transported by the more expensive methods, its price at Cushing needed to be discounted relative to Brent by an amount sufficient to offset the higher transportation costs of moving the incremental supply at Cushing to the Gulf Coast. Competition with international crudes therefore forced the price of WTI as quoted in Cushing to decline by the increased costs of delivering it to the Gulf Coast.

As new infrastructure is added, we would expect these crude differentials to decline. Recent data indicate that some constraints that have previously depressed WTI crude prices compared to Brent crude prices have been relieved, which has resulted in a reduced WTI to Brent crude price differential. This has happened as terminals capable of handling unit trains have been added to allow expanded and more efficient shipments of crude oil via rail and some crude and some pipeline flows have been reversed and expanded. Prices for crude oil will continue to reflect global supply and demand forces subject to logistical and quality differentials that can cause spreads between the prices of individual crude streams to widen or narrow over time.

Responses of Adam Sieminski to Questions From Senator Murkowski

Question 1. U.S. Resource Base—Please summarize any revisions that EIA has made to the United States' projected, technically-recoverable oil and natural gas resource base over the past decade.

Answer. Technically recoverable resources represent the volumes of oil and natural gas that could be produced with current technology, regardless of oil and natural gas prices and production costs. Economically recoverable resources are resources that can be profitably produced under current market conditions.

Even though over 250 trillion cubic feet of dry natural gas were produced in the United States between January 1, 1998[2] and January 1, 2011, natural gas reserves and resources have generally been increasing, primarily due to the growth in shale gas reserves and resources. In the Annual Energy Outlook 2013 (AEO2013), the estimated sum of total proved natural gas reserves and unproved technically recoverable resources equaled 2,327 trillion cubic feet as of January 1, 2011. Of that total, proved shale gas reserves equaled 94 trillion cubic feet and unproved shale gas resources equaled 543 trillion cubic feet for a total shale gas resource of 637 trillion cubic feet. Shale gas resources constitute 27 percent of total U.S. natural gas resources, with the remaining 1,690 trillion cubic feet of natural gas resources distributed among the conventional, tight (low permeability), and coalbed methane resources.

Prior to the advent of widespread shale gas drilling and production, the AEO2000 estimated total natural gas resources of 1,597 trillion cubic feet as of January 1, 1998. In the AEO2000, shale gas resources constituted 52 trillion cubic feet, which was only 3 percent of total natural gas resources, and thus shale gas resources grew 1,125 percent between AEO2000 and AEO2013. Even though the growth in natural gas resources is largely due to the growth in shale gas resources, conventional, tight, and coalbed methane natural gas resources grew from 1,545 trillion cubic feet in the AEO2000 to 1,690 trillion cubic feet in the AEO2013, a 9 percent increase.

EIA's estimate of the sum of U.S. proved crude oil resources plus unproved technically recoverable crude oil resources has increased from 140 billion barrels in the AEO2000 to 223 billion barrels in the AEO2013, even though over 26 billion barrels of oil were produced over that timeframe. It is more difficult to make direct comparisons across the AEO oil categories because some of the oil reserves and resources have been reclassified as being low-permeability "tight" oil resources. "Tight oil" refers to oil resources located in low-permeability sandstone, carbonate, and shale formations. The application of hydraulic fracturing and horizontal drilling to these tight oil formations has significantly expanded oil resources by making these formations economically productive under prevailing oil prices. Rising oil prices have also contributed to rising proved reserves. In the AEO2013, tight oil unproved resources account for 58 billion barrels or 26 percent of total oil resources.

Even though the AEO oil resources by category cannot be directly compared over time, AEO2013 proved oil reserves increased by 1.3 billion barrels over the AEO2000 estimate, a 5 percent increase, and including the 26 billion barrels of cumulative production this is a 115 percent increase. In addition AEO2013 unproved, undiscovered oil resources increased by 81.4 billion barrels, a 70 percent increase over the AEO2000 estimate.

The AEO2012 and AEO2013 both contain more detailed discussions of revisions to resource estimates for specific shale gas and tight oil plays and discussions of the inherent uncertainties in resource estimates. Please refer to pages 56 through 64 in AEO2012 and pages 33 and 34 of AEO2013. The Assumptions reports for the Oil and Gas Supply Module for each AEO also provide details about specific changes in resource estimates.

Question 2. Transporting Crude Oil—How do the transportation options for crude oil (including pipeline, rail, and barge) vary in terms of cost? Is there a specific mode that industry appears to prefer?

Answer. From 2005 to 2010, 96 percent of refinery crude oil receipts came by pipeline and tanker (ship). With relatively low cost and high capacity, pipelines have long been the delivery method of choice for inland refineries. Coastal refineries, on the other hand, have typically been served by tankers of waterborne imports or offshore production. This began to change in 2011 and by 2012, pipeline and tanker deliveries accounted for 93% of the total with the remainder being deliveries of domestic crude via barge, rail, and truck. Truck and rail movements accounted for 3 percent of the total and barge receipts for 3 percent. We believe the increase in barge movements may be explained, at least in part, by crude loaded on rail cars at production areas and then transferred to barges for the final leg of delivery to refineries on the East Coast and along the Mississippi River.

The cost of transporting crude via any of the above methods varies widely depending on the distance traveled, the type of crude being transported, and the terrain

[2] Reserves and resources in the AEO have a two year lag, for example AEO2000 reserves and resources were as of January 1, 1998 and AEO2013 reserves and resources were as of January 1, 2011.

over the transport distance, and other factors. EIA cannot accurately provide such cost data at this time.

Question 3. Increasing Gasoline Prices—Many recent news stories have suggested that last week's increase in gasoline prices will continue in the weeks ahead. In EIA's estimation, what are the various factors that are combining to push prices higher?

Answer. While the pump price of gasoline is influenced by a variety of factors, including changes in fuel specifications and fuel taxes, the major long-run determinant of gasoline prices is the global price of crude oil. In the last 10 years, the average price for gasoline in the U.S. has risen a little over $2 per gallon, while the price of Brent crude oil, the international benchmark for waterborne light sweet crude oil has gone up $1.87 per gallon. Over shorter time horizons, other factors that influence the price of gasoline include refinery operations, seasonal demand patterns, inventory levels, financial market activity, and distribution operations.

For the week ending July 22, 2013, the average price in the U.S. for regular grade gasoline was $3.68 per gallon. This was an increase of almost 19 cents per gallon from July 1 as compared to a 13 cent per gallon increase in the price of Brent crude oil during the same time period. Since June, average gasoline prices are up by 4 cents per gallon while Brent crude prices have increased by 15 cents per gallon. While the direction of both crude and gasoline prices are uncertain at this time, we are aware of the increased tensions in the Middle East, which are being monitored closely by the international crude markets.

Question 4. Spare Capacity—How has global spare capacity for oil production changed over the past five years? Has this change had a stabilizing influence on world oil prices?

Answer. Global spare production capacity for crude oil has varied greatly over the last five years. EIA estimates that spare capacity reached a low point of just below 1 million barrels per day at the beginning of this time frame, in the third quarter of 2008, amidst the all-time highest recorded prices for the Brent and WTI crude oil benchmarks. EIA estimates that the highest spare production capacity in the last five years was in the fourth quarter of 2009, when it reached 4.4 million barrels per day during the recovery from the financial crisis earlier that year. Spare production capacity generally declined from that point until the third quarter of 2012. EIA estimates that current global crude oil spare production capacity is about 2.2 million barrels per day.

In general, higher crude oil spare production capacity is associated with lower crude oil price volatility but there are many other factors that can affect price stability, such as uncertainty over future economic growth as well as supply disruptions. Anticipated spare capacity is another consideration. With growth in production by non-OPEC producers, including the United States, expected to exceed growth in global oil demand during 2013 and 2014, global spare capacity is expected to increase over the next 18 months in the absence of major supply disruptions or unexpected demand growth. The outlook for growth in spare capacity together with a moderate outlook for global economic growth has likely contributed to recent relative stability in crude oil prices

Question 5. Production/Volatility—I noted in my opening statement that a recent Wall Street Journal analysis found rising American oil production has reduced volatility in world oil prices. Do you agree that American oil production had a positive impact in minimizing crude price volatility?

Answer. Rising crude oil production in the United States has helped moderate prices over the last two years. For example, domestic crude oil production was 850,000 barrels per day higher in 2012 compared to 2011, largely due to the dramatic growth in tight oil that has only recently been recognized as an economically attractive resource. Increased U.S. production was roughly equal to the total growth in non-OPEC crude oil production in 2012, a year in which global spare production capacity was relatively tight given the effect of sanctions on Iran and production disruptions in countries including Sudan, South Sudan, and Syria. Absent the 2012 increase in U.S. production, already-low global spare capacity in 2012 would have been nearly cut in half, creating a significant prospect for world oil prices well above the levels that were actually realized.

Question 6. In your testimony, you briefly discuss the impacts of unplanned refinery outages on gasoline prices and describe price impacts as "relatively short-lived."

a. In your experience, when unplanned outages occur, causing gas prices to increase, how long do these price spikes last? In your opinion, is there anything that can be done to address this issue?

b. In your experience, do planned outages—referred to as "turnarounds"—have similar impacts on gas prices?

Answer. When a turnaround exceeds its planned timing or when a refinery outage occurs unexpectedly, the effect on petroleum product supplies and pricing can at times be significant, but usually not long-lasting. All areas of the country can be supplied with petroleum products from alternate refining centers, but such supplies often take some time to arrange and transport and are likely more costly than products from the usual supply sources that were disrupted. While no two outages are exactly the same, we have analyzed four such events that occurred on the West Coast between 2008 and 2012 and found that the price effects lasted from 6 to 10 weeks with an average of about 8 weeks in duration. The recent supply incident in the Midwest lasted approximately 10 weeks. As unplanned outages, these incidents are by their nature unpredictable such that little can be done to prevent them.

Major refinery units are generally taken out of service after 3-5 years of operation for repairs and routine maintenance. These planned activities, known as turnarounds, are planned years in advance in order to have equipment ordered and delivered and to schedule thousands of temporary workers, some of them highly skilled, for the work. For these periods of planned maintenance, refiners typically arrange for product supply to meet their contracted supply obligations. Resupply strategies include arranging for product to be supplied by other refineries in the area through exchange or purchase or through inventory builds prior to the turnaround. Also, these turnarounds are generally scheduled to occur when product demand is at a seasonally low level. For these reasons, turnarounds that do not exceed their planned time frame generally do not materially affect petroleum product supplies and prices.

