Joint Economic Committee | Democrats
Senator Amy Klobuchar, Vice Chair

MAY 2014

Gasoline Price Spikes

and Their Impact on the Economy

Executive Summary

Spikes in regional energy prices can have significant impacts on regional economies. When there are sudden increases in fuel prices, consumers spend less on other goods and services and businesses often pass along higher costs to consumers.

In the spring of 2013, the Midwest faced a spike in the price of gasoline which cost consumers and businesses more than $1 billion. A state-by-state breakdown of the economic impact of the recent gasoline price spike is included in this report.

This report examines the economic impact of spikes in regional energy prices; analyzes factors, including refinery outages, that lead to supply shortages and price spikes; and explores policies that would reduce the frequency of sudden increases in gasoline prices.

Regional gasoline price spikes can result from refinery outages, storage and transportation issues. Planned refinery shutdowns can take longer than anticipated, resulting in refineries being offline longer than expected. Refineries may need to be shut down without prior planning for unexpected maintenance or in the case of accident, fire or power outage.

In the Midwest in the spring of 2013, a number of oil refineries were shut down for planned maintenance at the same time, and delays and emergency shutdowns caused a gasoline supply shortage. Across the region, prices for a regular gallon of gasoline increased by 42 cents from April 15 to May 20. During the same period, the average regular gasoline price increased by 81 cents in Minnesota.

In the face of large price spikes, consumers have few options. People rely on gasoline for transportation to work and have few alternatives to automobile travel, especially in rural areas. Even large changes in gasoline prices have a minimal impact on supply and demand in the short term.

Low- and middle-income Americans are most affected by spikes in gasoline prices because a larger share of their income goes to gasoline consumption. On average, households in the lowest income quintile spend more than 12 percent of their incomes on gasoline and motor oil.

To reduce the effects of energy price spikes on consumers and businesses, policymakers should focus on decreasing the frequency of price spikes. Improving regional information collection on energy supply and demand, including refinery outages, increasing storage capacity, improving transportation and promoting alternative energy sources are policy options examined in this report.

JOINT ECONOMIC COMMITTEE
VICE CHAIR AMY KLOBUCHAR
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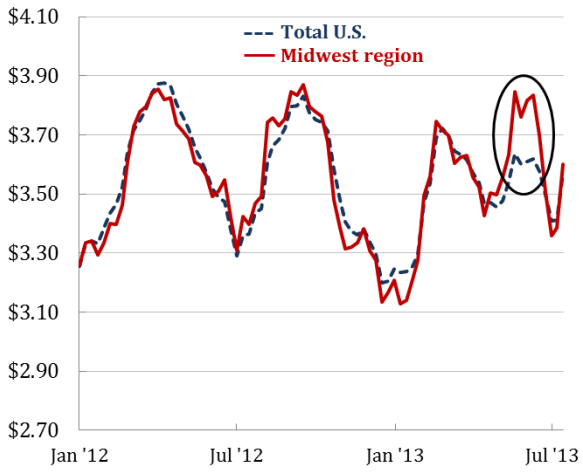
GASOLINE PRICE SPIKES AND THEIR IMPACT ON THE ECONOMY

Spikes in regional energy prices can have significant impacts on regional economies. Confronted with sudden increases in gasoline prices, consumers spend less on other goods and services and businesses often pass along higher transportation costs to consumers.

The Midwest faced a dramatic increase in the price of gasoline in the spring of 2013, harming consumers and the regional economy. Low- and middle-income households, as well as rural households, were hit hardest. The spike cost consumers and businesses in the Midwest more than $1 billion.

This report examines the economic impact of spikes in regional gasoline prices; analyzes factors, including refinery outages, that lead to supply shortages and price spikes; and explores policies that would reduce the frequency of sudden increases in gasoline prices.

Figure 1. Weekly Regular Conventional Retail Gasoline Prices, Total U.S. and Midwest Region ($/gallon)



Note: Black circle highlights Midwest price spike.
Source: JEC Democratic staff based on data from the U.S. Energy Information Administration.

