United States Government Accountability Office

Report to Congressional Requesters

March 2014

PETROLEUM REFINING

Industry's Outlook Depends on Market Changes and Key Environmental Regulations

GAO-14-249

GAO Highlights

Highlights of GAO-14-249, a report to congressional requesters

March 2014

PETROLEUM REFINING

Industry's Outlook Depends on Market Changes and Key Environmental Regulations

Why GAO Did This Study

The U.S. petroleum refining industry—the largest refining industry in the world—experienced a period of high product prices and industry profits from the early 2000s through about 2007. Since the recession of 2007 to 2009, the industry has been in transition.

Federal and state agencies regulate petroleum refining and the use of petroleum products to protect human health and the environment, as well as for other purposes. EPA, DOT, and California recently proposed or strengthened five key regulations, including EPA and DOT's coordinated fuel economy and GHG vehicle emission standards, and EPA's RFS, which has required that refiners and others ensure transportation fuels include increasing amounts of renewable fuels such as ethanol produced from corn.

GAO was asked to provide information on the domestic petroleum refining industry. This report examines: (1) major changes that have recently affected the industry and (2) the future of the industry. GAO reviewed information including studies by agencies and consultants and company financial filings; interviewed stakeholders, including agency officials and representatives of refiners and environmental organizations; and reviewed forecasts by the Energy Information Administration and others.

What GAO Recommends

GAO recommends that EPA identify the underlying causes of delays in issuing RFS standards and implement a plan to issue RFS standards on time. EPA generally agreed with GAO's findings and recommendations.

View GAO-14-249. For more information, contact Frank Rusco at (202) 512-3841 or ruscof@gao.gov.

What GAO Found

Stakeholders GAO contacted and information reviewed by GAO identified the following three major changes that have recently affected the domestic petroleum refining industry:

- *Increased production.* U.S. and Canadian crude oil production have increased, leading to lower costs of crude oil for some refiners. After generally declining for decades, monthly U.S. crude oil production increased over 55 percent compared with average production in 2008.
- *Declining consumption.* Domestic consumption of petroleum products declined by 11 percent from 2005 through 2012, resulting in a smaller domestic market for refiners.
- *Key regulations.* Two key regulations—the Environmental Protection Agency's (EPA) and Department of Transportation's (DOT) coordinated fuel economy and greenhouse gas (GHG) vehicle emission standards, as well as EPA's Renewable Fuel Standard (RFS)—have contributed to declining petroleum-based fuel consumption. For some refiners, compliance with the RFS increased costs in the first half of 2013, though costs have since declined to some degree from their peak. According to some stakeholders GAO contacted, this was primarily due to RFS requirements exceeding the capability of the transportation fuel infrastructure to distribute and the fleet of vehicles to use renewable fuels. Moreover, EPA has missed the statutory deadline to issue regulations establishing annual RFS blending standards since 2009. EPA has not systematically identified the underlying causes of these delays or changed its approach in order to avoid them. A late RFS contributes to industry uncertainty, which can increase costs because industry cannot plan and budget effectively, according to some stakeholders.

Stakeholders GAO contacted and information reviewed generally suggested that the U.S. refining industry's outlook depends on the following factors:

- *Domestic consumption.* Future consumption of petroleum products is uncertain, with projections ranging from stable to slightly increasing through 2020 but not returning to consumption levels of the past. Forecasts GAO reviewed suggest higher future refinery production in scenarios with higher domestic consumption.
- *Costs of key regulations*. The extent to which requirements in the key regulations increase costs for refiners will affect the industry's outlook. For example, future costs to comply with RFS may depend on the annual renewable fuel volumes EPA sets and whether EPA issues annual RFS standards on time. In general, increasing costs may be absorbed by refiners (i.e., by reducing their profits), be passed on to consumers through higher prices, or both.
- *Foreign markets.* The U.S. refining industry has increasingly relied on foreign markets. Exports grew from 7 percent of production in 2007 to 17 percent in 2012. The extent to which domestic refiners export their products will depend on the competitiveness of U.S. refiners. Factors that may affect competitiveness include domestic environmental regulations, levels of U.S. and Canadian crude oil production, and the balance between global refining capacity and demand for petroleum products.

Contents

Abbreviations

CAFE	Corporate Average Fuel Economy
CARB	California Air Resources Board
CI	carbon intensity
DOE	Department of Energy
DOT	Department of Transportation
EIA	Energy Information Administration
EPA	Environmental Protection Agency
GHG	greenhouse gas
IEA	International Energy Agency
LCFS	Low Carbon Fuel Standard
NHTSA	National Highway Traffic Safety Administration
OMB	Office of Management and Budget
ppm	parts per million
PSD	Prevention of Significant Deterioration
RFS	Renewable Fuel Standard
RIN	renewable identification number

U.S. GOVERNMENT ACCOUNTABILITY OFFICE
441 G St. N.W.
Washington, DC 20548

March 14, 2014

The Honorable David Vitter
Ranking Member
Committee on Environment and Public Works
United States Senate

The Honorable James Inhofe
United States Senate

The petroleum refining industry in the United States—the largest refining industry in the world—experienced what some observers and industry analysts have called a "golden age" from the early 2000s through about 2007. As we reported in 2007, this period was characterized by increased petroleum product prices, as well as higher price volatility and industry profits.[1] Conditions changed with the recession of 2007 to 2009—the most severe in this country since the 1930s—and the industry has since been in transition. Amid declining refining profits, seven refineries have closed since 2008, and the remaining refineries have not been run as intensively. Conditions have improved more recently, with an Energy Information Administration (EIA) official noting that the industry may be in a second golden age.[2] Petroleum refineries process crude oil into transportation fuels and other products (e.g., gasoline, diesel, and kerosene) that together comprise the largest source of energy in the United States—36 percent of the energy consumed in 2012, according to data from EIA. Domestic petroleum refineries produce the majority of the fuels used in our transportation system, which also uses a small portion of other fuels such as renewable fuels produced from corn, sugar cane, and soybeans.

Federal and state agencies regulate aspects of petroleum refining and the use of refined petroleum products for several purposes, including to protect human health and the environment, and to respond to concerns

[1]See GAO, *Energy Markets: 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,* GAO-08-14 (Washington, D.C.: Dec. 20, 2007).

[2]EIA is a statistical agency within the Department of Energy (DOE) that collects, analyzes, and disseminates independent information on energy issues.

regarding the nation's dependence on imported crude oil. Petroleum refining and the combustion of gasoline and diesel emit carbon dioxide, a greenhouse gas (GHG) linked to climate change. To address climate change and other concerns, the Environmental Protection Agency (EPA), the primary federal agency responsible for implementing many of the nation's environmental laws, along with the Department of Transportation (DOT) and the state of California recently proposed or strengthened five key environmental regulations as follows:[3]

- *Renewable Fuel Standard (RFS)*. Established in light of concerns such as climate change and the nation's dependence on imported crude oil, the RFS provides that U.S. transportation fuels must contain certain percentages of renewable fuels. Under the law establishing the program, volumes of renewable fuels were to increase over time, though EPA determines requirements annually and may reduce percentages under certain circumstances.[4]

- *Corporate Average Fuel Economy (CAFE) and GHG vehicle emission standards*. A coordinated program in which DOT establishes fleet-wide gas mileage or fuel economy standards and EPA establishes GHG emission standards for vehicle manufacturers.

- *Tier 3 Motor Vehicle Emission and Fuel Standards*. EPA's standards for vehicles and transportation fuels to reduce emissions of certain air pollutants.

- *Stationary source GHG requirements*. EPA's new requirements to address GHG emissions at new refineries and refineries that undertake major modifications.