RESPONSE OF ADAM SIEMINSKI TO QUESTION FROM SENATOR UDALL

Question 1. As the United States oil industry and market are undergoing a major transformation, what impact do these shifting dynamics have on the global oil market and—particularly—on our most important international allies?

Answer. The most important changes occurring in the U.S. oil industry are increasing domestic production of crude oil and increasing levels of petroleum product exports from U.S. refineries.

Domestic crude oil production in the United States has increased significantly over the past three years, reaching 7.4 million barrels per day as of April 2013, the highest level since October 1992. As a result, U.S. imports of crude oil from sources such as Africa, Latin America, and the Middle East during this period have declined. At the same time, imports from Canada have increased.

In 2012, the U.S. exported some 2.7 million barrels per day of finished petroleum products and gasoline blendstocks, up from 1.3 million barrels per day in 2007. Of this 1.4 million barrels per day increase, about 52% (740,000 barrels per day) is diesel fuel and about 25% (360,000 barrels per day) is gasoline and gasoline blendstocks. At the same time, U.S. imports of gasoline, gasoline blendstocks, and diesel have declined by over 670,000 barrels per day. With declining demand for petroleum products in the United States due to fuel efficiency gains and increased use of biofuels, U.S. refineries increasingly depend on product exports to maintain high operating rates and profitability. The extent to which exports can grow depends on demand growth in the international market, the competitive position of U.S. refineries to serve those markets, and domestic demand. Wholesale gasoline and diesel will continue to reflect conditions in global markets, with both import and export opportunities dictated by differences in prices between regional market centers such as New York Harbor, Rotterdam, the U.S. Gulf Coast, Los Angeles, and Singapore that are large enough to make international shipments of products profitable. Such shipments generally continue to the point where regional product prices align so that opportunities for profitable arbitrage are eliminated.

RESPONSE OF ADAM SIEMINSKI TO QUESTION FROM SENATOR RISCH

Question 1. Please give us your thoughts on the unfairness and the unintended consequences of the Renewable Fuel Standard and what suggestions do you have for changes that will correct this problem?

Answer. My June 26, 2013, testimony before the Subcommittee on Energy and Power of the House Energy and Commerce Committee outlines EIA's views regarding the Renewable Fuel Standard (RFS) program. While I would refer you to the testimony for a complete perspective, four of its main points are briefly summarized below.

First, the RFS program is not projected to come close to achievement of the legislated target of 36 billion gallons of renewable motor fuels use by 2022. This is not a new finding—all of EIA's Annual Energy Outlook (AEO) Reference case projections since the targets were enacted in 2007 have indicated that EPA would need

to apply the law's flexibility to reduce requirements for cellulosic, advanced, and total biofuels.

Second, substantial increases in biofuels can only occur in forms other than the low-percentage blends of ethanol and biodiesel that account for nearly all of their current use. Of the potential alternative pathways (1) increased use of higher ethanol blends, (2) the advent of drop-in biofuels, or (3) the development of compatible renewable fuel components, such as biobutanol. So far, none have achieved a significant market role.

Third, the implicit premise that cellulosic and other advanced biofuels would be available in significant quantities at reasonable costs within 5 to 10 years following adoption of the 2007 RFS targets has not been borne out. The AEO Reference case projections do not assume breakthroughs in transformational biofuels technologies

EIA has not yet been able to discern an impact on gasoline prices due to the large increase in RIN prices in the first quarter of this year. While the cost of refined gasoline blendstock can be affected by high RIN prices, the increased cost to gasoline blenders is almost exactly offset by their increased revenue generated from the sales of RINs that are separated when ethanol is blended into gasoline. Going forward, EIA would expect that efforts to achieve the escalating targets for biofuels use specified in the RFS legislation would likely cause gasoline prices to increase relative to their level in the absence of an escalating RFS mandate. The actual outcomes will likely depend on the extent to the Environmental Protection Agency exercises its legal authority under the RFS statute to set standards for cellulosic, advanced, and total biofuels below the legislatively specified target levels.

RESPONSES OF ADAM SIEMINSKI TO QUESTIONS FROM SENATOR

Question 1. Can you comment on how converting vehicles to use natural gas as a fuel—to supplant either diesel or gasoline—might impact our finished product exports? I would guess that we'd export more products and it'd be good for our trade balance, but it could also result in refineries shutting down. What are your thoughts on this matter?

Answer. In EIA's Annual Energy Outlook 2013 natural gas use in vehicles, including both the direct use of natural gas in vehicles-i.e. liquefied natural gas used in heavy duty vehicles-and the indirect use of natural gas as liquids from a gas-to-liquids process, reaches 1.7 trillion cubic feet by 2040, displacing 0.7 million barrels per day of other motor fuels, principally diesel fuel. Over the same period, diesel fuel consumption increases by 0.8 million barrels per day, primarily for use in heavy duty vehicles, offsetting the displacement diesel fuel by natural gas. As a result, EIA does not expect the increased use of natural gas as a motor vehicle fuel to result in refinery shutdowns. Even if higher amounts of traditional petroleum fuels were displaced by increased natural gas use, the ability to export petroleum products could avoid the need to close refineries as long as they remained competitive in the global markets.

Question 2. Can you comment on how a technology like advanced EOR can extend the life of our oil fields? Or discuss other research areas that can help us get the most bang for our buck from these fields, and keep the oil flowing?

Answer. Technology development within the oil and natural gas industry is an ongoing process involving both the Federal laboratories and the research and development activities undertaken by oil and natural gas production and service companies. Almost all of the current EOR production results from the injection of either steam or carbon dioxide (CO_2) to improve oil field recovery rates.

The greatest current constraint to higher CO_2 EOR production is the lack of affordable CO_2 supply. If more CO_2 supply were available to oil producers at affordable prices, then CO_2 EOR investment and oil production could increase significantly. Both the Department of Energy laboratories and private industry are devoting substantial research dollars to develop more efficient and economic technologies to capture and concentrate CO_2 from fossil fuel combustion flue gases at electric power plants and at industrial manufacturing facilities. This research and development could have a great impact on increasing future oil production if it removes current constraints on CO_2 supply and makes significant new sources of CO_2 available to oil producers at affordable prices.

Two other areas of current EOR research also merit attention. The first of these is focused on supplementing steam and CO_2 EOR injection with the co-injection of chemical surfactants to further reduce oil viscosity, thereby further enabling the movement of oil to production wells. This research is still at an early stage and will require considerably more research and testing before it could be widely implemented.

Another avenue of steam and CO_2 EOR research is the better monitoring and characterization of the movement of fluids through oil reservoirs so that the bypassed oil in the reservoir can be produced. Better monitoring could be achieved with the better and less expensive downhole instrumentation and surface seismic equipment. Research efforts are underway to reduce the cost of downhole instrumentation and seismic equipment so that that they can be used more widely and frequently. The better characterization of fluids movement through the reservoir is being achieved through the research and development of better reservoir simulator software that show how to increase and optimize the movement of fluids through the reservoir.

APPENDIX II

Additional Material Submitted for the Record

STATEMENT OF CONGRESSIONAL RESEARCH SERVICE

This memorandum is written in response to your request for an analysis of crack spreads at U.S. refineries, over time, organized by Petroleum Administration Defense District (PADD).[1] Crack spreads calculated for this memorandum compare revenues earned by refineries from the sale of gasoline and diesel fuel to the cost of a variety of crude oils, including the composite value of domestic and imported oil as reported by the Energy Information Administration (EIA) as the refiner's acquisition cost of crude oil, West Texas Intermediate (WTI), and Brent crude oil. Monthly crack spreads were calculated for 2012.

Crack Spreads

Crack spreads are a simple, although incomplete, measure of refinery profitability. The simplest crack spread is the 1:1 spread which represents the refinery profit margin between a key product, usually value of gasoline, and the cost of crude oil. The incompleteness of this spread in measuring profit is seen by considering what is left out of the calculation. When a refinery processes a barrel of crude oil, over a dozen petroleum products are produced, although about 75 percent of the production output consists of gasoline and distillates. Each of these products has an economic value that contributes to the revenue side of the profit calculation. While crude oil represents about two thirds of the refinery's costs, labor, energy and other operating costs must also be met. As a result, a 1:1 crack spread is only a rough measure of likely profitability.

When considering a crack spread that more accurately reflects the output of a refinery, multiple products and their relative yields at the refinery should be accounted for. A 3:2:1 spread better reflects the yield of a typical refinery in that production yields double the amount of gasoline compared to distillates. This crack spread is calculated as the value of two barrels of motor gasoline plus one barrel of No. 2 distillate minus the cost of three barrels crude oil. Although this measure profitability remains incomplete, it does account for approximately 75 percent of the revenue earned by refinery.

If the calculated 3:2:1 crack spread has a positive value, this indicates the possibility of overall profitability for the refinery. If the value of the spread is negative, losses due to refinery operations are likely.

[1] PADD 1 is the East Coast. PADD 2 is the Midwest. PADD 3 is the Gulf Coast. PADD 4 is the Rocky Mountains. PADD 5 is the West Coast.

Table 1. 3:2:1 Crack Spread, 2012

(dollars per barrel)

	PADD 1	PADD 2	PADD 3	PADD 4	PADD 5	Average
January	10.76	18.74	12.28	15.17	14.26	16.23
February	9.00	25.14	16.58	22.50	22.98	19.24
March	10.68	41.07	18.15	37.23	25.83	26.59
April	15.39	38.99	9.14	48.16	24.37	29.21
May	14.83	36.06	15.08	51.63	28.12	29.14
June	13.63	34.96	16.80	43.04	23.32	26.35
July	13.15	39.42	20.81	42.14	21.40	27.38
August	16.15	45.99	27.55	45.64	31.18	33.30
September	23.76	42.52	25.49	50.40	34.45	35.32
October	17.91	34.59	21.98	49.58	31.37	31.08
November	13.79	30.57	14.58	42.30	27.89	25.82
December	10.16	30.43	14.13	29.50	15.91	20.02
Average	14.10	34.87	18.54	39.77	25.09	

Source: EIA data, available at www.eia.doe.gov.

Notes: Table entries are calculated as the value of 2 barrels of motor gasoline + the value of 1 barrel of No.2 distillate – the cost of three barrels of crude oil. Prices of gasoline and No 2 distillate are Refiners Sales for Resale Prices. Prices for crude oil are Refiners Acquisition cost of Crude Oil Composite.