Case Study: Midwest Gasoline Price Spike in 2013

The gasoline price spike in the Midwest was triggered by structural problems in gasoline refining and distribution. A number of oil refineries were shut down for planned maintenance at the same time, and delays and emergency shutdowns caused a gasoline supply shortage.[1] The shortage pushed up the price for a gallon of regular gasoline in the region by 42 cents from April 15 to May 20, 2013 (**Figure 1**). This price increase was even more dramatic in parts of Minnesota and North Dakota, which are farthest from the refineries in the Gulf Coast region. According to the U.S. Energy Information Administration (EIA), the average retail regular gasoline price in Minnesota increased by 81 cents between April 15 and May 20.[2] Prices did not come back down until five weeks after that peak.

Entering March 2013, Midwest gasoline inventories were robust, but they became depleted as both planned and unplanned outages took hold.[3] Augmenting those inventories with additional gasoline purchased from the Gulf Coast took weeks.[4]

Table 1. Estimated Impact of the Spring 2013 Price Spike on Gasoline Expenditures

States in Midwest Region	Estimated higher spending on all grades of gasoline during price spike
Illinois	$171,700,145
Indiana	$106,778,430
Iowa	$47,513,841
Kansas	$55,814,514
Michigan	$158,173,015
Minnesota*	$109,389,002
Missouri	$104,109,744
Nebraska	$28,974,151
North Dakota	$15,361,597
Ohio*	$143,379,833
South Dakota	$17,146,334
Wisconsin	$97,036,540
Total, Midwest Region	**$1,055,377,146**

* denotes prices that are specific to these states.

Source: JEC Democratic staff calculations based on data from the U.S. Energy Information Administration, monthly prime supplier sales and weekly prices by area.

Notes: Following the methodology in Bulow et al., we take the prime supplier sales in the state for the period April 15 - June 30, 2013 and multiply by the premium in the price relative to the Texas price minus the premium in the same period in 2012. The calculation is done separately for Regular, Midgrade and Premium gasoline sales. We use the Midwest region price as a proxy for the price in the state for all states except Minnesota and Ohio for which prices are directly available from the EIA.

This price spike harmed consumers and businesses across the Midwest, with consumers and businesses spending $1 billion more on gasoline during this period than otherwise would have been the case.[5] Consumers and businesses in six states (Illinois, Indiana, Michigan, Minnesota, Missouri and Ohio) experienced excess gasoline costs exceeding $100 million (**Table 1**).

Factors that Affect the Price of Gasoline

The United States depends on crude oil to meet its transportation needs.[6] The continued reliance on oil in the United States leaves consumers and the economy vulnerable to sharp increases in oil and gasoline prices. Even in a recovering or strong economy, rising oil prices can hinder growth, reduce employment and contribute to inflationary pressures.

Crude Oil Prices and Production

The price of crude oil is the main factor in the price of gasoline, accounting for almost 70 percent of the price of a gallon of gasoline.[7] Refining costs and profits (12 percent), distribution, marketing costs and profits (9 percent) and taxes (12 percent) also affect the prices consumers pay at the pump.

The price of oil depends largely on global supply and demand. The United States accounts for over 20 percent of global consumption, making it the largest consumer of petroleum in the world.[8]

Despite a small share of world reserves, production from unconventional sources (such as shale oil) has led to a significant increase in the number of barrels of oil produced domestically in the past decade.[9] Production reached 7.9 million barrels per day in December 2013 or 10 percent of the world's daily oil production.[10] In fact, in recent months, domestic production of crude oil has surpassed crude oil imports.[11] The International Energy Agency (IEA) predicts that the U.S. will surpass Saudi Arabia as the world's largest oil producer by 2016.[12]

Net crude oil and petroleum product imports in the United States have fallen by more than half since reaching a recent peak of 13.4 million barrels per day in August 2006.[13] In 2013, net imports of crude and petroleum products fell to 6.2 million barrels per day, the lowest level since 1987, and accounted for less than 33 percent of U.S. petroleum consumption last year.[14] The increase in domestic oil production from places like North Dakota and greater biofuel production are contributing to the decline in imports.

At the same time as oil production has risen, stronger vehicle gas mileage standards, growing use of telecommuting and e-commerce

and increasing natural gas production have helped reduce U.S. demand for oil.[15] Further efforts to reduce demand for crude oil in the United States could result in lower gasoline prices.

Supply Disruptions

Changes in the price of oil are a major, though not exclusive, driver of price swings consumers face at the pump.[16] Other factors that can lead to short-term price swings include natural or man-made disasters that disrupt supply, transportation networks or refinery output.