- *Low Carbon Fuel Standard (LCFS)*. California's recently implemented LCFS requires reductions to the amount of carbon in California's transportation fuels. California is important for the domestic refining industry because it is the nation's largest consumer of petroleum-

[3]We use the term key environmental regulations to refer to these five regulations.

[4]The RFS was created in the Energy Policy Act of 2005, and then expanded through the Energy Independence and Security Act of 2007. See Pub. L. No. 109-58, § 1501 (2005) and Pub. L. No. 110-140, §§ 201-203, 210 (2007), codified as amended at 42 U.S.C. § 7545(o) (2013).

based transportation fuels. It also has the nation's third largest refining capacity, after Texas and Louisiana.

You asked us to provide information about the domestic petroleum refining industry and its market environment. This report examines what is known about: (1) major changes—including key environmental regulations—that have recently affected the domestic petroleum refining industry and (2) major factors that may affect the future of the domestic petroleum refining industry—including its production, profitability, and competitiveness in foreign markets.

To conduct this work, we reviewed information, including studies by federal agencies and consultants, and company financial regulatory filings; and summarized the results of interviews with a nonprobability sample of 32 stakeholders. Stakeholders included representatives from refining companies, environmental organizations, consultants, and officials from federal and state agencies. We also visited several refineries of selected refining companies. We selected these stakeholders to represent broad and differing perspectives on these issues based on recommendations from agencies, industry associations, and others. We took into account such factors as the location and size of companies' refineries. Because we used a nonprobability sample, the views of stakeholders are not generalizable to all potential stakeholders but provide illustrative examples of the range of views. Similarly, the conditions at the refineries we visited are not generalizable to all refineries. The stakeholder views we summarize were not necessarily supported by all types of stakeholders, though we identify differing views where appropriate. The stakeholders we contacted and information we reviewed identified a number of changes that have affected industry and factors that may affect its future, and we report on those that were most often cited. Based on our research and information from stakeholders, we identified five key regulations that were recently strengthened or proposed, though other regulations may also affect the industry. To illustrate major changes affecting industry over time, we summarized historical data from EIA. We took several steps to assess the reliability of EIA data, including reviewing documentation, interviewing EIA staff, and consulting with stakeholders. We determined the EIA data to be sufficiently reliable for the purposes of this report. To provide information about major factors that could affect the industry, we also reviewed

forecasts from EIA, the International Energy Agency (IEA),[5] and IHS,[6] and summarized projections through 2020 under different scenarios. While forecasts are subject to inherent uncertainties, we found these forecasts to be reasonable for describing a range of views about potential conditions of the domestic refining industry and major factors that will help determine these conditions.[7] Appendix I provides additional information on our scope and methodology, and appendix II lists the stakeholders we interviewed.

We conducted this performance audit from November 2012 to March 2014 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

This section describes the petroleum refining industry and the five key regulations that we reviewed.

Petroleum Refining Industry

According to data from EIA, there were 143 petroleum refineries in the United States as of January 2013, with a capacity to process 17.8 million barrels of crude oil per day.[8] While there are refineries in most regions of the country, most refining capacity (almost 90 percent) is located in the

[5]IEA is an international organization composed of 28 of the member nations of the Organisation for Economic Co-operation and Development that, among other things, collects energy data and provides research and analysis on ways to ensure reliable, affordable, and clean energy.

[6]IHS is a firm that provides comprehensive economic and financial information on countries, regions, and industries.

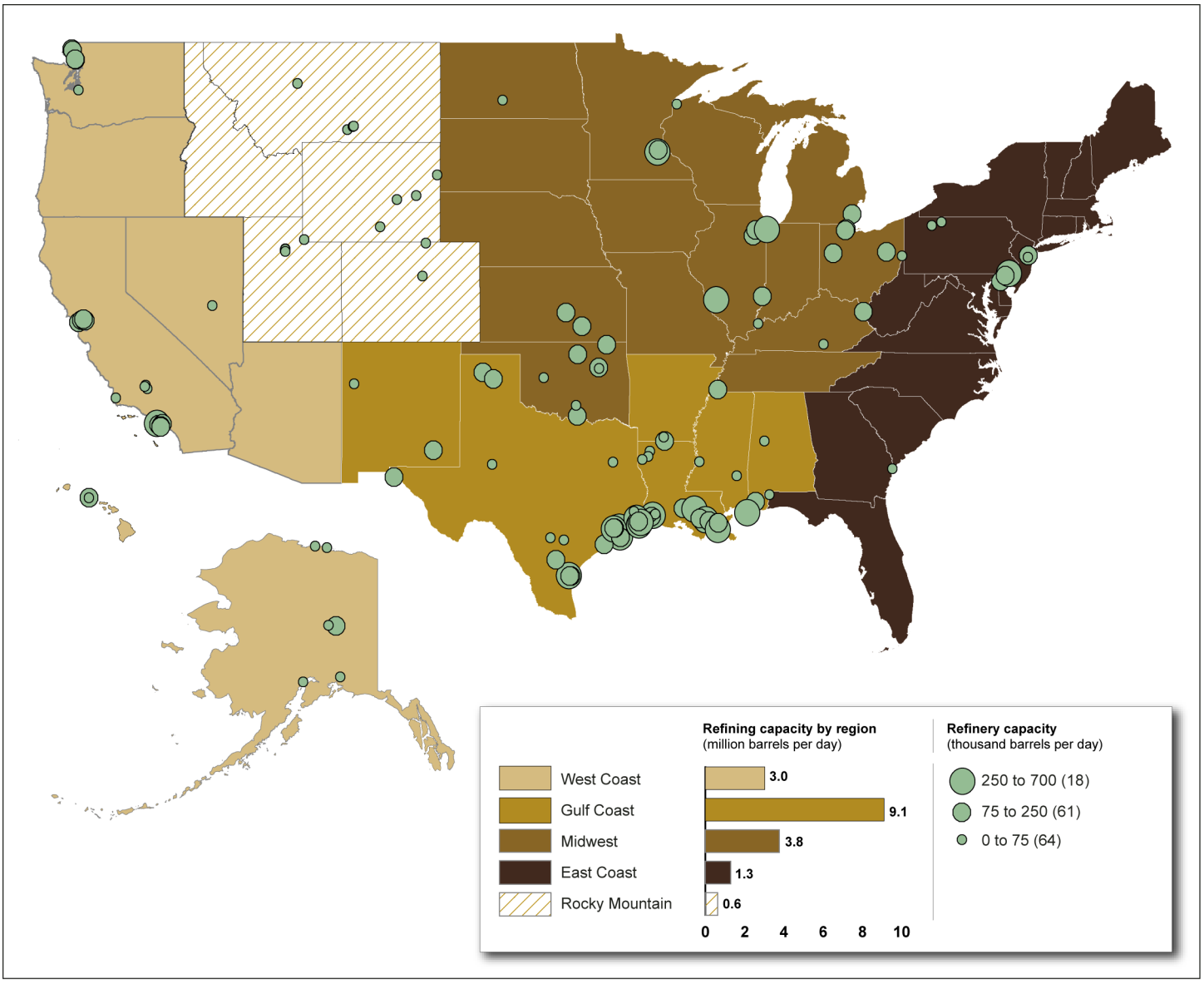
[7]Forecasts reflect assumptions and data available at the time the forecasts are developed. The forecasts we reviewed were developed at different points in time. For example, the 2013 EIA forecast we reviewed was released in April 2013 while IHS's forecast was released in October 2013. More recent forecasts may more fully reflect recent developments such as changes in economic growth and in crude oil production.

[8]A refinery's capacity refers to the maximum amount of crude oil designed to flow into the distillation unit of a refinery, also known as the crude unit.