Table 1 shows that the value of the 3:2:1 crack spread in PADDs 2 and 4, on average was over twice that of PADDs 1 and 3 and approximately 38% higher than PADD 5. Most of this difference can be traced to the lower costs of crude oil observed in PADDs 2 and 4. In 2012, PADD 5 refiners faced a composite refiner's acquisition cost of crude oil of $111.50 per barrel. In PADDs 3 and 5 the same measure of crude oil cost was $104.84 and $104.69 respectively. These costs contrast with those observed in PADDs 2 and 4 which were $89.42 and $84.71, both on a per barrel basis.

Differences in the cost of crude oil among the PADDs were not proportionately reflected in petroleum product prices. Motor gasoline sale prices, measured by the refiner's sale for resale price ranged from a low of $2.86 per gallon in PADD 3 to a high price of $3.07 per gallon in PADD 5. Refiners in the two PADDs experiencing the lowest crude oil costs, 2 and 4, received $2.89 and $2.86 per gallon in 2012. PADD 1 refiners obtained a price of $2.93 per gallon for motor gasoline for resale. A similar pattern was observed for No. 2 distillate with prices ranging from a high of $3.15 per gallon in PADD 4 to a low of $3.07 in PADD 3. The remaining PADDs had prices for No.2 distillate ranging from $3.10 per gallon to $3.13 per gallon.

Table 2 shows the year-on-year 3:2:1 crack spread, as well as yearly percentage changes, based on annual data from 2007 to 2012.

Table 2. Year-on-Year 3:2:1 Refiner's Composite Cost of Crude Oil Crack Spread 2007-2012
(dollars per barrel, percentage change)

	2007	2008	%	2009	%	2010	%	2011	%	2012	%
PADD 1	17.58	16.29	-7.3	11.27	-30.8	11.09	-1.5	11.07	-0.1	14.08	+27.1
PADD 2	25.78	18.75	-27.2	14.16	-24.4	15.01	+6.0	29.18	+94.4	34.88	+19.5
PADD 3	21.42	18.45	-13.8	11.34	-38.5	12.53	+10.4	16.30	+30.0	18.37	+12.6
PADD 4	31.77	26.36	-17.0	17.25	-34.5	21.85	+26.6	35.59	+62.8	39.75	+11.6
PADD 5	27.84	21.15	-24.0	18.78	-11.2	19.33	+2.9	20.85	+7.8	25.09	+20.3
U.S.	23.76	19.08	-19.6	13.79	-27.7	14.59	+5.8	20.49	+40.4	24.22	+18.2

Source: EIA data, available at www.eia.doe.gov

Notes: Table 2 is built from annual data, **Table 1** is built from monthly data. Small differences in data result from rounding and differences in monthly and annual data sets.

Table 2 shows that the spread values of 2007 could not be sustained in the recession period that began in December of 2007. Spreads declined in every PADD in both 2008 and 2009. Although the refining industry in all PADDs experienced negative profit growth after the recession, all continued to make positive profits, but at lower levels. Recovery began to take over in all PADDs except PADD 1 in 2010. 2011 was also a positive year for all PADDS except PADD 1. In 2012 profit growth, as measured by the 3:2:1 crack spread occurred in all PADDs. The years 2010 through 2012 coincide with the expansion of the use of domestic crude from shale deposits, especially in PADDs 1, 2, and 4.

Table 3. Year-on-Year 3:2:1 Brent Crack Spread 2007-2012
(dollars per barrel, percentage change)

	2007	2008	%	2009	%	2010	%	2011	%	2012	%
PADD 1	17.58	16.32	-7.1	11.20	-31.3	11.39	1.6	10.82	-5.0	13.95	28.9
PADD 2	20.24	16.74	-17.2	11.06	-33.9	11.39	2.9	11.10	-2.5	12.69	14.3
PADD 3	16.46	15.62	-5.1	9.24	-40.8	9.57	3.5	9.28	-3.0	11.43	23.1
PADD 4	22.76	19.54	-14.1	11.90	-39.0	14.61	22.7	11.94	-18.2	12.83	7.4
PADD 5	23.74	19.54	-17.6	15.82	-19.0	17.06	7.8	14.32	-16.0	18.15	26.7
U.S.	19.26	16.88	-12.3	11.34	-32.8	11.67	2.9	11.10	-4.8	13.53	21.8

Source: EIA data, available at www.eia.doe.gov

Notice: Table 3 is based on annual data

Table 3 shows the same 3:2:1 crack spread based on the yearly spot prices of Brent crude oil and the refiner's composite acquisition cost of crude oil. Brent averaged $77.04 from 2007 to 2009, while the refiner's composite acquisition cost of crude oil averaged $75.99 per barrel, approximately $3 per barrel less. From 2010 to 2012 the price gap widened still. Brent averaging $100.83 per barrel, while the refiner's composite acquisition cost of crude averages $93.16, over $7 per barrel less.

Table 4. Year-on-Year WTI 3:2:1 Crack Spread 2007-2012

(dollars per barrel, percentage change)

	2007	2008	%	2009	%	2010	%	2011	%	2012	%
PADD 1	7.68	13.59	77.0	10.85	-20.2	7.52	-30.7	27.26	262.5	21.53	-21.0
PADD 2	20.37	14.2	-30.3	10.81	-23.9	11.42	5.6	27.48	140.7	20.27	-26.2
PADD 3	6.56	12.39	88.9	9.08	-26.7	9.10	0.2	25.66	182.0	17.05	-33.6
PADD 4	22.56	15.3	-32.2	11.49	-24.9	14.74	28.3	36.50	147.6	30.44	-16.6
PADD 5	23.84	19.8	-17.0	15.6	-21.2	17.19	10.2	30.48	77.3	25.71	-15.6
US	19.36	11.15	-42.4	11.11	-0.4	14.45	30.1	37.48	159.3	31.[illegible]	-16.2

Sources: [illegible] available at www.eia.doe.gov

Notes: Table 4 is based on annual data.

Table 4 shows the 3:2:1 crack spread computed on the basis of the yearly spot price of WTI. The price of WTI averaged $77.99 per barrel from 2007 to 2009. This value was about $1 per barrel more than the refiner's composite acquisition cost of crude oil. From 2010 through 2012 WTI averaged $89.47 per barrel, about $1 per barrel less than Brent, and $4 per barrel less than the refiner's composite acquisition cost of crude oil.

Tables 3 and 4 are hypothetical in the sense that they were computed using the EIA spot prices for Brent and WTI. The product prices were computed on a PADD basis. It is unlikely that any refinery uses purely Brent or WTI or the EIA spot prices to price its [illegible] of petroleum products.

Comparison of Tables 3 and 4 shows the less than $1 per barrel premium WTI brought over Brent during 2007 and the less than $2 per barrel earned in 2009. During 2010 prices of the average WTI barrel sold for $9.5 over target. During 2011 & W 2012 Brent received a premium over WTI of $15 per barrel in 2011 and $17 per barrel in 2012.

Refining Capacity

Comparisons using the crack spread tables in this memorandum should be made in the context of the inequality of number of refineries, refinery capacity differentials in the PADDs

Table 5. U.S. Refining Base
(number of refineries, million barrels per day)

	PADD 1	PADD 2	PADD 3	PADD 4	PADD 5	U.S.
Number of Refineries	7	25	43	15	17	[illegible]
Refining Capacity	1.27	3.76	9.25	0.62	3.24	[illegible]

Sources: Anthony Andrews, Robert Pirog, Molly F. Sherlock, Brent D. Yacobucci, "The U.S. Oil Refining Industry: Background in Changing Markets and Fuel Policies", CRS Report R41478.

Notes: To some extent the PADDs are interconnected. As a result, some PADDs have access to the excess capacity over PADD demand in PADD 3.

In general, PADDs 1 and 2 rely on petroleum products from PADD 3. PADDs 4 and 5 are self-sufficient and PADD 3 has capacity above PADD 3 demand. Thus, even though a PADD may show a high 3:2:1 crack spread margin, the overall profit earned by the refining industry in that PADD may be less than that earned in other PADDs with a greater number of refineries and/or greater refining capacity.

Statement of Matthew Chesnes*

Abstract

This paper considers the effects of refinery outages (due to planned turnarounds or unplanned events) on current petroleum product prices and future refinery investment. Empirical evidence on these relationships is mixed and highly dependent on the size and duration of the outage, the geographic area considered, the level of inventories available at the time of the outage, and the tightness of the market as measured by the capacity utilization rate. Using a detailed database of plant-level refinery outages for both upstream and downstream refining units, I estimate the effects of outages on product prices controlling for the crude oil price and the ability of operating plants to respond to the outage. I also consider the effect of current market profitability on the likelihood of planned refinery outages and the effects of high utilization rates and planned maintenance on the likelihood of unplanned outages. I then use plant-level capacity data to analyze the effects of outages, profitability, and utilization rates on future investment decisions of the refinery.

Results based on OLS and probit models show that planned outages tend to occur during the spring and fall and during times of relatively low margins as measured by the crack spread. The length of time since the last plant turn-around is positively associated with future unplanned outages. Price regressions show that atmospheric distillation and catalytic cracking outages have positive effects on gasoline prices and these effects are larger the higher is the utilization rate at the time of the outage. The relationship between investment and (recent) past outages is weak, suggesting that refiners may be responding to longer-term trends in the operations and profitability of their plants.

Introduction

The United States is the largest consumer of crude oil in the world and this resource accounts for 40 percent of the country's total energy needs.[1] Although a majority of this oil comes from foreig11 sources, almost all is refined domestically. Refineries distill crude oil into a large number of products such as gasoline, distillate (diesel fuel and heating oil), and jet fuel. While much attention has been paid to the upstream crude oil production industry (see Hamilton (1983) and Hubbard (1986)), and the downstream retail sector (see Borenstein (1991 & 1997), Lewis (forthcoming), Noel (2007), and Chesnes (under review), very little research has fo-

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The opinions expressed here are those of the author and not necessarily those of the Federal Trade Commission or any of its Commissioners.

[1] Source: 2007 Annual Energy Review, Energy Information Administration (EIA).

cused on the role of the refining industry. In the short-run, refiners face a complicated linear progTamming problem of optimizing their operations using multiple types of crude oil, various configurations of upstream and downstream refining units, and many refined products whose prices are constantly changing.[2] This challenging problem is made even harder when considering the potential for full or partial plant outages which frequently occur. Over the longer term, refiners are also optimizing over the size of their plant, making investments in the capacities of upstream and downstream units to both process more crude oil and to have the flexibility to use different types of crude oil and change their output slate in the face of relative price changes. This paper considers the relationship between refinery outages, utilization rates, price spreads, and investment.