Because refinery output is concentrated in the Gulf of Mexico, supply disruptions in the Gulf region are likely to affect national prices of petroleum products. Hurricane Katrina, for example, caused the immediate loss of 13 percent of the nation's refining capacity when it made landfall in August 2005, while another 14 percent of refining capacity was lost when Hurricane Rita made landfall in September 2005.[17] As a result of the loss in Gulf Coast gasoline production and transportation disruptions, prices increased sharply across the nation. The largest price increases occurred on the East Coast.

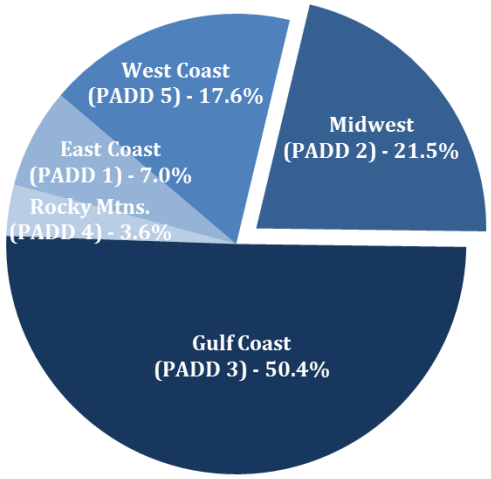
Regional price spikes are more likely to occur because of unanticipated refinery outages or transportation issues. Planned shutdowns can take longer than anticipated, resulting in refineries being offline longer than expected. Refineries may need to be shut down without prior planning for unexpected maintenance or in the case of accident, fire or power outage.[18] Those types of outages can have an impact on gasoline prices in a particular region. Economic studies have confirmed that unanticipated outages at local refineries result in higher gasoline prices.[19]

Refining Capacity

Different regions in the United States have varying access to gasoline supplies depending on the regional refining capacity and the ease with which gasoline can be imported into the region.

With half of the nation's refining capacity located in the Gulf Coast, that region supplies a large proportion of the petroleum products sold in the U.S. and produces much more gasoline than it consumes (**Figure 2**).[20] Gasoline prices in the Gulf Coast tend to be less volatile than the rest of the country because of the abundant supply of local gasoline. The East Coast relies heavily on gasoline deliveries from the Gulf Coast and to a lesser extent, international sources. The Midwest relies primarily on its own refineries and on gasoline deliveries from the Gulf Coast. The Rocky Mountain region relies on its own refineries, with production about equaling consumption. The West Coast relies primarily on its own refineries. California is particularly isolated when there are refinery outages because of its distance from the Gulf Coast.

Figure 2. Distribution of U.S. Refining Capacity
Share of operable crude oil distillation capacity
2012 annual averages



Note: PADD stands for Petroleum Administration for Defense District.
Source: JEC Democratic staff calculations based on data from the U.S. Energy Information Administration.

Planned and Unplanned Shutdowns

Refineries are shut down on regular intervals for routine maintenance to ensure their continued safe and efficient operation. Regional gasoline supply systems are more vulnerable during periods when significant turnaround (when the refinery switches between winter and summer fuels) and shutdown activity is occurring.[21] Any unplanned outages occurring during maintenance times, including planned turnarounds that take more time or are more extensive than previously planned, may lead to significant price spikes (**Box**).

Refiners operate as close to full capacity as possible, meaning that when there is an unanticipated shortage in supply, they do not have significant spare capacity that would enable them to quickly produce more gasoline. It is during this time, when supply has not adjusted and demand remains high, gasoline prices are more likely to spike. Over time, as additional supply reaches the region, prices come down. The duration of a price spike depends on how quickly refining can be resumed in the region to restore supply and how long it takes to import gasoline from other parts of the country.

Other Examples of Gasoline Price Spikes Resulting from Unanticipated Refinery Shutdowns

Several incidents of large price spikes have been documented that involve unanticipated refinery shutdowns which occur around times when the ability of the local refiners to increase production at other refineries was compromised. Those included spikes in the Midwest in June 2000, a spike in Arizona in August 2003 and spikes on the West Coast in 2012.

Midwest price spike in 2000: In the spring and early summer of 2000, several factors came together to lead to a spike in the price of gasoline in the Midwest.[1] During that time, the implementation of new Environmental Protection Agency regulations in certain urban areas corresponded with the national average retail price of reformulated gasoline (RFG) reaching a high of $1.67 per gallon. The price increase in the Midwest was significantly higher. For example, the price of RFG reached $2.13 per gallon in Chicago, and $2.02 per gallon in Milwaukee. At the request of Congress, the Federal Trade Commission investigated the matter and found that longer than anticipated turnarounds and unplanned outages caused by accidents were among the factors that led to the price spike.