Gulf Coast, West Coast, and Midwest regions (see fig. 1).[9] These refineries employed over 70,000 people in 2013.

[9]These regions are Petroleum Administration for Defense Districts, which were created during World War II to help organize the allocation of petroleum products. Many petroleum data collection organizations use these regions to organize their data for analytical purposes.

Figure 1: Location and Capacity of Petroleum Refineries and Capacity by Region as of January 1, 2013



Sources: GAO analysis of EIA data; MapInfo (map).

Note: These regions are Petroleum Administration for Defense Districts.

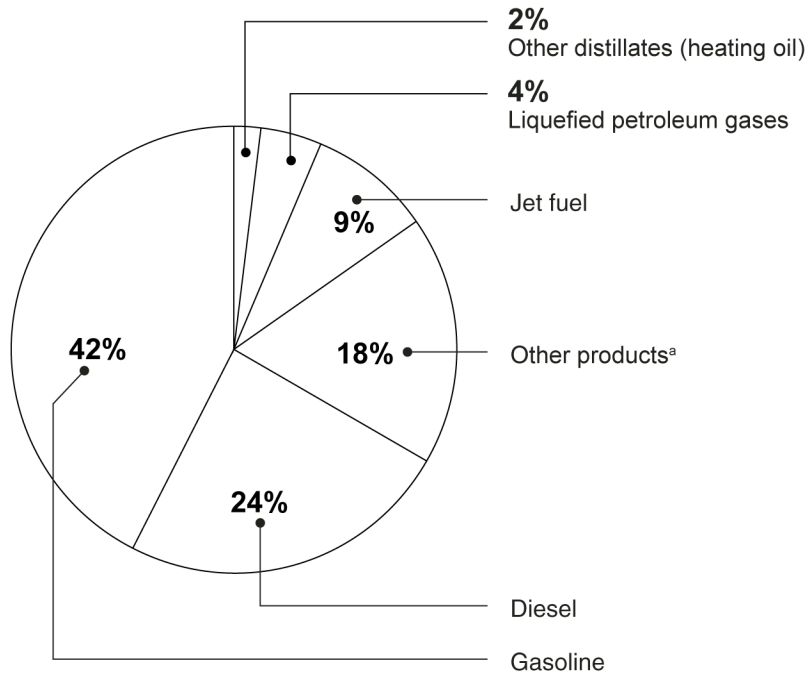
Refineries process crude oil into products primarily through a distillation process that separates crude oil into different fractions based on their boiling points, which can then be further processed into final products. One barrel of crude oil can be processed into varying amounts of

gasoline, diesel, jet fuel, and other petroleum products depending on the configuration—or complexity—of the refinery and the type of crude oil that is being refined. Through the addition of specialized equipment, refineries can be optimized—or "upgraded"—to produce greater proportions of specific types of products or to use different types of crude oil. For example, a coker unit upgrades the low-value residual oil from the distillation process into higher value products such as diesel, increasing a refinery's ability to process heavier crude oils.[10] As shown in Figure 2, from a barrel of crude oil, U.S. refineries primarily produce gasoline, diesel, and jet fuel that are used in the transportation sector, along with heating oil and liquefied petroleum gases such as propane used in home heating.[11]

[10]Coking processes use temperatures greater than 900 degrees Fahrenheit to thermally break molecules that make up feedstocks into products such as diesel, leaving behind petroleum coke—a coal-like material. Petroleum coke is used as a fuel input to produce electricity or as a raw material in the steel and aluminum industry.

[11]Except where noted, we use the term diesel to refer to what EIA calls distillate fuel oil. Distillate fuel oil is a general term that includes primarily diesel fuel, as well as fuel oils used for heating and electric power generation. In 2011, 90 percent of distillate fuel oil was diesel according to EIA data.

Figure 2: Petroleum Products Made from a Barrel of Crude Oil in the United States in 2012



Source: GAO analysis of EIA data.

[a]Other products include heavy fuel oil, petroleum coke, asphalt and road oil, and other miscellaneous products.

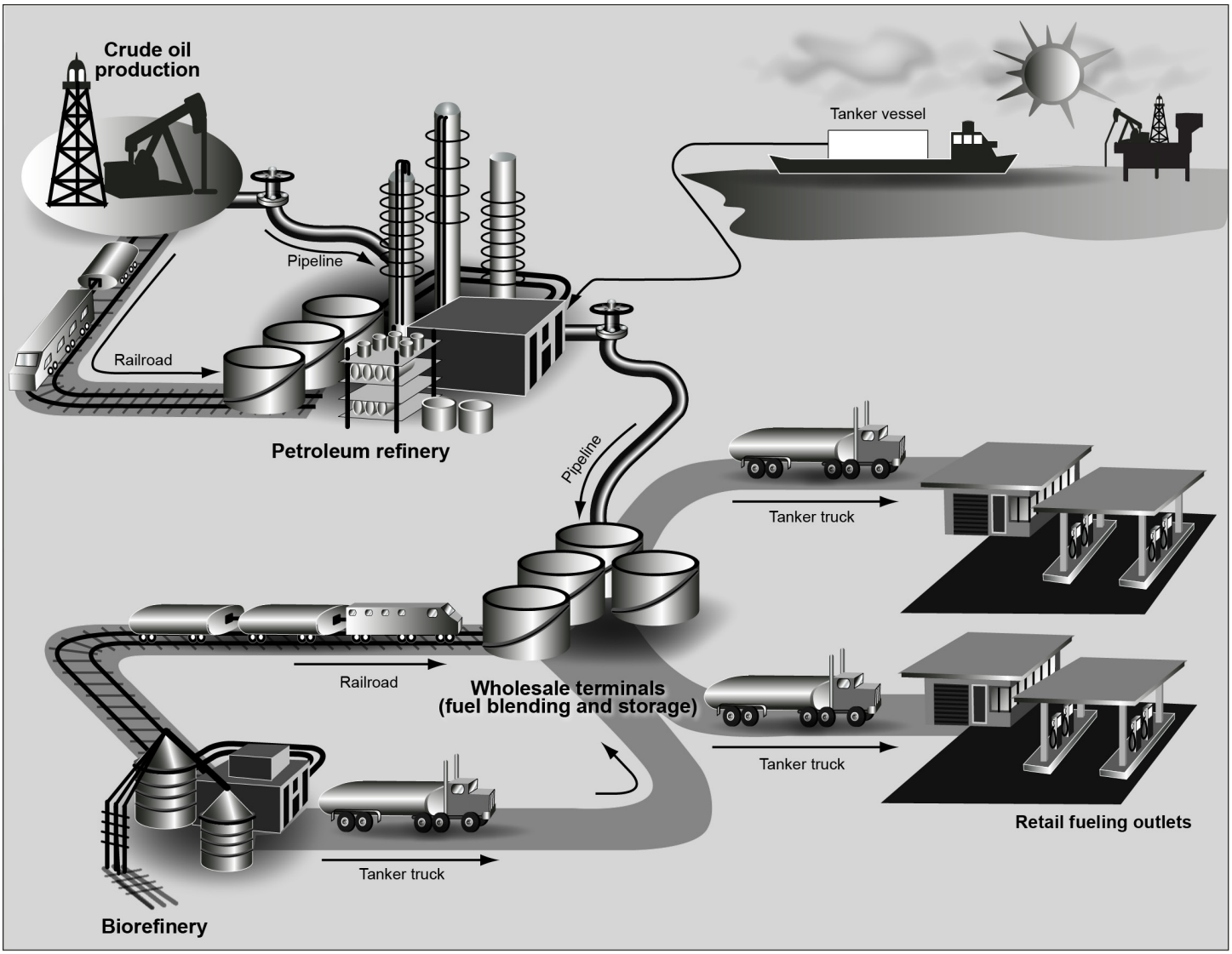
Note: Numbers do not add to 100 due to independent rounding.