The optimal choice of capacity accumulation, i.e., the increased ability to distill crude oil into higher valued products, is a long-term decision. Capacity is expensive to build and may take time to come online so forecasts of future market conditions are crucial. A shorter-term problem involves a refiner's choice of capacity utilization. This rate measures the intensity with which a firm uses its capital, which for a refinery may include the use of boilers, distillation columns, and downstream cracking units.[3] In addition to planned outages that involve a plant going offline for preventative maintenance, unplanned outages also occur that can affect the entire plant or just individual units.[4] Since a refiner is interested in maximizing the profits of the plant, the prices of both inputs (crude oil and oxygenates) and outputs (gasoline, diesel fuel, etc.) are crucial to the short-run and long-run production and investment decisions. The crack spread, or the difference between the prices of crude oil, gasoline, and heating oil, is a proxy for the profitability of turning a barrel of oil into higher-valued products.

I first consider planned outages (also called turn-arounds) at US refineries. There is strong seasonality in the demand for refined products and refineries tend to choose to schedule planned turn-arounds when demand is low and spare capacity or product inventories can fill in for the lost production. However, refiners also face uncertain demand and may push back or move up planned outages when profitability (as measured by the crack spread) is relatively high or low respectively. However, shocks, such as hurricanes can and do occur, sometimes during periods when there is little excess capacity. Therefore, I next focus on unplanned outages. While weather events can occur randomly and affect a large number of plants, other idiosyncratic outages that only affect one plant (such as a refinery fire) may be related to the utilization rate at which the plant is running or the time since the plant last performed a turn-around.[5]

Once I understand when and why outages occur, I then focus on the effect of the outages on product prices. Some studies (EIA, (2011)) have found very little correlation between outages and product prices with crude oil price fluctuations being the primary driver of the variation in product prices. One benefit of the detailed outage data that I employ is that outages are reported by refining unit. Since some units (such as the Fluid Catalytic Cracking or FCC unit) are more important for the production of certain products (such as gasoline), I can determine how certain types of outages affect different product prices. Outages that occur during periods of low demand or high inventories likely have less of a price effect compared to periods where inventories are relatively low and/or utilization rates are high because plants are less able to respond to nearby outages. Therefore, my analysis will control for the level of market tightness at the time of the outage when assessing its impact.

Finally, I consider the effects of outages, price spreads, and utilization rates on investment decisions of the refiners. I expect that unplanned outages during a given year might lead to future investment as a refiner wants to update their plant and avoid future outages. The crack spread is a measure of profitability so in years following relatively wide crack spreads, I expect more investment if refiners expect that profitability will remain favorable in the future. Investments in capacity may also be larger if a plant found it optimal to run at a high utilization rate in the

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[2] Different types of crude oil are better adapted to producing certain refined products. Plants are heterogeneous in their complexity so some are able to process a wider variety of crude oils.

[3] More details on the refining process can be found in the next section.

[4] A refinery is generally composed of an upstream atmospheric distillation unit that first separates the crude oil and many downstream units, such as cracking units, hydrotreaters and reformers that further process the crude into higher-valued products. Though an upstream outage can have a domino-effect on downstream units, refineries can also buy feedstocks from other plants to partially mitigate the outage.

[5] Unfortunately, I do not observe plant-level utilization rates, but I do observe utilization rates at the refining district level. However, even these utilization rates only reflect the rate of atmospheric distillation (the first phase of refining) and not the production intensity of downstream units.

prior year. If high utilization rates generally lead to more unplanned outages, then investing in more capacity can help avoid future outages.[6] My data also allows me to study investments in both upstream (atmospheric distillation) capacity and and in downstream units. This is important because refiners may find it optimal to increase the complexity of their plant by investing in downstream units such as hydrocrackers and reformers that allow them more flexibility in their production slate.

While a fully structural model of the refining industry may provide important insights into the industry and how it responds to shocks, the complexity of the input and output choices, the heterogeneous technology, and other factors make modeling this behavior intractable.[7] The reduced-form approach in this paper allows to me assess the relationships between key variables and gain insights into how the oil refining industry responds to shocks, while averaging over some of the variation not captured by the model (such a refiner's choice of different types of crude oil).

My results indicate that planned outages tend to occur during the spring and fall and during times of relatively low margins as measured by the crack spread. Plants need to perform annual maintenance each year no matter how profitable are price spreads, so with very large crack spreads, some plants still perform planned turnarounds. The length of time since the last plant turn-around is positively associated with future unplanned outages. Since utilization rates are only available at the PADD-district level, unplanned outages are actually decreasing in the utilization rate, but this effect does not measure the impact of plant-level production intensity on future unplanned outages.

Price regressions show that atmospheric distillation and catalytic cracking outages have positive effects on gasoline prices and these effects are larger the higher is the utilization rate at the time of the outage. Distillate prices also respond positively to atmospheric distillation outages, but are unaffected by catalytic cracking outages, a unit better-equipped for producing gasoline. Investment in certain refining units is positively associated with planned and unplanned outages of those units, but in general, the relat ionship between investment and past outages is weak, suggesting that refiners may be responding to longer-term trends in the operations and profitability of their plants.

The remainder of this paper is organized as follows. In section 2, I provide an overview of the oil refining industry to better understand the complicated problem facing the refiner. I describe my data in section 3 and describe my empirical specifications and results in section 4. Section 5 concludes and provides a discussion of potential extensions.

2 Background on the US Oil Refining Industry

The oil industry is broadly comprised of several vertically oriented segments. They include crude oil exploration and extraction, refineries which distill crude oil into other products, pipeline distribution networks, terminals that store the finished product near major cities, and tanker trucks which transport products to retail outlets.[8] The largest refined product, gasoline, accounts for about 55 percent of total production, while distillate makes up another third. A full 68 percent of output from the oil refining industry is used in the transportation industry. Figures 1 and 2* provide a description of the production process and average product yields.[9] The main distillation process produces some final products like gasoline, but it is complemented by other units that extract more of the highest valued products. Technical details of the refining process and background on the types of crude oil available can be found in the appendix.

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[6] Relatively low product inventories, volatile prices, and investments by competing plants may also affect future investment decisions, but I do not focus on these relationships in this paper.

[7] In technical terms, the state space of crude and product prices, capacities, and inventories (to name a few) is very large. Modeling only a subset of these state variables masks important variation that is important to the refiner as he optimizes production each period.

[8] 75 percent of terminals in the US are owned by companies not involved in the upstream exploration and refining.

[9] Note the motor gasoline blending components are shown here as a part of refinery production, even though EIA reports them as a (negative) input into refining since they leave the refinery as an unfinished product, later to be mixed with other chemicals (usually ethanol) by a blender.

* All figures and maps have been retained in committee files.

The market for refined oil products is large and growing, with the US consuming 388 million gallons of gasoline each day and one quarter of the world's crude oil.[10] Aside from refining crude oil into gasoline, refmeries produce many products that are important inputs into other industries. Retail gasoline prices have recently experienced increased variability in the US and in summer 2008 hit an all time high of $4.11 per gallon. Wholesale prices peaked around $3.40 a gallon in the same period.[11] Many justify the high prices as a result of the growing demand for gasoline and supply limitations, including the scarcity of crude oil, Middle East uncertainty, hurricanes, and the OPEC cartel. Others claim the high prices result from coordinated anticompetitive behavior by big oil companies. Outages, investment and utilization choices by oil refineries may also play a significant role in affecting downstream prices.

About one-half of US production occurs near the Gulf of Mexico in Texas and Louisiana, though there are significant operations in the Northeast, the Midwest, and California. During World War II, the country was divided into Petroleum Administration for Defense Districts (PADDs) to aid in the allocation of petroleum products. Figure 3 displays a map of refinery locations along with delineations of the five PADDs and ten refinery districts.

While retail markets for gasoline tend to be very small, markets for wholesale gasoline are relatively large due to the extensive pipeline network use to transport most refined products. While a PADD may have roughly approximated a market in 1945, these delineations were made before the pipeline network had been fully developed, so they are now just a convenient way to report statistics on the industry.[12] A map of major crude oil and production pipelines is shown in figure 4. With important pipelines connecting the Gulf Coast production center to the population centers in the Northeast and the Midwest, PADDs I, II, and III are closely linked and may constitute one large wholesale gasoline market. The Rocky Mountain region (PADD IV) is fairly isolated from the rest of the country and imports only limited refined product from other regions. Finally, refiners on the West Coast (PADD V), which includes California, a state that, due to strict environmental regulations, are limited in their ability to use products that are refined in other states.

Aside from the domestic refining industry, US refiners face limited competition from abroad. While the US is very dependent on foreign oil, domestic production accounts for about 90 percent of US gasoline consumption, though the import share has grown since the mid 1990s. These imports come primarily into the Northeast, which receives 45 percent of its supply from outside sources, such as the US Virgin Islands, the United Kingdom, the Netherlands, and Canada. Recent US regulations limiting certain types of fuel additives combined with increased European dependence on diesel fuel has limited the ability of US markets to rely on foreign imports.

2.1 Capacity and Utilization of US Oil Refineries

The refining industry is fairly competit ive, with 142 refineries owned by 61 refining companies in January 2011. However, no new refineries have been built in the US since 1976. In fact, many plants have closed and the number of refineries ha..c; fallen from 223 in 1985. However, most of these closures were small and inefficient plants, and those that remain have expanded, so total operable capacity has grown from 15.6 million barrels per day (bbl/day) in 1985 to over 18 million bbl/day today (at mospheric distillation capacity). The overall number of refineries along with their production capacity are displayed in figure 5. The average plant size has increased from 74,000 bbl/day in 1985 to almost 128,000 bbl/day in 2011. The largest refiner (Exxon Mobil) controls about 10 percent of the total US refining capacity and the top five refiners account for 43 percent of total capacity.