Arizona price spike in 2003: When a pipeline supplying gasoline from West Texas to Phoenix, Arizona ruptured on July 20, 2003, the average price of gasoline in Phoenix went from $1.52 at the beginning of August, to a peak of $2.11 per gallon in the third week of August.[2]

West Coast price spikes in 2012: Domestic gasoline prices are generally highest on the West Coast because of slow arrival of supply from outside the region, the lack of pipeline capacity from the Gulf Coast, the unique blend of reformulated gasoline in California, and demand outpacing refining capacity. The prices spikes in May and October of 2012 were partly blamed on refinery fires.[3]

Sources:

[1] Jeremy Bulow and others, "U.S. Midwest Gasoline Pricing and the Spring 2000 Price Spike," *The Energy Journal*, vol. 24, no. 3 (2003).

[2] Federal Trade Commission, *Gasoline Price Changes: The Dynamic of Supply, Demand, and Competition*, (June 2005), p. iii, http://www.ftc.gov/reports/gasoline-price-changes-dynamic-supply-demand-competition-federal-trade-commission-report.

[3] Robert McCullough, Sean Long, and Jil Heimensen, McCullough Research, letter to McCullough Research Clients, "May and October 2012 Gasoline Price Spikes on the West Coast," (November 15, 2012), http://www.mresearch.com/pdfs/489.pdf.

Economic Impact of Gasoline Price Spikes

Even large changes in gasoline prices have a minimal impact on supply and demand in the short term. As discussed above, if there is an unanticipated shortage, for example due to a refinery outage, other refineries have little ability to quickly increase production. It takes several weeks for additional gasoline to be moved into a region. In addition, people rely on gasoline for transportation to work and have few alternatives to automobile travel, especially in rural areas.

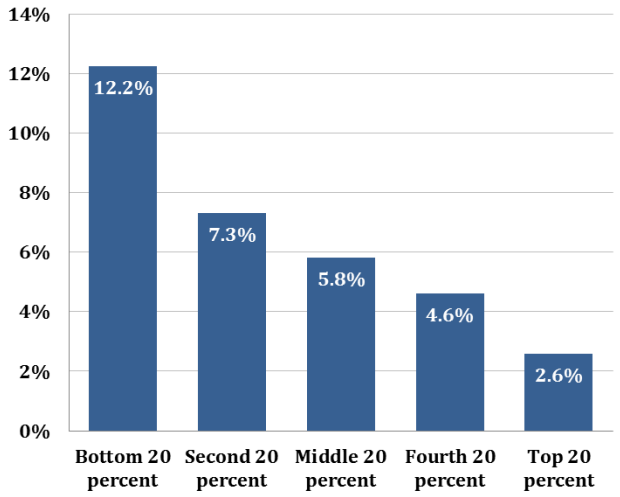
Many studies have confirmed that households do not reduce their consumption of gasoline by very much in the short term when gasoline prices increase.[22] As gasoline prices spike, consumers spend a larger share of their income to meet transportation needs, leaving less money for other goods and services. In addition to pushing up transportation costs, higher gasoline prices reduce consumer confidence, which can also affect consumer spending.

The price spike in spring 2013 was particularly difficult for consumers in rural areas in the Midwest. To minimize the impact of energy price increases on consumers and the economy, consumers must be able to quickly adjust their consumption when the price moves sharply or unexpectedly. Yet, over 90 percent of American households have at least one car and rely on those cars to go to work, run household errands and take vacations.[23] Many people living in rural and suburban areas have few transportation alternatives, such as mass transit.

Gasoline expenditures currently account for the highest share of consumer budgets since the 1980s.[24] Gasoline price spikes, therefore, can have a large impact on family budgets. Low- and middle-income Americans are most affected by spikes in gasoline prices because a larger share of their income goes to gasoline consumption (**Figure 3**). On average, households in the lowest income quintile spend more than 12 percent of their incomes on gasoline and motor oil.