The U.S. petroleum refining industry consists of firms of varying sizes that, in addition to operating refineries, may also have operations in other related industry segments: (1) the upstream segment, which consists of the exploration for and production of crude oil; (2) the midstream segment, which consists of pipelines and other infrastructure used to transport crude oil and refined products; (3) the downstream segment, which consists of the refining and marketing of petroleum products such as gasoline and heating oil; and (4) the renewable fuels segment, where biorefineries produce renewable fuels that are blended with petroleum products at wholesale terminals before being distributed to consumers. To varying degrees, refiners may primarily operate refineries—these are called merchant refiners—or may be integrated, participating in various other related industry segments. HollyFrontier Corporation is an example of a merchant refiner that purchases crude oil from unaffiliated producers and sells refined products to other companies operating retail fuel outlets,

while Chevron is an example of a fully integrated company, a refiner that also produces crude oil and operates pipelines and retail fueling outlets across the United States.

Crude oil, petroleum products, and renewable fuels are transported between market participants through an extensive supply infrastructure including pipelines, tanker vessels, rail, trucks, wholesale terminals, and retail outlets. (See fig. 3.) In 2012, refineries received the majority of their crude oil by pipeline (over 50 percent) and by tanker vessel (37 percent), with trucks and rail generally playing a more limited role according to EIA data.

Figure 3: Primary Transportation Infrastructure for Crude Oil, Petroleum Products, and Renewable Fuels



Source: GAO.

Note: Other means of transportation are also used to move petroleum and renewable fuels to wholesale terminals. For example, for ethanol, barges are also used to a limited extent.

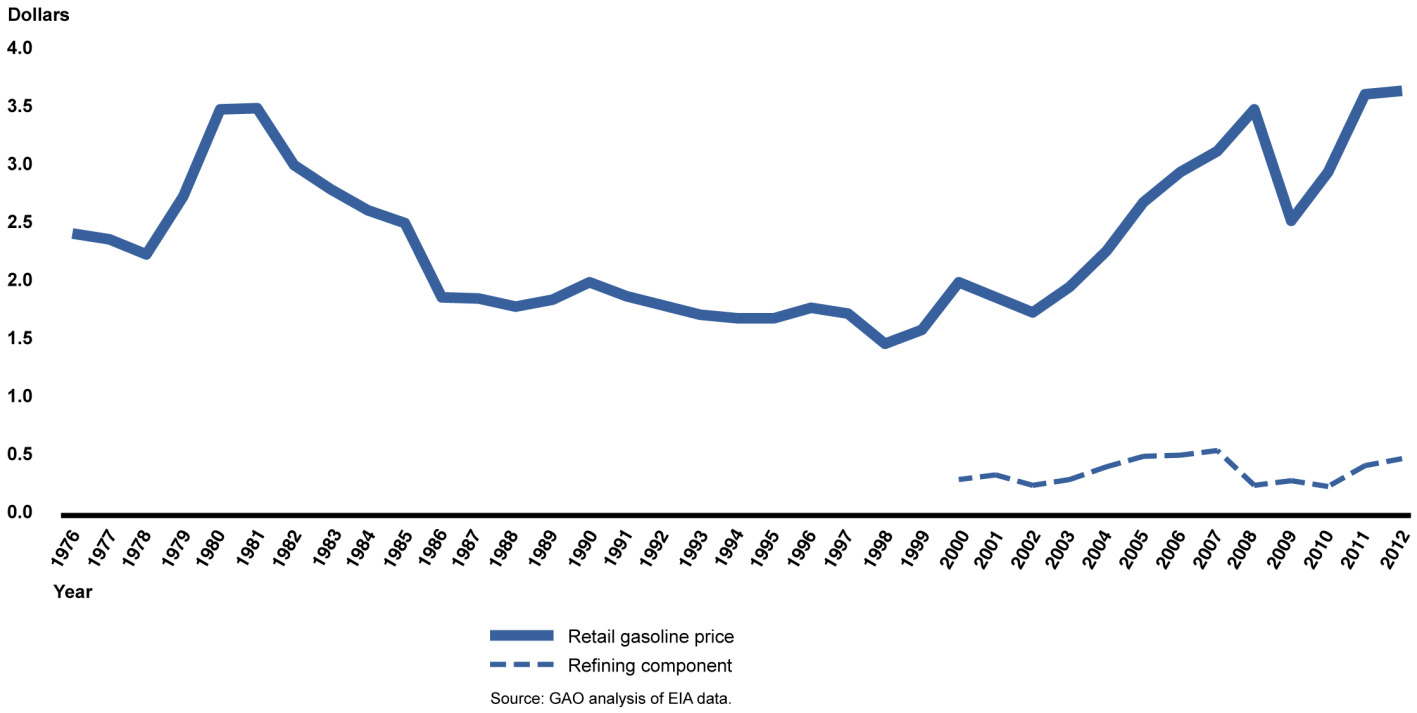
As we reported in 2007, according to industry officials and experts, the refining industry was a low-return industry for much of the prior two decades.[12] Retail prices for regular gasoline averaged $3.63 per gallon in 2012, the highest annual average price when adjusted for inflation since 1976, the earliest comparable data available from EIA.[13] Retail prices have declined in 2013—gasoline averaged $3.55 in the first half of 2013 and $3.18 in November 2013—but are still near historic highs. Market dynamics anywhere along the supply chain can influence consumer prices, beginning with upstream crude oil production, the production of renewable fuels, through downstream refining and retailing.[14] According to EIA data, increases in crude oil costs have been the largest component of the recent increases in gasoline prices. The refining component of prices—including labor, materials, energy, and other costs of the refining process, as well as profits to refinery owners—has fluctuated over time but has not increased in a significant way since 2000, when EIA began reporting estimates of the components of retail prices (see fig.4).

[12]GAO-08-14.

[13]Prices in this section were converted to 2012 dollars using the Bureau of Labor Statistics' Consumer Price Index.

[14]We have previously reported on several factors affecting these dynamics. See, for example: GAO, *Energy Markets: Estimates of the Effects of Mergers and Market Concentration on Wholesale Gasoline Prices,* GAO-09-659 (Washington, D.C.: June 12, 2009); GAO-08-14; and GAO, *Motor Fuels: Understanding the Factors That Influence the Retail Price of Gasoline,* GAO-05-525SP (Washington, D.C.: May 2, 2005). A more complete list of related reports is included at the end of this report.

Figure 4: U.S. Real Annual Average Retail Regular Gasoline Price and Refining Component of Retail Price, 1976-2012



Source: GAO analysis of EIA data.

Note: EIA began reporting estimates of the components of retail prices in 2000. Prices were converted to 2012 dollars using the Bureau of Labor Statistics' Consumer Price Index.

Key Regulations Affecting the Domestic Refining Industry

The five key environmental regulations affecting the domestic refining industry that we reviewed are concerned with various health, environmental, and other issues.