Though the atmospheric distillation capacity of oil refineries is the most often cited figure when talking about the size of plants, downstream units are also becoming more and more important as refiners seek maximum flexibility in their production slate. Figure 6 displays the average size of downstream refining units as a proportion of total downstream capacity by PADD. While there are other downstream units, such as hydrotreaters and vacuum distillation units, these four units make up a majority of a normal refinery's downstream capacity. (Fluid) Catalytic Cracking units make the largest percentage of downstream capacity for all five PADDs. These units break up heavy gas oils into smaller and more valuable molecules. Catalytic

[10] Annual world consumption of crude oil totals 30 billion barrels, of which 7.5 billion barrels comes from the US. About 60 percent of crude oil used by refineries is imported and US consumption of refined gasoline represents 40 percent of world consumption.

[11] US regular gasoline, source: EIA. 6 Source: EIA

[12] For instance, the Colonial pipeline, which runs from the Gulf Coast up to the Northeast, was built in 1968. Pipelines now carry 70 percent of all refined products shipped between PADDs.

reformers are the next largest group of units and these are generally used to increase the octane level of petroleum products. Instead of breaking down molecules like a cracker, reformers reconfigure molecules to make them more valuable. Thermal cracking and catalytic hydrocracking are the smallest of the downstream units, though used relatively more in PADD V. These also break apart chains of hydrocarbons into smaller chains either using heat (thermal) or using a catalyst and hydrogen (hydrocracking). One extreme form of thermal cracking is known as coking, which breaks apart heavy feedstocks into lighter oils. Hydrocrackers are relatively more efficient at making distillate than making gasoline.

Capacity utilization rates at US refineries had been rising throughout the 1900s, but have fallen throughout the 2000s to an average of about 85 percent in 2011 as shown in figure 7. From 2000 to 2008, the average utilization rate in all US manufacturing industries was 77 percent, so even with the recent drop, refiners still operate their plants at high rates.[13] Also shown in the figure is the average utilization rate by month (averaged across years). It is clear that although annual averages have fallen, refiners still run their plants at a high rate during the high-demand summer driving months with utilization rates averaging over 90 percent.

Building a new refinery is very expensive, and environmental requirements and permits create significant hurdles.[14] Evidence from a 2002 US Senate hearing estimated the cost of building a 250,000 bbl/day refinery at around 2.5 billion dollars, with a completion time of 5-7 years (Senate (2002)). This assumes the various environmental hurdles and community objections are satisfied. No one wants a dirty refinery operating near them.[15] In May 2007, the chief economist at Tesoro, Bruce Smith, was quoted as saying that the investment costs in building a new refinery arc so high that you'd need 10 to 15 years of today's margins [at the time, around 20 percent] to pay it back."[16]

Even without new refineries, existing refineries have invested to expand capacity. The distribution of historical investment rates is shown in figure 8. While the mean investment has been 1.3 percent per year, the median is zero as plants tend to make very infrequent investments. Even restricting the sample to non-zero changes as shown in the graph, investments tend to be small, with almost 85 percent of the non-zero changes less than 10 percent. Though over half of the plant-year observations in my sample show no change in atmospheric distillation capacity, there is some investment in either upstream or downstream units in over 63 percent of the observations.

*2.2 Profitability (Crack Spreads)**

Although oil refining has historically been an industry plagued by thin profit margins, oil producers typically see larger profits when crude oil prices arc low and/or product demand is relatively high. One simple measure of the profit margin at a refinery is the "crack spread." For every barrel of crude oil the refinery uses, technological constraint.s require that about half of it goes into gasoline production and about a quarter into distillate. So the crack spread, expressed in dollars per barrel, is calculated as:

The crack spread for three stats are shown in figure 9. Data arc from EIA and arc based on the first purchase price of crude oil, gasoline and distillate in each state.[17] The crack spread fluctuates quite a bit from month to month, generally peaking in the summer months of each year. Refineries in each state may be using very different crude oils (for example Brent on the East Coast, WTI in the Midwest, and Alaskan North Slope on the West Coast). Though the crack spreads shown tend to move together, the levels vary and refineries in one area of the country may have better price spreads than in another area and these relationships change over time. Some argue that based on this measure of profitability, it is surprising that more refiners have not overcome the setup costs and entered this industry.

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[13] See http://jwww.federalreserve.govjreleases/G17jcaputl.htm.

[14] 0ne of the few new plants in development is in Yuma, Arizona. The builder is still acquiring all the necessary permits to begin construction, but plans to be up and running in 2013. Another project in Elk Point, South Dakota is also underway.

[15] Commonly referred to as "NIMBY," an acronym for Not In My Back Yard.

[16] The National Petrochemical & Refiners Association estimates that the average return on investment in the refining industry between 1993-2002 was 5.5 percent. The S&P 500 averaged over 12 percent for the same period. See "Lack of Capacity Fuels Oil Refining Profits" available online at http://www.npr.org/templates/story/story.php?storyld=l0554471 (downloaded: 09/13/2008).

*All equations have been retained in committee files.

[17] See: http://www.eia.gov/dnav/pet____ pet____pri____dfpl____m____.htm and http://www.eia.gov/dnav/pet/pet____pri____refoth____a____epm0____pwg____dpgal____m.htm

Aside from the recession of 2008, while total refining capacity has risen in the past 10 years, it has not kept up with demand growth. Capacity of oil refiners has increased by 10 percent in the past 10 years, while demand for gasoline has increased about 17 percent. The gap has been filled by new requirements that gasoline be blended with ethanol and to some degree, growing imports. However, new regulations requiring the shift from MTBE[18] oxygenates to ethanol poses a problem for this segment of supply because foreign refiners have not invested in the facilities to produce ethanol blended gasoline. Even with excess capacity, at certain times of the year supply alternatives can be limited so even a minor supply disruption (or a major one like Hurricane Katrina) can have a large price impact.[19]

2.3 Refinery Maintenance and Outages

An oil refinery is a complex operation that requires frequent maintenance, ranging from small repairs to major overhauls.[20] The regular maintenance episodes tend to be short and have minimal impact on production as they are strategically scheduled for low demand periods. Unplanned outages, by definition, can take place at any time and can have a major impact on production capability. The EIA divides refinery outages into four classes, summarized in table 2.3.**

Planned turn-arounds are major refinery overhauls, while planned shutdowns bridge the gap between turn-arounds. Unplanned shutdowns involve unexpected issues that may allow for some strategic planning of the downtime, but often may force a refinery to reduce production sub-optimally. Finally, emergency shutdowns are those that cause an immediate plant breakdown like a refinery fire.

Organization for planned turn-arounds typically start years in advance, and cost millions of dollars Lo implement, in addition to the revenue lost from suspending production. Due to the hiring of outside personnel, major refineries often have to plan these turnarounds at different times because of the shortage of skilled labor to implement them. Given the typical seasonal variation in product demand, the ideal periods for maintenance are the first and third quarter of the year, though in some northern refineries, cold winter weather forces shifts in planned downtimes. Figure 10 shows the planned and unplanned outages over time for all US plants. Clearly seen in the figure is the increase in unplanned outages following the hurricanes in 2005 and the increase in planned outages in 2009 as refiners went offline for maintenance as demand fell during the recession.

Even though refineries consist of several components, such as distillation columns, reformers and cracking units, these components are dependent on one another so a breakdown of any one component can affect the production capability of the entire refinery. Downstream units include hydrocrackcrs, reformers, fluid catalytic cracking (FCC) units, alkylation units, and coking units. They are responsible for breaking down hydrocarbons into more valuable products and removing impurities such as sulfur. For example, in a typical refinery, only 5 percent of gasoline is produced from the primary distillation process; the rest comes hydrocrackers (5 percent), reformers (30 percent), FCC and alkylation units (50 percent), and coking units (10 percent). Not all refineries have all of these components, so such refineries are even more affected when one component goes down (EIA (2007)).

Figure 11 shows the percent of capacity offline by year and for various refining units. Though the percentages tend to move roughly together, certain units are more affected in some years (e.g., most catalytic hydrocracking capacity is located along the Gulf Coast so was particularly effected by the hurricanes in 2005). Since 2005, typically 5-8 percent of each unit's capacity is offline in a given year for either planned maintenance or unplanned outages.

At the PADD level, EIA reports that in the 1999-2005 period, refineries experienced reductions in mont hly gasoline and distillate production of up to 35 percent due to outages. At the monthly frequency, there is little effect of outages on product prices. This is primarily because most (planned) outages occur during the low-demand months when markets are not tight; most outages last less than a month; and the availability of imports, increased production from other refineries, and inventories provide a cushion to supply. However, unplanned outages, like those caused by a hurricane, still affect may have significant effects on the downstream prices and profitability of all refineries.

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[18] Methyl Tertiary Butyl Ether.

[19] Following Hurricane Katrina on 9/23/05, capacity fell by 5 MBbl/Day. This represented a full one third of US refining capacity. Inventories are also limited as there is only about 20-25 days worth of gasoline in storage at any time.

[20] Refinery maintenance is crucial not only for production sustainability, but also for the safety of the plant . A 2005 fire at BP's Texas City refinery killed 15 workers and injured over 100 more.

** All tables have been retained in committee files.

Overall, the oil refining industry features several economic puzzles, some of which I explore in this paper. While the industry is relatively competitive, refiners at times can earn significant profits, as measured by the crack-spread. However, entrants have yet to overcome the regulations and costs of setting up a new plant and existing firms have been cautious in their expansion. As a result, plants may run at high rates of utilization, which leads to instability in the face of unexpected capacity disruptions. These outages can impact both product prices and the investment decisions of refiners.

3 Data

I collect outage data on all refineries from 2001 2010 from Petrocast (Industrial Info Resources) . Outage data are available by plant and unit type (atmospheric distillation, FCC, hydrocrackers, reformer, and thermal crackers) and planned and unplanned outages are reported separately. I observe the length of the outage (in days) and the number of barrels that were offline.[21] Descriptive statistics on the outages data are shown in table 2. Of the 13,696 plant-year-month observations in the data, 3,544 contain some type of outage. The average monthly atmospheric distillation outage is around 203,000 barrels.

I match the outage data with investment data that is publicly available from the US Energy Information Administration (EIA). The data reflect the current atmospheric distillation capacity of the plant, but also the capacities of the downstream units mentioned above. Capacity data is available at an annual level and descriptive statics for 2010 are shown in table 3. Almost all plants in the database have atmospheric distillation and reforming capacity and most have catalytic cracking units.[22] Investments in physical capacity are infrequent given the high costs of taking units offline while the changes are made. Therefore annual data is appropriate for measuring these changes, however smaller increases in capacity throughput (known as "capacity creep,) may occur throughout the year. Since EIA and Petrocast do not share a common plant identifier, I manually match plants between the two datasets based on their name and location, which results in a database containing 107 plants and representing about 92 percent of total US refining capacity.