Gasoline price spikes also affect the cost of goods and services across the economy. For example, an increase in the price of transportation fuel can lead to an increase in the prices of food and other common household items. Farmers who use energy to keep their equipment running are also vulnerable to price spikes. For businesses, increased transportation costs can reduce their profits, which ultimately reduce economic growth and tax revenue.

Figure 3. Household Spending on Gasoline and Motor Oil as a Share of Income, by Income Quintile



Note: Income includes public assistance and food stamps.
Source: JEC Democratic staff based on Bureau of Labor Statistics, 2012 Consumer Expenditure Survey.

Policy Solutions to Reduce the Impacts of Gasoline Price Spikes

Policymakers should focus on decreasing the frequency of gasoline price spikes by preventing or reducing the occurrence of shortages. Improving information collection on refinery outages and inventory levels can help suppliers maintain adequate supply levels. In addition, promoting alternative energy sources can help reduce demand for gasoline.

Improving Regional Information Collection and Sharing

Collecting and sharing additional information regarding supply and demand conditions could help reduce the risk of price spikes. This additional information should include inventory levels for all refined petroleum products (gasoline, diesel and heating oil). The EIA recently resumed "regular semiannual reporting on refinery outages and their potential implications for available refinery capacity and petroleum market products."[25] The reporting on planned refinery outages was recommended in the Gas Prices and Refinery Capacity Relief Act of 2013 (S. 1073) to avoid overlapping closures that could lead to price spikes.

Information about when an unusually large number of scheduled turnarounds and shutdowns are occurring at the same time in a particular region could help mitigate the risk of a supply disruption that leads to a gasoline price spike. While this information eventually becomes known to market participants, refiners generally do not know when other refiners have scheduled outages when making their own maintenance plans.[26] Refiners may be reluctant to share proprietary information for fear of violating federal antitrust laws and consider their maintenance schedules a trade secret.

Increasing Inventory Levels and Improving Reliable Transportation of Fuel

The Gas Prices and Refinery Capacity Relief Act of 2013 (S. 1073) would require the Secretary of Energy to consider the feasibility of increasing storage levels in regions that are especially vulnerable to shortages. Providing incentives to increase inventories may also help prevent shortages that lead to price spikes. In addition to improving storage, improving reliable transportation of fuel would help reduce or shorten price spikes. Regional differences in transportation infrastructure may require different storage levels. Storage levels should be scaled based on how quickly refined product can be transported into a region in the event of a supply disruption.

Promoting Alternative Energy Sources

There are very few alternatives to gasoline, so prices will rise when there is a shortage. To lower the costs of switching to an alternative fuel or alternative form of transportation, policymakers can invest in better mass transit, support development of alternative fuels and build out infrastructure networks that deploy alternative fuels. Currently, for example, there are nearly 160,000 gasoline stations in the United States, while there are about 700 public refueling stations for natural gas.[27] The Alternative Fueled Vehicles Competitiveness and Energy Security Act of 2013 (S. 1230) would accelerate the adoption of alternative fuel vehicles. This bill supports the deployment of alternative fuel filling stations and provides grants to train workers for manufacturing and maintaining alternative fuel vehicles as well as installing refueling infrastructure. Similarly, the Clean Vehicle Corridors Act (S. 1264) would strengthen the country's natural gas infrastructure by adding more alternative fuel fueling stations along the federal interstate highways. These corridors would encourage use of compressed natural gas, liquefied natural gas, liquefied petroleum gas, plug-in electric, advanced biofuels, hydrogen and other clean fuels.

Conclusion

Spikes in regional gasoline prices can have significant economic impacts on consumers in the affected regions. Consumers have less money to spend on other goods and services and businesses often pass along energy costs to consumers. Policymakers should take action to

reduce shortages, including improving information collection and providing incentives to increase inventory levels, which would decrease the frequency of gasoline price spikes.

Sources:

[1] There was planned maintenance at the ExxonMobil Joliet, Illinois, and Marathon Catlettsburg, Kentucky, refineries that reduced gasoline production in the Midwest. In addition, planned long-term projects occurring at BP's Whiting, Indiana refinery and Northern Tier's St. Paul, Minnesota, refinery also reduced regional capacity. All of this was occurring while refineries were transitioning to summer-grade gasoline. With capacity already compromised due to those planned events, a number of unplanned outages seemed to have stressed the system beyond the point of which existing inventories could make up the lost production. Those unplanned outages included HollyFrontier refineries in Cheyenne, Wyoming and El Dorado, Kansas, the Citgo LeMont Refinery in Illinois, and Flint Hills' St. Paul, Minnesota, refinery.