RFS

Under the RFS, since 2006, transportation fuels sold in the United States have been required to contain increasing amounts of renewable fuels such as ethanol and biodiesel. EPA is responsible for administering the RFS and annually issues regulations that establish the percentage of gasoline and diesel fuels that refiners, importers, and other obligated parties must ensure are renewable fuels. Congress established the RFS in light of concerns such as climate change and the nation's dependence on imported crude oil. As shown in figure 5, the law generally required that transportation fuels contain 9 billion gallons of renewable fuels in 2008, and that volumes increase 4-fold through 2022 to 36 billion gallons. The Administrator of EPA is authorized to waive the RFS levels established in the act if the Administrator determines—in consultation with the Secretaries of Agriculture and Energy—that implementing the requirement would severely harm the economy or environment, that there

is an inadequate domestic supply, or in certain other situations.[15] The major source of renewable fuels has traditionally been ethanol produced from corn; however, as we reported in 2009, the increased cultivation of corn for ethanol, its conversion into renewable fuels, and the storage and use of these fuels could affect water supplies, water quality, air quality, soil quality, and biodiversity.[16] Under the RFS' statutory provisions, the increasing amounts of renewable fuels are to primarily come from renewable fuels other than corn ethanol—called advanced biofuels—that meet certain criteria, including reducing GHG emissions by at least 50 percent compared with the gasoline or diesel fuel they displace.[17] According to EPA, achieving the RFS' statutory blending levels in 2022 could result in total benefits—including those related to overall fuel costs, energy security, health, and GHG effects—of between $13 and $26 billion and could reduce GHG emissions by 138 million metric tons of carbon dioxide equivalent emissions, equal to taking about 27 million vehicles off the road.[18]

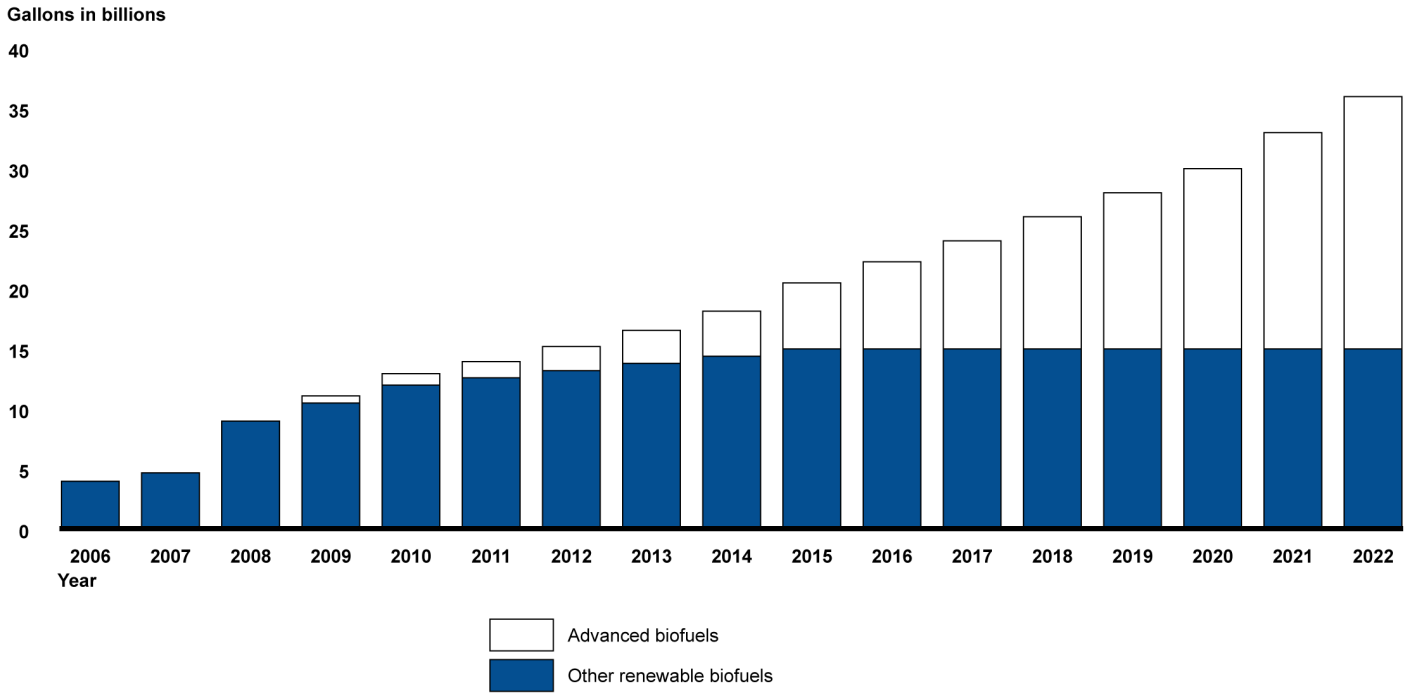
[15]EPA may also reduce the requirements for total renewable fuel and advanced biofuel in years when EPA reduces cellulosic biofuel or biomass-based diesel under applicable provisions. See 42 U.S.C. § 7545(o)(7)(D)-(E) (2013). EPA also must provide public notice and an opportunity for comment before making a determination for a waiver.

[16]See GAO, *Biofuels: Potential Effects and Challenges of Required Increases in Production and Use,* GAO-09-446 (Washington, D.C.: Aug. 25, 2009) and GAO, *Energy-Water Nexus: Many Uncertainties Remain about National and Regional Effects of Increased Biofuel Production on Water Resources,* GAO-10-116 (Washington, D.C.: Nov. 30, 2009).

[17]Beginning in 2015, the RFS' statutory provisions call for more than half of advanced biofuels to be produced from cellulosic materials, which can include perennial grasses, crop residue, and the branches and leaves of trees. Such cellulosic biofuels must generally achieve at least a 60 percent reduction in life cycle greenhouse gas emissions compared with the gasoline or diesel fuel they displace. However, according to EIA, all EIA forecasts and projections made since the passage of the Energy Independence and Security Act of 2007 anticipated large shortfalls between the RFS targets and the volumes of cellulosic biofuels. In addition, some advanced biofuels must be produced from biomass-based diesel, which generally includes diesel made from biomass feedstocks such as soybeans.

[18]EPA's estimates of the benefits and costs of the regulations presented throughout this report refer to monetized amounts. As not all benefits and costs can be monetized, these may represent a subset of overall benefits and costs of the regulations. We did not independently assess EPA's estimates of the benefits or costs of these regulations. We are examining EPA's economic analyses in relation to its adherence to guidance for regulatory analysis and expect to report later this year on these issues.

Figure 5: Renewable Fuel Standard Volumes Established by the Energy Independence and Security Act of 2007



Sources: Energy Independence and Security Act of 2007, Pub. L. No. 110-140 §202(a)(2) (2007).

CAFE and GHG Vehicle Emission Standards

The federal government has regulated vehicle fuel economy through CAFE standards since 1978 and, more recently, aligned these standards with new GHG vehicle emission standards in a joint national program aimed at reducing oil consumption and GHG emissions from the transportation sector.[19] CAFE standards are administered by the National Highway Traffic Safety Administration (NHTSA) and require that vehicle manufacturers meet fleet-wide average fuel economy standards for vehicles.[20] The Energy Independence and Security Act of 2007 instituted several changes to the CAFE standards and, in 2009, the administration announced a new program to increase vehicle fuel economy and reduce

[19]The Energy Policy and Conservation Act, Pub. L. No. 94-163 tit. III (1975) established CAFE standards effective beginning in model year 1978.