Finally, I collect refiner wholesale prices of gasoline, distillate (diesel fuel), and first purchase prices of crude oil from which I create a simple 3-2-1 crack spread described in section 2.[23] Both the crude oil and product prices are usually available at the state-level so all refineries in a given state are matched to the same set of prices. For states that EIA does not report a crude oil price, I use the corresponding PADD price. In some regressions below, I also use PADD-level gasoline and distillate prices that are averages of the state-level prices. Gasoline and distillate stocks (available at the PADD level) and utilization rates (available at the PADD-district level) arc also matched to the data.[24] Descriptive statistics on utilization rates, prices, and refinery stocks are shown in table 4. Utilization rates during my sample average about 89 percent of atmospheric distillation capacity and crude prices average 58 dollars per barrel (though peak around $134 in 2008). The crack spread experiencs considerable variability over the sample period, ranging from 20 cents up to almost one dollar per gallon.

4 Empirical Specifications and Results

In the following section, I outline my empirical specifications and results regarding the relationships between oil refinery outages, profitability, utilization and investment. I first consider planned outages and how they are affected by profitability and time-ofyear effects. Then I move to unplanned outages and consider how the intensity at which a plant is running and the time since the last maintenance episode affect the likelihood of future outages. Once I understand the causes of outages, I then turn to their effect on prices, specifically considering how the current tightness of the market as measured by utilization rates and product stocks affect the impact of outages on prices. The last empirical specification brings everything to-

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[21] There are other potentially interesting dimensions to the data that I plan to exploit in future work. I mention a few in section 5.

[22] 0f the 107 plants in the database, 103 are active in 2010.

[23] EIA defines a first-purchase price as "An equity (not custody) transaction involving an arms-length transfer of ownership of crude oil associated with the physical removal of the crude oil from a property (lease) for the first time. A first purchase normally occurs at the time and place of ownership transfer where the crude oil volume sold is measured and recorded on a run ticket or other similar physical evidence of purchase."

[24] Data. are available here: capacity: http://www.eia.gov/petroleum/refinerycapacity/product prices: http://www.eia.gov/dnav/pet/pe___pri___refoth___dcu___nus___m.htm crude prices: http://www.eia.gov/dnavj/pet/pet___pri___dfpl_____m.htm utilization Rates: http://www.eia.gov/dnav/pet/pet___pnp___unc___dcu___nus___m.htm stock: http://www.eia.gov/dnav/pet/pet___stoc___wstk___a___epmO___sae___mbbl___m.htm

gether to determine how planned and unplanned outages, utilization rates, the crack spreads affect the future investment decisions of refiners.

4.1 Planned Outages

In this subsection, I try to answer the question, "Do refiners generally take planned downtime for maintenance when profit margins are low and do they delay taking their plants offline when margins are high?" To answer this question, I estimate the following regression:

Planned outages by refinery j in month m are regressed on the crack spread (available at the state level) and month fixed effects.[25] I estimate a simple probit regression predicting the probability of an outage, running separate models for all outages, atmospheric distillation outages, catalytic cracking outages, and catalytic hydrocracking outages. Controlling for month effects is crucial because it is well know that plants take annual maintenance in the low-demand periods (usually early spring and again in the fall) and my goal is to estimate the effect of the crack spread changing throughout the year.

Results of this specification are shown in table 5. The cocfiicient on the crack spread is negative and significant when considering the probability of any planned outage meaning that refiners to tend to hold off planned outages when profitability is favorable. I also consider planned atmospheric, catalytic cracking and hydrocracking outages separately, and the results generally hold for all but the last type of outage. The crack spread is clearly a very rough measure of refinery profitability so other prices and constraints may be affecting the result for the hydrocracking specification.

Interpreting the magnitude of these coefficients is easier by considering the marginal effects. In figure 12, I plot the marginal effects by the month of the year. The graph shows the strong seasonality in planned outages, peaking in May and again in October. I evaluate these effects at three different levels of the crack spread: the lOth, 50th and 90th percentiles. The higher crack spreads are associated with a lower predicted probability of a planned outage. Figure 13 shows the marginal effects of varying the crack spread for three different months of the year. The predicted probability of a planned outage ranges from over 0.3 when crack spread is low to less than 0.05 when tho crack spread is relatively high.

4.2 Unplanned Outages

Next, I move on to the question, "How are unplanned outages affected by utilization rates and the time since the last plant turn-around?" Unfortunately, utilization rates are only measured at the PADD-district level so are an imperfect proxy for the production intensity of any given plant. They also measure only the atmospheric distillation utilization, which is an important unit at a refinery, but only one of many that is involved in the production process. Therefore, I estimate the following regression:

Again, a probit model is estimated predicting the probability of an unplanned outage at refinery j in month m. The variable TSLTA measures the time since the last turnaround in months. I calculate this time using the last planned outage of the atmospheric distillation unit at a given plant. Turn-arounds generally involve complete plant shut downs so planned atmospheric distillat ion outages are a good indicator of turn-arounds.[26] Again, month fixed effects are included because, although unplanned outages are more random than planned outages, weather (such as, late summer hurricanes) can introduce some seasonality into unplanned outages.

Results of this specification are presented in table 6. While the TSLTA variable is consistently positive and significant as expected, the utilization rate is estimated to be negative and significant in all specifications. This is likely because the rate is measured at the PADD-district level and a large outage that affects all plants in a district will lead to large outages contemporaneous with low utilization rates where the outages may last more than a month, driving the negative relationship. In future work, I will consider only isolated outages, where one plant experiences an unplanned outage while its neighbors (in the same district) are fully operational.

Again, the magnitude of the effects are better seen with a graph of the marginal effects. Figure 14 shows the probability of an unplanned outage as a function of the time since the last planned plant turn-around. This effect is increasing though lower for higher utilization rates, ranging from about 0.10 for plants that have recently

[25] Including the crack spread in the previous month produces similar results.

[26] For robustness, I have also used both the time since the last planned FCC and hydrocrack outage and the results are similar.

performed maintenance to 0.25 for plants that have not experienced a planned turn-around in 8-9 years.[27]

4.3 Product Prices

The last two subsections showed that planned outages tend to occur during the spring and fall and during times of relatively low margins as measured by the crack spread. The amount of time since the last plant turn-around is positively associated with future unplanned outages. But the question then becomes, "Do these outages have an effect on prices?" An outage that occurs during a time when inventories are relatively high and/or nearby utilization rates are low, should have less of an effect on output prices than when the market is relatively tight. Therefore, I estimate the following regression equation using OLS:

Since wholesale prices arc generally determined by markets that are larger than individual states (due to pipelines, imports, etc), I run this regression on gasoline prices in PADD p and month m. The independent variables include the crude oil price, aggregate outages in the PADD, and gasoline stocks. Month and PADD fixed effects are also included to account for seasonality and any geographic variation in the level of prices unrelated to outages. I also run the model on distillate prices and stocks.

Table 7 presents results of four specifications run on gasoline and distillate prices using either atmospheric distillation outages or FCC (fluid catalytic cracking) outages. In each regression, I include planned and unplanned outages separately to determine if product prices are better able to absorb planned outages. The results clearly show that the variation in the crude oil price is the primary driver of the level of gasoline and distillate prices with coefficients very close to one. The gasoline price regressions also show that unplanned atmospheric and FCC outages have a positive and significant effect on prices, and the effect is about twice as large as the effect of planned outages (the latter coefficients are not statistically significant). Gasoline stocks have an expected negative and significant effect on prices.

The distillate price regressions show that planned atmospheric distillation outages have an effect on prices and FCC outages show no significant effect. The FCC unit is relatively more important for ga..c;oline production so this result is not unexpected though it is surprising that unplanned atmospheric outages show no significant effect. To better account for the fact that a refinery is composed of many refining units and each is more or less important for producing gasoline and distillate, I run two regressions of prices on the outages of individual refining units. These results are presented in table 8. The results show that atmospheric distillation and catalytic cracking have the largest positive effect on gasoline prices and thermal cracking is also important for distillate prices. In both specifications, the coefficient on reformer outages comes out negative and significant. This may be because reformers are used to increase the octane of gasoline so if the reformer goes down, plants will end up producing more (lower octane) regular grade gasoline, depressing the price.[28]

Finally, in figure 15, I show the estimated price effect of atmospheric distillation outages, where I run separate regressions for various levels of the utilization rate.[29] 95 percent confidence limits on the estimated coefficient arc also shown on the graph. The estimates are generally increasing in the prevailing utilization rate indicating that outages that occur during periods of high utilization rates have more of an effect on prices then when utilization rates are low. The economic importance of these results can be seen by estimating the predicted effect on prices for typical outages seen in the real world. For example, at 90 percent utilization rates, if an average US refinery went offline, the model predicts that gasoline prices would rise by 7.3 cents per gallon. When utilization rates are closer to 85 percent (the average

[27] The data are not rich enough to show planned turn-arounds that are spurred on by unplanned outages, but for robustness I calculate the TSLTA variable based on the time since the last outage (of any type) and the results are similar. Note, the mean and median time since the last planned atmospheric distillation outage are 17.5 and 13 months respectively.

[28] Explaining the coefficient on reformer outages in the distillate regression is harder, but it may have something to do with refiners increasing their distillate yield (perhaps by adjusting the yield on their hydrocracker) driving down the price of distillate.

[29] I run separate regression for months when the utilization rate in the PADD-district was between 72.5 percent and 77.5 percent and then between 77.5 percent and 82.5 percent, etc.

in 2011), the same outage would cause a predicted increase in gasoline prices of 2.4 cents per gallon.[30]

4.4 Investment

The last set of regressions consider how planned and unplanned outages, utilization rates, and profitability affect the future investment behavior of refiners. I expect that refiners would be more likely to invest in additional capacity following years with high crack spreads, high utilization rates, and large unplanned outages. I estimate the following regression:

Investment in capacity by plant j in year y is regressed on last year's average crack spread and utilization rate.[31] I include plant and year fixed effects in some of the specifications. Year fixed effects are important to control for the interest rate that may be changing over time and affecting a refiner's investment decision. Results are shown in table 9. The three specifications presented have no fixed effects, year fixed effects, and year and plant fixed effects respectfully. With a complete set of controls, the crack spread and utilization rate do come out positive as expected though both are insignificant. Outages, especially planned outages, are positively associated with investment, which may result from refiners taking planned outages to prepare their plants for future investments in capacity.