U.S. Energy Information Administration, *Refinery Outages: Description and Potential Impact on Petroleum Product Prices*, SR/OOG/2007-01 (March 2007), p. 35; Testimony of Dan Gilligan, President, Petroleum Marketers Association of America, before the Senate Committee on Energy and Natural Resources, (July 16, 2013), p. 3, http://www.energy.senate.gov/public/index.cfm/files/serve?File_id=57e91a3d-9cc4-4872-b1ee-b0c105169177 ; and U.S. Energy Information Administration, "This Week in Petroleum," (May 23, 2013), http://www.eia.gov/oog/info/twip/twiparch/2013/130523/twipprint.html.

[2] U.S. Energy Information Administration, "This Week in Petroleum," (May 23, 2013), http://www.eia.gov/oog/info/twip/twiparch/2013/130523/twipprint.html.

[3] U.S. Energy Information Administration, "This Week in Petroleum," (May 23, 2013), http://www.eia.gov/oog/info/twip/twiparch/2013/130523/twipprint.html.

[4] For example, it takes 12 to 18 days for gasoline to travel from the Gulf Coast to Chicago, and additional time may be required to schedule a pipeline shipment.

Jeremy Bulow and others, "U.S. Midwest Gasoline Pricing and the Spring 2000 Price Spike," *The Energy Journal*, vol. 24, no. 3 (2003), p. 129; and U.S. Energy Information Administration, "This Week in Petroleum," (May 23, 2013), http://www.eia.gov/oog/info/twip/twiparch/2013/130523/twipprint.html.

[5] JEC Democratic staff calculations based on data from the U.S. Energy Information Administration.

[6] U.S. Energy Information Administration, *Monthly Energy Review*, "Table 2.5: Transportation Sector Energy Consumption," (April 2014), http://www.eia.gov/totalenergy/data/monthly/.

[7] U.S. Energy Information Administration, "Frequently Asked Questions: What do I pay for in a gallon of regular gasoline?" (April 24, 2014), http://www.eia.gov/tools/faqs/faq.cfm?id=22&t=10.

[8] As of 2012, the U.S. consumed 18.5 million barrels per day of petroleum products and crude oil, down from a peak of 20.8 million barrels per day in 2005. The entire world consumes 88.7 million barrels per day.

U.S. Energy Information Administration, "Overview Data for the United States: Petroleum," (May 30, 2013), http://www.eia.gov/countries/country-data.cfm?fips=US#pet.

[9] Even with the recent expansion of proved reserves, the U.S. had only 26.5 billion barrels of proved reserves of oil compared to 267 billion barrels in Saudi Arabia and 1,525 billion barrels for the entire world in 2012.

U.S. Energy Information Administration, International Energy Statistics, "Crude Oil Proved Reserves (Billion Barrels)," http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=5&pid=57&aid=6.

[10] JEC Democratic staff calculations based on data from the U.S. Energy Information Administration, "Production of Crude Oil including Lease Condensate (Thousand Barrels Per Day)," (May 14, 2014), http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=50&pid=57&aid=1&cid=&syid=2013&eyid=2013&freq=M&unit=TBPD.

[11] In February 2014, the U.S. produced 8.033 million barrels per day of crude oil and only imported 6.96 million barrels per day.

U.S. Energy Information Administration, "Crude Oil Production," http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbblpd_m.htm; and "Net Imports of Crude Oil into the U.S. by Country," (April 29, 2014), http://www.eia.gov/dnav/pet/pet_move_neti_a_epc0_imn_mbblpd_m.htm.

[12] Alex Lawler, Ron Bousso, and Peg Mackey, "U.S. to surpass Saudi as top oil producer by 2016 – IEA," (November 12, 2014), http://www.reuters.com/article/2013/11/12/iea-outlook-idUSBQE7DN0FD20131112.

[13] U.S. Energy Information Administration, "U.S. Net Imports of Crude Oil and Petroleum Products," (April 29, 2014), http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=mttntus2&f=m.

[14] JEC Democratic staff calculations based on data from the U.S. Energy Information Administration, "U.S. Net Imports of Crude Oil and Petroleum Products" and "U.S. Product Supplied

of Crude Oil and Petroleum Products," http://www.eia.gov/petroleum/data.cfm. (As of April 29, 2014).