[20]The NHTSA, under DOT, is responsible for setting and enforcing CAFE standards, among other things.

vehicle GHG emissions, which was implemented by a joint rulemaking with NHTSA raising CAFE standards and EPA establishing the first GHG emissions standards for vehicles.[21] Although the CAFE and GHG vehicle emission standards are distinct, their targets were aligned for compliance purposes. NHTSA and EPA put the national program into place by issuing coordinated regulations covering vehicle model years 2012 to 2025.[22] As shown in figure 6, fuel economy standards for cars largely remained unchanged from 1990 through 2010, but vehicle manufacturers are now expected to meet increasingly stringent standards reaching the projected combined average fuel economy of about 50 miles per gallon by 2025—about 80 percent more efficient than required under the 2011 standards.[23] EPA estimated that the 2011-2025 standards may save consumers and businesses $1.7 trillion, reduce oil consumption by 12 billion barrels, and reduce GHG emissions by 6 billion metric tons over the lifetime of the vehicles sold during model years 2011-2025.[24]

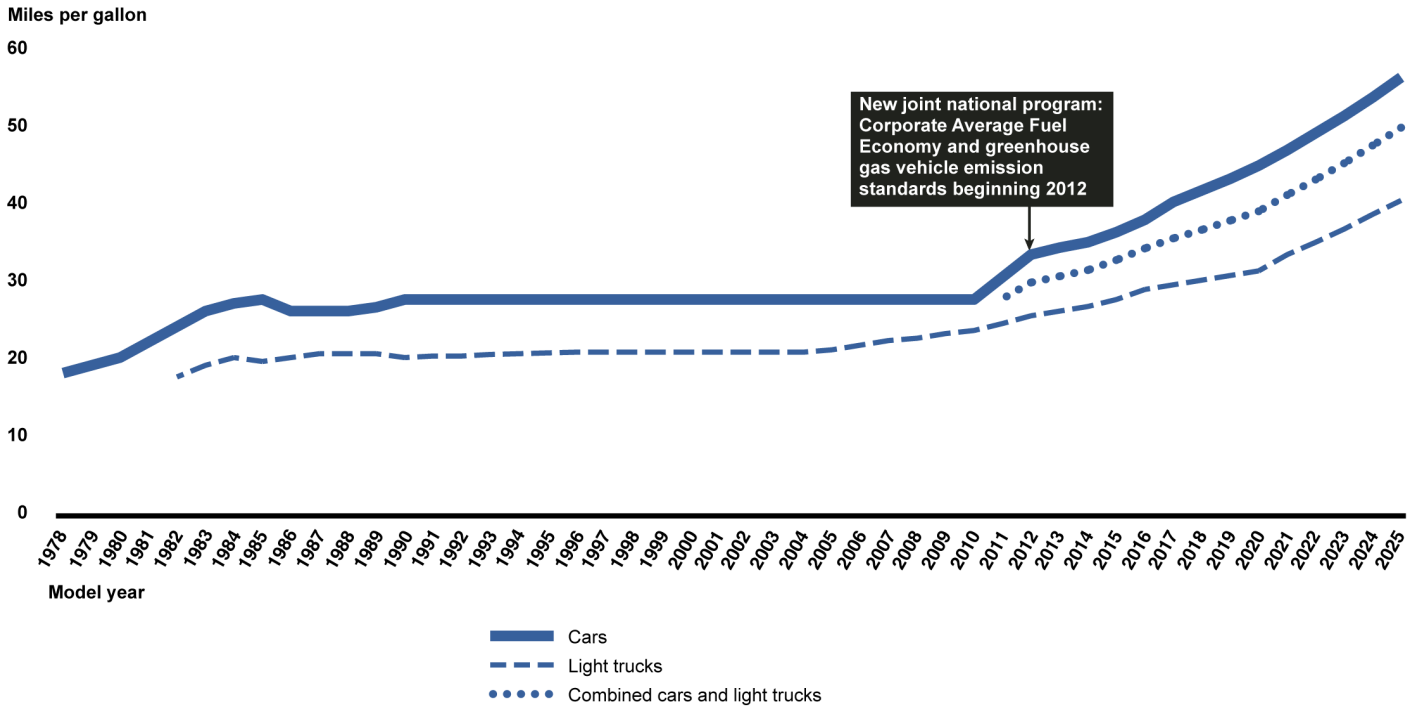
[21]The Energy Independence and Security Act of 2007, Pub. L. No. 110-140, tit. 1, subtit. A. Among other things, the act extended and codified NHTSA's reform of the CAFE standards by moving from a single fleet standard to an attribute-based standard for light trucks and passenger vehicles. The move from a single standard for a fleet to attribute-based standards for each vehicle model based on a vehicle's footprint was designed to address a number of downsides associated with moving to smaller vehicles, including potential safety implications and consumer choice limitations, see GAO, *Vehicle Fuel Economy: NHTSA and EPA's Partnership for Setting Fuel Economy and Greenhouse Gas Emissions Standards Improved Analysis and Should Be Maintained,* GAO-10-336 (Washington, D.C.: Feb. 25, 2010).

[22]In the coordinated rulemaking, NHTSA issued regulations establishing CAFE standards for model years 2012 to 2021 and identified nonbinding, projected standards for model years 2022-2025 due to a statutory requirement that allows the agency to set CAFE standards for not more than 5 model years in a given rulemaking. See 77 Fed. Reg. 62,624, 62,639 (Oct. 15, 2012). For further information on these rulemakings and the process used to set them, see GAO-10-336.

[23]The national program of CAFE and GHG vehicle emission standards is projected to result in an industry-wide fuel economy of 54.5 miles per gallon in 2025 if all GHG reductions are achieved with fuel economy technologies, but use of air conditioning refrigerant credits would lower the expected fuel economy to about 50 miles per gallon. Actual fuel economy will differ, depending on the fleet of vehicles sold and how manufacturers choose to meet the standards given certain flexibilities, including credits for improved air conditioning efficiency.

[24]In model year 2011, CAFE standards alone were in effect; from 2012-2025, both CAFE and GHG vehicle emission standards are in effect.

Figure 6: Corporate Average Fuel Economy (CAFE) Standards, 1978-2025



Sources: GAO analysis of EPA and National Highway Traffic Safety Administration data.

Note: Data from 2011 on are projected fuel economy based on final standards, and data for 2022-2025 are based on projected standards. Projected fuel economy for 2017-2025 used model year 2008 as the baseline. Actual fuel economy may differ, depending on the fleet of vehicles sold and how manufacturers choose to meet the standards given flexibilities in the standards, including credits for improved air conditioning efficiency. The figure indicates CAFE standards, which are generally aligned with EPA's greenhouse gas vehicle emission standards.

Tier 3 Motor Vehicle Emission and Fuel Standards

Under the Clean Air Act, EPA is authorized to establish certain standards for new motor vehicles and fuels to address air pollution that may reasonably be anticipated to endanger public health or welfare.[25] On May 21, 2013, EPA proposed the Tier 3 standards, and on March 3, 2014, EPA announced the final Tier 3 standards which establish more stringent

[25]Clean Air Act Amendments of 1970 §§ 202, 211(c)(1), Pub. L. No. 91-604, 84 Stat. 1676 (1970), codified as amended at 42 U.S.C. §§ 7521, 7545(c)(1) (2013) (commonly referred to as the Clean Air Act).

vehicle emission standards and reduce the sulfur content of gasoline.[26] (Because EPA finalized this rulemaking after the draft report was completed and provided to agencies, the views of stakeholders and other information on Tier 3 that we reviewed and summarize in the rest of this report relate primarily to the proposed standards. EPA stated that the final rulemaking is very similar to the proposal, and that EPA made some changes—including to the sulfur provisions—based on public input.) According to EPA, more than 149 million Americans experience unhealthy levels of air pollution that has been linked to respiratory and cardiovascular problems and other adverse health effects. Cars and light trucks are significant contributors to air pollution, and EPA estimated that the Tier 3 standards will reduce pollution from such sources. The standards set more stringent tailpipe emission standards for new vehicles and generally require refiners to lower the sulfur content of gasoline from 30 parts per million (ppm) to 10 ppm on an annual average basis by 2017, among other things.[27] According to EPA, reducing the sulfur content of gasoline allows emissions control systems to work more effectively for existing and new vehicles and would therefore enable more stringent vehicle emissions standards. EPA estimated that the Tier 3 standards would reduce on-highway vehicle emissions of nitrogen oxides, a pollutant that has been liked to respiratory illnesses, by 10 percent in 2018, and 25 percent in 2030.[28] According to EPA estimates, by 2030, annual emission reductions from the Tier 3 standards would generate annual benefits of between $6.7 and $19 billion and prevent up to 2,000 premature deaths annually. EPA estimated that the vehicle and fuel standards would cost approximately $1.5 billion in 2030, including costs for refiners to install and operate equipment to remove sulfur from