I also consider downstream investment in capacity as shown in table 10. Estimated coefficients on crack spreads and utilization rates are mixed. Unplanned outages of FCC units have a positive and significant effect on FCC investment and planned thermal cracking outages are also associated with more investment in thermal cracking capacity. However, other types of outages on the various refining units do not show a consistent or significant effect.

5 Conclusion

The focus of this paper was the effect of refinery outages on product prices and investment. It is well known that crude oil prices are the primary driver of gasoline and other petroleum product prices. However, I have shown that outages at refineries, both planned and unplanned, can have important implications for the level of prices and the future investment decisions of refiners. Refineries are extremely complicated operations and understanding how their operations and outages affect the price we pay for gasoline is difficult to determine. However, with detailed data on both the capacities and outages of individual refining units, it is possible to show that depending on the current market conditions (prevailing utilization rates and crack spread), refiner behavior can have an economically significant effect on product prices.

As expected, planned outages tend to occur during the low-demand periods and when crack spreads are less favorable for production, while unplanned outages are more likely to occur when a refiner has put off performing planned maintenance on the plant. Product prices are positively associated with outages, though the effect varies with the type of outage and the level of tightness in the market as measured by the utilization rate and product stocks. Finally, I showed that investment in certain refining units is higher when outages to those units have recently occurred, but the effects are weak suggesting that there are other considerations affecting a refiner's decision to invest in capacity. These likely include long-term forecasts of product demand, crude oil supply and prices, and a regulatory environment that is constantly changing and affecting a plant's profitability.

There are several directions for future work exploiting a few of the unique features of the dataset. The outage data includes information about planned outages that have been rescheduled or postponed. This may allow me to better estimate how refiners respond to economic conditions as they determine when to perform their planned maintenance. For more recent data (2009 and 2010) , I also observe the reason for the outage (planned turn-around, economic conditions, etc). A more challenging project involves gaining a better understanding of the motivations for investment (or divestment) in the refining industry since gasoline and other refined petroleum products are essential to the US economy and domestic refineries supply almost all of those products.

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[30] The first estimate is found by multiplying the predieted effect (1.5 cpg) by the size of an average refinery (161,000 bpd) divided by 1 percent of an average PADD's total capacity (33,227 bpd).

[31] The crack spread is based on state-level prices and the utilization rate is the average annual utilization rate in the corresponding refining district.

A The Distillation Process

Since the various components of crude oil have different boiling points, a refinery's essential task is to boil the crude oil and separate it into the more valuable components. Figure A.1 displays a simplified diagram of a typical refinery's operations. The first and most important step in the refining process is called fractional distillation. The steps of fractional distillation are as follows:

1. Heat the crude oil with high pressure steam to 1,112 degrees fahrenheit.
2. As the mixture boils, vapor forms which rises through the fractional distillation column passing through trays which have holes that allow the vapor to pass through.
3. As the varpor rises, it cools and eventually reaches its boiling point at which time it condenses on one of the trays.
4. The substances with the lowest boiling point (such as gasoline) will condense near the top of the distillation column.

While some gasoline is produced from pure distillation, refineries normally employ several downstream processes to increase the yield of high valued products by removing impurities such as sulfur. Cracking is the process of breaking down large hydrocarbons into smaller molecules through heating and/or adding a catalyst. Cracking was first used in 1913 and thus changed the problem of the refiner from choosing how much crude oil to distill into choosing an appropriate mix of products (within some range). Refineries practice two main types of cracking:

- Catalytic cracking: a medium conversion process which increases the gasoline yield to 45 percent (and the total yield to 104 percent).
- Coking/residual construction- a high conversion process which increases the gasoline yield to 55 percent (and the total yield 108 percent).

The challenge of choosing the right input and output mix given the available technology creates a massive linear programming problem.

B Crude Oil Quality

Crude oil is a flammable black liquid comprised primarily of hydrocarbons and other organic compounds. The three largest oil producing countries are Saudi Arabia, Russia and the United States.[32] Crude oil is the most important input into refineries and this raw material can vary in its ability to produce refined products like gasoline. The two main characteristics of crude that determine its quality are American Petroleum Institute (API) gravity and sulfur content. The former is a measure (on an arbitrary scale) of the density of a petroleum liquid relative to water.[33] Table B.l summarizes these characteristics and includes some common crude types and their gasoline yield from the initial distillation process.

Worldwide, light/sweet crude is the most expensive and accounts for 35 percent of consumption. Medium/sour is less expensive and accounts for 50 percent of consumption while heavy/sour is the least costly and accounts for 15 percent. Figure B.l show how the average crude oil used by US refiners is becoming heavier and more sour over time though leveling off toward the latter part of the 2000s. This means that the production costs of a gallon of gasoline are changing as refineries must invest in more sophisticated technology in order to process lower quality crude oil.

Since crude oil by itself has very little value to any industry, the price of a barrel of oil reflects the net value of the downstream products that can be created from it. The two major sources of movements in the crude oil price are upstream supply shocks (e.g., due to OPEC's production quotas, internat ional tensions, and hurricanes affecting oil rigs in the Gulf of Mexico) and downstream demand shocks (mainly due to consumer's demand for refined products). The other source often sited by industry experts are refinery inventories of crude oil. Maintaining stocks of crude oil allow the refinery to respond quickly to downstream shocks like an unexpectedly cold winter increasing the demand for heating oil.

Within the various types of crude oil, the prices of each quality respond differently to shocks. The ((light/heavy" differential is one measure that indicates the benefit a refiner can achieve by investing in sophisticated equipment to process heavier crude oil into highly-valued refined products. The differential has varied significantly over the last 10 years from 3 dollars per barrel to almost 20 dollars per barrel. An oil refinery faces a unique decision when making its production choice, one that provides for both flexibility and complexity. One one hand, consumers do not

[32] Production in this sense refers to the quantity extracted from a country's endowment.

[33] Technically, API gravity = (141.5/ specific gravity of crude at 60 F)—131.5. Water has an API gravity of 10° .

care about the type of crude oil, oxygenates, or distillation process used to make, for example, the gasoline they put in their cars. They just want their car to run well. While this would appear to make a refiner's problem easier, choosing their heterogeneous inputs, such as crude oil, satisfying federal, state and city environmental regulations, and all while maximizing profits, makes for an enormously complex optimization.

*C Other Tables and Figures**

Note: All equations have been retained in committee files.

STATEMENT OF ROBERT F. MCCULLOUGH, JR., MANAGING PARTNER, MCCULLOUGH RESEARCH, PORTLAND, OR

This report reviews the recent shift in the gasoline market in California. A careful re-view of the limited information available indicates that a relatively minor plant problem at ExxonMobil's Torrance refinery was to blame for the almost instantaneous increase in wholesale prices in October 2012. Yet there is evidence that the Torrance refinery problems were overstated and that speculation in gasoline began before the difficulties at Torrance were known and understood in the market. An article indicating that all of the majors took part in the speculative trading raises the question of collusion, since it would be unlikely that ExxonMobil, the owner of Torrance, would inform its competitors of operating problems prior to informing regulators and the media.

Since May 2012, retail prices on the West Coast have diverged significantly from fun-damentals. As a simple measure, the correlation of California retail prices and world oil prices was 90 percent, but in May the correlation had fallen to less than 2 percent. A traditional statistical study would be unable to reject the hypothesis that California retail prices are independent of world oil prices.

The chart* above draws a line (shown in red) through gasoline prices since April 2012. The shallow slope of the line indicates the marginal impact world oil prices have had upon California consumers since April 2012. Market data until May 2012 is shown in white. The slope of the white line reflects the traditional relationship between oil prices and gasoline prices. The quality of the statistical relationship is shown by the R_2. A perfect relationship between two variables has an R_2 of 1.00. The R_2 of two completely unrelated variables is 0.00. The R_2 value of 0.904 indicates that before May 2012, the price of gasoline could be well explained by the price of crude oil. However, since May, the R_2 value of .0185 suggests that there is almost no relationship between oil prices and gasoline prices in California.

The industry's response to studies questioning this abrupt change is generally uncon-vincing. The May spike was widely blamed on the Cherry Point fire in February. The October spike was largely blamed on the outage at Torrance, but the Richmond explosion—two months earlier—was also blamed. No explanation has been forthcoming on why price spikes would be delayed by several months instead of occurring immediately.

Gasoline markets in the U.S. traditionally track world oil prices. Additional critical information concerns the level of production and the size of gasoline inventories. These well-known factors are available on a weekly basis from the Energy Information Administration.[1] Some states provide more detailed information. The California En-ergy Commission publishes the Weekly Fuels Watch Report, which offers detailed data on gasoline inventories and production.[2]

It is often useful to "backcast" economic events, in this case examining a forecasting model to see how well the explanatory variables—oil prices, production, inventory, and demand—explain gasoline prices. The backcast of gasoline prices in California identifies two periods, May and October 2012, as periods when prices diverged significantly from fundamentals.

The following chart* compares the prices that would have resulted from the forecast with the actual prices over this period.

The May 2012 price spike reflects a period when gas prices increased while oil prices declined. The October spike is interesting since the price increase was more dramatic and took place over a very short time period. In fact, the rate of price increase over the October 2012 period is the highest observed between 2000 and the present, even after correcting for inflation.

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*All charts have been retained in committee files.

[1] http://www.eia.gov/petroleum/supply/weekly/

[2] http://energyalmanac.ca.gov/petroleum/fuels—watch/index.php

As shown in the chart above, the fundamentals in October 2012 would not have indicated a retail price increase. October gasoline sales in California showed a small increase over September 2012 and the price of crude in October showed a small decline over the period of the price spike. In fact, inventory levels actually increased during the spike—contradicting the shortage theory.

The California Energy Commission's alternative explanation of problems at ExxonMobil's Torrance refinery appears to have some merit, although the timing of the price spike is highly suspect[3] As mentioned, it appears that the price began spiking before the "power failure" at the Torrance refinery was publicly announced.

Gordon Schremp, the California Energy Commission's witness at the November 15, 2012 hearing held by the California Senate, provided the following chart*:

This chart suggests that the steep retail and wholesale price increases incurred imme-diately after the ExxonMobil problems at Torrance. Mr. Schremp argued that later data releases from the California Energy Commission showed stable production and increasing inventories which mitigated the perception of shortage and gradually re-duced prices.[4]

Announcement effects such as the California Energy Commission's alternative explanation generally are difficult to prove. The valuable information provided in the CEC's weekly reports is likely to affect market perceptions. Unfortunately, the data also reflects the fundamentals in the market, meaning that it is statistically very difficult to determine whether it was the CEC's report or the market fundamentals that affected prices.