[15] According to EIA, energy consumption by light-duty vehicles peaked at 12,900 miles per driver per year in 2007 and had declined to 12,500 miles per driver per year in 2012. The share of the workforce that telecommutes at least one day of the week increased from 7% to 9.5% and the share of the working population that works exclusively from home increased from 4.8% to 6.6% from 1997 to 2010.

U.S. Energy Information Administration, Patricia Hutchins and John Maples, "Light-duty vehicle energy demand: demographics and travel behavior," (April 16, 2014), http://www.eia.gov/forecasts/aeo/veh_demand.cfm.

[16] U.S. Energy Information Administration, "Frequently Asked Questions: What do I pay for in a gallon of regular gasoline?" (April 24, 2014), http://www.eia.gov/tools/faqs/faq.cfm?id=22&t=10.

[17] Federal Trade Commission, Bureau of Economics, *Gasoline Price Changes and the Petroleum Industry: An Update*, (September 2011), p.24, http://www.ftc.gov/reports/federal-trade-commission-bureau-economics-gasoline-price-changes-petroleum-industry-update.

[18] U.S. Energy Information Administration, *Refinery Outages: Description and Potential Impact on Petroleum Product Prices*, SR/OOG/2007-01 (March 2007), p. 3.

[19] Federal Trade Commission, *Gasoline Price Changes: The Dynamic of Supply, Demand, and Competition*, (June 2005), http://www.ftc.gov/reports/gasoline-price-changes-dynamic-supply-demand-competition-federal-trade-commission-report; Matthew Chesnes, "The Impact of Outages on Prices and Investment in the U.S. Oil Refining Industry," (February 2012), www.chesnes.com/docs/RefineryOutages.pdf; Government Accountability Office, Energy Markets: Refinery Outages Can Have Varying Gasoline Price Impacts, but Gaps in Federal Data Limit Understanding of Impacts, GAO-09-700 (July 2009), http://gao.gov/products/GAO-09-700 ; and U.S. Energy Information Administration, *Refinery Outages: Description and Potential Impact on Petroleum Product Prices*, SR/OOG/2007-01 (March 2007), p. 3.

[20] See Figure 1, Testimony of Adam Sieminki, Administrator, U.S. Energy Information Administration, U.S. Department of Energy, before the U.S. Senate Committee on Energy Natural Resources, (July 16, 2013), http://www.energy.senate.gov/public/index.cfm/files/serve?File_id=bb2fa999-fe76-4c27-9853-fc21b7b3601e.

[21] Those "planned shutdowns" may take two to six months in planning and preparation with the shutdown lasting five to 15 days in duration. In addition to regular planned shutdowns, production units must go through major maintenance or overhaul activities termed as "planned refinery turnarounds."

[22] Short-term price elasticity of gasoline demand is significantly more inelastic today than in previous decades. Jonathan Hughes, Christopher Knittel and Daniel Sperling, "Evidence of a Shift in the Short-Run Price Elasticity of Gasoline Demand," *The Energy Journal*, vol. 29, no. 1 (2006).

[23] U.S. Census Bureau, American Community Survey, "Table DP04: Selected Housing Characteristics," 2012 1-year estimates, http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_12_1YR_DP04&prodType=table.

[24] U.S. Senate, Committee on Energy and Natural Resources, "To Explore the effects of ongoing changes in domestic oil production, refining and distribution on U.S. gasoline and fuel prices," Hearing, (July 16, 2013), Government Printing Office, Serial No. 82-692, http://www.gpo.gov/fdsys/pkg/CHRG-113shrg82692/pdf/CHRG-113shrg82692.pdf.

[25] U.S. Energy Information Administration, *Outlook for Refinery Outages and Available Refinery Capacity in the First Half of 2014*, (February 2014), p. 1, http://www.eia.gov/petroleum/refinery/outage/.

[26] Testimony of Dan Gilligan, President, Petroleum Marketers Association of America, before the Senate Committee on Energy and Natural Resources, (July 16, 2013), http://www.energy.senate.gov/public/index.cfm/files/serve?File_id=57e91a3d-9cc4-4872-b1ee-b0c105169177.

[27] U.S. Department of Energy, Alternative Fuels Data Center, "Alternative Fueling Station Counts by State," (May 14, 2014), http://www.afdc.energy.gov/fuels/stations_counts.html.