[26]For the proposed standards, see: 78 Fed. Reg. 29,816 (May 21, 2013). The final standards were signed by the Administrator of the EPA on March 3, 2014. (See: EPA, *Control of Air Pollution from Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards, Final rule*, accessed March 5, 2014, http://www.epa.gov/otaq/documents/tier3/tier-3-fr-preamble-regs-3-3-14.pdf.) The Tier 3 standards replace the current vehicle emission and fuel sulfur standards that were established in 2000 under Tier 2. See 65 Fed. Reg. 6698 (Feb. 10, 2000). Tier 2 standards generally reduced sulfur in gasoline from 300 ppm to 30 ppm on an annual average basis and were phased in from 2004 through 2007.

[27]EPA also will provide a 3-year delay for certain small refiners, as well as certain small volume refineries that processed 75,000 or fewer barrels of crude oil per day averaged over 2011.

[28]EPA, *Control of Air Pollution from Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards Final Rule; Regulatory Impact Analysis.* (EPA-420-R-14-005, March 2014).

gasoline, as well as costs for vehicle manufacturers to improve the emissions performance of vehicles.

Stationary Source GHG Requirements

Under the Clean Air Act, EPA is authorized to take certain steps to address emissions from stationary sources, including refineries. EPA has regulated certain emissions of air pollutants from stationary sources for several decades, and EPA recently issued rules concerning how GHGs are to be included in certain existing permitting processes.[29] Specifically, permitting authorities[30] are to include GHG emission control requirements in Prevention of Significant Deterioration (PSD) permits and certain other permits issued to refineries and other stationary sources that trigger GHG emissions thresholds.[31] Since 2011, construction of any new refineries and certain refineries that are modified have generally been subject to the use of the "best available control technology" for GHG emissions. The best available control technology is determined for each facility based on an analysis of available technologies considering cost and other factors. According to EPA, in most cases, the best available control technology selected for GHGs are energy efficiency improvements. For example, for refineries, this could involve the installation of heat recovery units, which capture and use otherwise wasted heat in the refinery process. Such energy efficiency improvements can lower GHG emissions and other pollutants while reducing fuel consumption and saving money. Current regulations do not require existing facilities to take any steps to control GHG emissions unless they undertake a major modification. Examples of major modifications at a refinery include a significant expansion of crude

[29]Several industry groups have challenged EPA's determination that its regulation of GHG emissions from new motor vehicles triggered permitting requirements under the Clean Air Act for stationary sources that emit GHGs. The U.S. Court of Appeals for the D.C. Circuit upheld EPA's determination, and the Supreme Court granted a petition to review the D.C. Circuit's judgment and will consider the issue in 2014.

[30]Permitting authorities include EPA regions and approved state and local agencies. Some states are not approved to issue GHG permits. In these states, EPA regions issue GHG permits.

[31]Permits that address GHG emissions from new or modified stationary sources are known as PSD permits. PSD permits address GHG emissions only for those sources and projects meeting specific emission thresholds. In addition, operating permits, also known as Title V permits, can be triggered by sources that emit GHGs at specified emissions thresholds. Operating permits generally do not add new pollution control requirements but contain procedural requirements such as compliance monitoring and reporting. Thus, only PSD permits will impose GHG emission control requirements.

oil processing units, or installing new secondary processing units that would increase GHG emissions above specified thresholds.

LCFS

California's LCFS aims to lower GHG emissions by reducing the level of carbon in transportation fuels. Established by the California Air Resources Board (CARB) following state legislation and an executive order, the LCFS has been fully in effect since January 2011. The LCFS would change the mix of fuels and vehicles in California to reduce emissions throughout the fuel "life cycle"—which includes emissions associated with producing, transporting, distributing, and using the fuel. To reduce emissions, carbon intensity (CI) scores are used, which are to reflect each fuel's life cycle GHG emissions. Refiners generally are required to ensure that the overall CI score for their fuels—which can include gasoline, diesel, and their blendstocks and substitutes—meets the annual carbon intensity target for a given year. Unlike the RFS, which requires certain types of renewable fuels be used, under LCFS refiners can meet the CI reduction targets using a variety of low carbon fuel technologies. Low carbon fuel technologies include renewable fuels from waste and cellulosic materials, natural gas, electricity used in plug-in vehicles, and hydrogen used in fuel cell vehicles. The original LCFS statewide reduction targets for gasoline, diesel, and their substitutes started at 0.25 percent of 2010 values in 2011 and increased to 10 percent by 2020. However, in 2013 a state Court of Appeal found that CARB must correct certain aspects of the procedures by which the LCFS was originally adopted.[32] CARB officials subsequently announced a regulatory package would be proposed in 2014, and that the 2013 standards—a 1 percent decrease in carbon intensity from 2010 values—will remain in effect through 2014.

To comply with LCFS, refiners can produce their own low carbon fuels, buy such fuels from other producers to blend into their products and sell on the market, or purchase credits generated by others. Refiners can also generate credits—which can be banked and traded—if their use of low carbon fuels results in greater-than-required carbon intensity reductions. CARB estimated that the 2020 targets would reduce GHG emissions

[32]Specifically, the California Fifth District Court of Appeal allowed the LCFS regulations to remain in effect, but found that the manner in which the CARB adopted the LCFS violated certain procedural requirements of the California Environmental Quality Act and California's Administrative Procedures Act. As a result, CARB anticipates addressing the court's concerns with a regulatory package in 2014.

associated with the transportation sector in California by 10 percent in 2020, or 23 million metric tons of carbon dioxide equivalent.[33]

Market Changes and Key Environmental Regulations Likely Affected the Refining Industry

Stakeholders we interviewed identified three major changes that have likely recently affected the domestic petroleum refining industry.[34] First, crude oil production in the United States and Canada has increased, which has lowered the cost of purchasing crude oil for some refiners but poses some challenges related to crude oil transportation infrastructure constraints and the types of crude oils produced. Second, after many years of generally increasing domestic consumption of petroleum products, consumption has fallen since 2005, resulting in a smaller domestic market for refiners. Third, two key environmental regulations—CAFE and GHG vehicle emission standards and the RFS—have likely recently contributed to declining consumption of petroleum fuels, and compliance with the RFS has increased costs for some refiners.