The timing of the announcement of a power failure at ExxonMobil's Torrance refinery is another matter. The initial event, a frequency fluctuation on SCE's system, was extensively reported in the media. One reporter even referenced the "power bump, which was felt in the Daily Breeze offices on Hawthorne Boulevard, knocking out electricity for a split-second."[5]

ExxonMobil filed notifications with the South Coast Air Quality Management District (SCAQMD) at 8:20 a.m. and the California Emergency Management Agency at 8:28 a.m. Such notifications are not very informative other than noting the date and time of the event. Reuters reported on the SCAQMD flare notification at 8:21 a.m.[6] The first in-depth article describing the power outage was released by Dow Jones Newswire at 8:55 a.m.:

> ExxonMobil Corp. (XOM) on Monday said flaring could be visible throughout the day at its oil refinery in Torrance, Calif., due to equipment breakdown.
>
> The company reported the incident to the South Coast Air Quality Management District soon after it occurred at 10:20 a.m. EDT on Monday. The report said the unplanned flaring event is expected to end by midnight, but didn't say what equipment was involved in the event.[7]

This story was unlikely to lead to panic buying in California markets, although an article published 45 minutes later gave significantly more information:

> REFINERY NEWS—L.A. CARBOB DIFFERENTIAL JUMPS OVER 35 CENTS ON TORRANCE UPSET

Houston (Platts)—1Oct2012/1240 pm EDT/1640 GMT Refinery: Tor-rance, California Owner: ExxonMobil Overall capacity (b/d): 149,500 Units affected: N/A Units capacity (b/d): N/A Duration: Emissions window 7:20 a.m. PDT to 11:59 p.m. PDT Monday Notes: The Los An-geles CARBOB differential spiked more than 35 cents Monday after a power failure at the refinery, sources said.

The main California-specific grade of gasoline was heard done at NYMEX November RBOB contract plus 58 cents and plus 65 cents/gal early, and then bid to plus 85 cents/gal, with offers at $1/gal heard. Platts assessed the differential at plus 50 cents/gal on Friday.

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[3] Schremp, Gordon. "California Refineries: System Reliability, Gas Prices and the Economy." November 15, 2012.

[4] The October 5, 2012 CEC Weekly Fuels Watch Report indicated that inventories had actually increased from the previous week. http://energyalmanac.ca.gov/petroleum/fuelswatch/output.php

[5] Altman, Larry. "Torrance ExxonMobil refinery flare erupts against morning sky." Daily Breeze, October 1, 2012

[6] Unspecified Breakdown Leads to Flaring at ExxonMobil's 149,500 b/d Torrance, California Refinery." Reuters, 11:21 a.m. EDT., October 1, 2012. "ExxonMobil Corp. reported unplanned flaring due to an unspecified breakdown at its Torrance refinery Monday morning, according to a filing with the South Coast Air Quality Management District,"

[7] Marton-Vitale, Rose. "ExxonMobil Reports Equipment Breakdown, Flaring at California Refinery." DowJones Newswire, October 1, 2012.

The differential increase came after reports of the breakdown at the gas-oline-centric plant that sources said suffered a power failure. An Exx-onMobil spokeswoman did not immediately respond for comment.

The underlying November RBOB futures contract was trading at $2.8912/gal at noon EDT. Source: Market sources[8]

Translated into everyday English, this article says that prices in wholesale California markets had spiked $.35/gallon within 45 minutes of the first substantive coverage by the media and 80 minutes after ExxonMobil reported the event to SCAQMD.

It is clear that the reporting of the flaring to SCAQMD by Exxon did not cause, or even set in motion events that would cause prices to increase by $.35/gallon. During 2012, the Torrance facility reported 27 other flaring events, none of which set off price increases anywhere near the scale of those seen on October 1st.[9]

Why was this flaring report different, and what happened during this period that raised the wholesale price so significantly? From the official notifications and the thin media coverage, no outsider would be able to conclude that a major event had occurred at Torrance. As we discuss below, press coverage and SCAQMD emissions records suggest that production continued during this time period.

One media article described the majors jumping into the market on October 1:

> "Today, gasoline was like a bat out of hell," said the trader who asked not to be identified. "All the majors came out and bought. This morning it was all bad news from the get-go."[10]

The morning in question was roughly contemporaneous with the reports above since the article's author and, presumably, the unidentified trader, were in Houston.

The wholesale prices increased in California over three days. On Monday October 1st, there was a significant price increase of over $.20/gallon.[11] On Tuesday, prices in-creased $.14/gallon and on Wednesday, October 3rd, prices increased $.45/gallon.

The scale of the problem at Torrance is still doubtful. On Monday, ExxonMobil told the media that there had been an external power outage:

> "The ExxonMobil Torrance Refinery experienced an unplanned flaring event due to an external power interruption and notified the Torrance Fire Department," spokeswoman Gesuina Paras said in an email. "The cause is under investigation."[12]

A spokesperson for Southern California Edison described the situation differently:

> "But SCE says the only electricity incident that morning was a 'flickering light-type condition,' according to Steve Conroy, a Southern California Edison spokesman.
>
> Conroy describes it like a hiccup—lasting less than a second according to residential customers in the area. He says there was no outage at the substation.
>
> 'An outage just means you've lost service. Your power goes off. We're not aware of that happening in the community to other customers,' said Conroy. 'How that condition affected the refinery is not known to us at this point in time.'"[13]

Our previous reports on the gasoline price spikes relied on emissions data for individual refineries supplied by California's Air Quality Management districts.[14] We returned to this source to better understand how the Torrance refinery was affected by this flaring event and the resulting impact on the October 2012 price spike.

The evidence from the nitrogen oxide (NO_X) reports filed by ExxonMobil at SCAQMD tends to support a more moderate view of the incident. NO_X emissions

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[8] "Refinery News: L.A. CARBOB Differential Jumps Over 35 Cents on Torrance Upset." Platts Commodity News, October 1, 2012.

[9] SCAQMD flare archives at http://www.aqmd.gov/listserver/email/exxonmobiltorrance.arc/right.htm

[10] "US West Coast Products—Gasoline jumps on refinery outage." Reuters News, October 1, 2012.

[11] Different reports give different values for the price increases. The OPIS data represents an end-of-day survey. Press reports often cite anecdotal evidence after discussions with individual traders.

[12] "Refinery News Update: ExxonMobil reports breakdown at Torrance, California." Platts Commodity News, Oc-tober 1, 2012.

[13] "ExxonMobil Torrance refinery investigated for effect on spiking California gas prices." Los Angeles News, October 12, 2012.

[14] "May and October 2012 Gasoline Price Spikes on the West Coast." November 15, 2012, http://www.mre-search.com/pdfs/489.pdf

from the refinery's cogeneration facility dropped to 30 percent of Sunday's levels. This would indicate that the co-generation unit had gone off-line at 7:30 a.m. on October 1.

Cogeneration equipment is used to produce steam for operations elsewhere at a refin-ery. Torrance has three small cogeneration turbines that are integrated with the facility. A temporary "flicker" would normally take power generation equipment off-line in order to protect it from operating at a different frequency than the grid. The NOx data supports this scenario. The Fluid Catalytic Cracker, a critical part of the production process, showed increased NO_X emissions through Wednesday, October 3, which is consistent with the flaring associated with a shutdown and startup procedure.

Overall, the NO_X data does not support a full plant closure as a result of the frequency problem at Southern California Edison. Other than the Fluid Catalytic Cracker, half of the NOx reports from Torrance stayed at normal operating ranges during this period. In fact, most of the metered units continued at an intermediate level of operations.

By Wednesday, October 3, a Dow Jones Newswire article corroborated the NO_X data:

> Update—ExxonMobil Says Operations Normalizing at Its 149,500 b/d Torrance, California Refinery by October 3 after Power Outage October 1
>
> ExxonMobil Corp. said operations at its Torrance refinery were getting back to normal following a plant-wide power outage Monday morning. The power interruption, which was caused by an outage at a Southern California Edison substation, resulted in refinery unit shutdowns and slowdowns, which caused flaring. ExxonMobil said flaring associated with the normalization process could continue through October 9, ac-cording to a filing with the Southern California Air Quality Management District. The refinery anticipated only minimal impact to production, and expected to meet all its contractual commitments.[15]

The frenzied trading on October 1, 2012 followed by additional wholesale price increases on October 2 and 3 seem anomalous. The trading activity on Monday apparently predated news about the scale of the problems of the Torrance refinery and the media significantly overstated the severity of the problem:

> REFINERY NEWS—ExxonMobil reports breakdown at Torrance, California
>
> Houston (Platts)—1Oct2012/1222 pm EDT/1622 GMT Refinery: Torrance, California Owner: ExxonMobil Overall capacity (b/d): 149,500 Units affected: N/A Units capacity (b/d): N/A Duration: Emissions window 7:20 a.m. PDT to 11:59 p.m. PDT Monday Notes: ExxonMo-bil's Torrance refinery suffered a breakdown Monday leading to poten-tial emissions/flaring, according to an unplanned flare event filing to state regulators.
>
> The company did not immediately respond to a request for comment, but sources said the 149,500 b/d gasoline-centric plant near Los Ange-les suffered a power failure.
>
> The filing did not specify the nature of the breakdown or which unit or units may be involved. The filing said related emissions exceeding al-lowed levels were, according to estimates, more than 500,000 cubic feet of combusted vent gas and more than 500 lbs of sulfur oxides.[16]

Logically, ExxonMobil might have immediately sought some additional supplies upon hearing of the shutdown of the cogeneration units. It would not have been logical for ExxonMobil to notify its competitors of its activities, nor for the competitors to immediately start buying in the market on receipt of a standard flare report at SCAQMD.

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[15] "ExxonMobil: Torrance, California, Refinery Operations Normalizing after Power Outage." Dow Jones News-wires, October 3, 2012.

[16] "Refinery News: ExxonMobil reports breakdown at Torrance, California," Platts Commodity News, October 1, 2012.

A reasonable alternative explanation is that speculation in the California wholesale gas-oline market may have been the cause of the exaggerated media reports, and that the relatively minor outage at Torrance was viewed as an opportunity to secure windfall profits.

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