Increased Crude Oil Production Has Lowered Crude Oil Costs for Some Refiners

U.S. and Canadian crude oil production has increased in recent years, leading to lower crude oil costs for some refiners, according to several stakeholders we contacted. According to EIA data, U.S. production of crude oil reached its highest level in 1970 and generally declined through 2008, reaching a level of almost one-half of its peak. During this time, the United States increasingly relied on imported crude oil to meet growing domestic energy needs. However, recent improvements in technologies have allowed companies that develop petroleum resources to extract oil from shale formations that were previously considered to be inaccessible because traditional techniques did not yield sufficient amounts for economically viable production. In particular, the application of horizontal drilling techniques and hydraulic fracturing—a process that injects a combination of water, sand, and chemical additives under high pressure to create and maintain fractures in underground rock formations that allow oil and natural gas to flow—have increased U.S. crude oil and natural gas

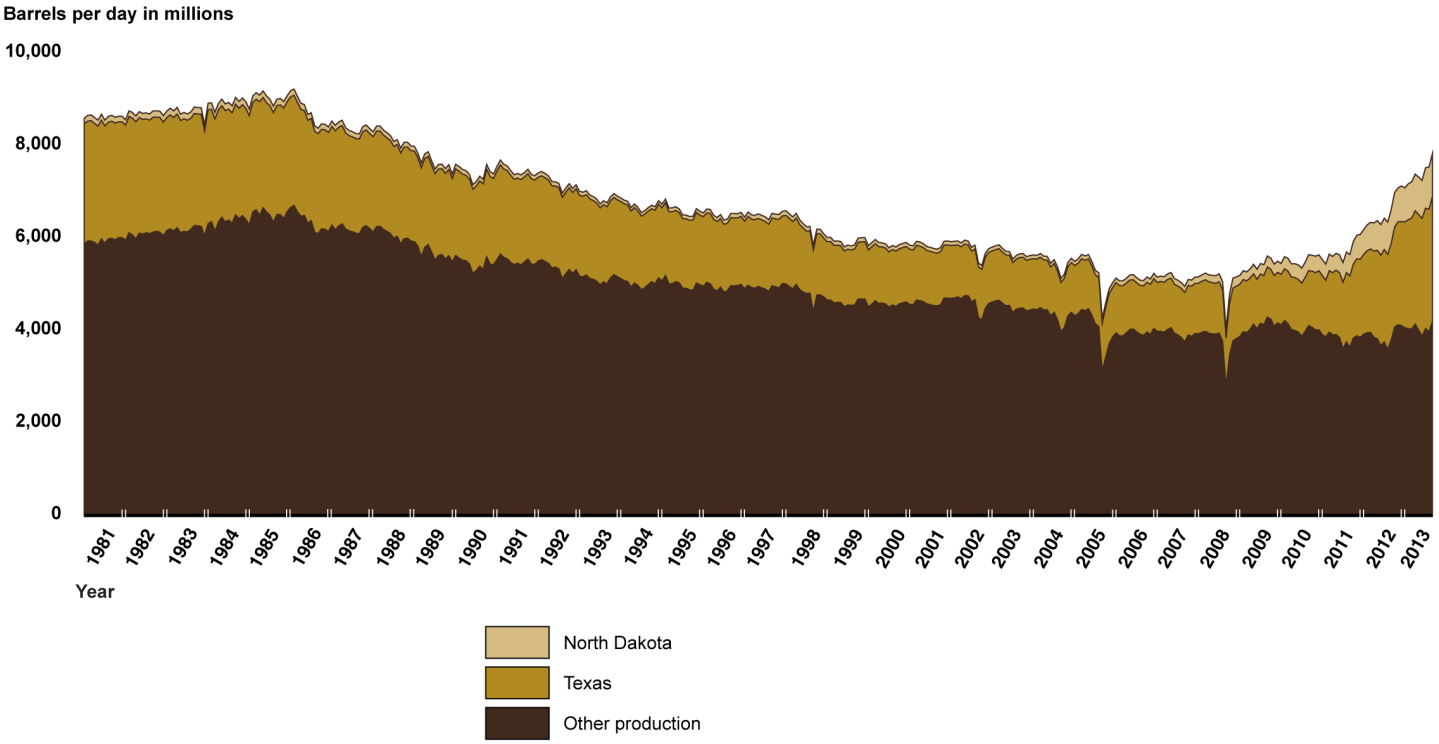
[33]CARB, *Staff Report: Initial Statement of Reasons Proposed Regulation to Implement the Low Carbon Fuel Standard, Volume I* (Sacramento, CA: Mar. 5, 2009).

[34]The stakeholder views summarized throughout this report were not necessarily supported by all types of stakeholders, though we identify differing views where appropriate.

production.[35] As shown in figure 7, monthly domestic crude oil production has increased by over 55 percent through September 2013 compared with average production in 2008. According to EIA, increases in production in 2012 and 2013 were the largest annual increases since the beginning of U.S. commercial crude oil production in 1859. Much of the increase in crude oil production has been from shale and other formations, such as the Bakken in North Dakota and the Eagle Ford in Texas, according to EIA data. Similarly, crude oil production in Canada—the largest foreign supplier of crude oil to the United States—has also increased significantly in recent years. From 2005 through 2012, total Canadian crude oil production increased by 32 percent and U.S. imports from Canada increased almost 50 percent.

[35]For more information, see: GAO, *Oil and Gas: Information on Shale Resources, Development, and Environmental and Public Health Risks,* GAO-12-732 (Washington, D.C.: Sept. 5, 2012).

Figure 7: Monthly Crude Oil Production in Texas, North Dakota and the Rest of the United States, January 1981-September 2013



Source: GAO analysis of Energy Information Administration data.

The rapid growth in U.S. and Canadian crude oil production has lowered the cost of crude oil for some domestic refiners that have the access and ability to process these crude oils. For example, West Texas Intermediate crude oil—a domestic crude oil used as a benchmark for pricing—was $17.60 per barrel less expensive in 2012 than Brent, an international benchmark crude oil from the European North Sea that was historically about the same price as West Texas Intermediate. Those refineries able to take advantage of these lower priced crude oils have benefited because crude oil costs are the largest cost for refiners.[36] However, all

[36]Closely related to increases in crude oil production, natural gas production has also increased in the United States in recent years. This increasing availability and lower prices for natural gas have been a benefit to domestic petroleum refiners since natural gas is an important energy source for many petroleum refineries, according to several stakeholders we contacted.

refineries may not have been able to take advantage of these crude oils to the same extent for two key reasons:

- *Transportation infrastructure challenges*. The development of domestic and Canadian crude oil production has created some challenges for U.S. crude oil transportation infrastructure because some of the growth in production has been in areas with limited transportation linkages to refining centers. Most of the system of crude oil pipelines in the United States was constructed in the 1950s, 1960s, and 1970s to accommodate the needs of the refining sector and demand centers at that time. According to DOE officials, this infrastructure was designed primarily to move crude oil from the South to the North, but emerging crude oil production centers in Western Canada, Texas, and North Dakota have strained the existing pipeline infrastructure. Though pipeline capacity has increased—investments increased pipeline capacity to deliver crude oil to a key Cushing, Oklahoma hub by about 815,000 barrels per day from 2010 through 2013—EIA reported that it has been inadequate. Because of these challenges, some refineries may not have been able to take full advantage of crude oil production increases or had to rely on other more expensive crude oil transportation options such as truck, rail, or barge. For example, two of the refineries we visited recently installed facilities to enable them to receive crude oil from North Dakota or Canada by rail. According to EIA data, while refinery receipts of crude oil by these methods of transportation is a small percentage of total receipts, they have increased 57 percent from 2011 to 2012. Infrastructure constraints have, according to EIA, contributed to discounted prices for some domestic crude oils.

- *Configuration constraints at refineries*. Increasingly, the crude oil being produced in the United States and Canada has different characteristics from the crude oils that some domestic refineries are configured to use. Production of new domestic crude oil has tended to be light and sweet, whereas a portion of new Canadian production has been heavy and sour crude oils.[37] To a certain extent, some

[37]Crude oil is generally classified according to two parameters: density and sulfur content. Less dense crude oils are known as “light,” while denser crude oils are known as “heavy.” Crude oils with relatively low sulfur content are known as “sweet,” while crude oils with higher sulfur content are known as “sour.” In general, heavier and more sour crude oils require more complex and expensive refineries to process the crude oil into usable products.

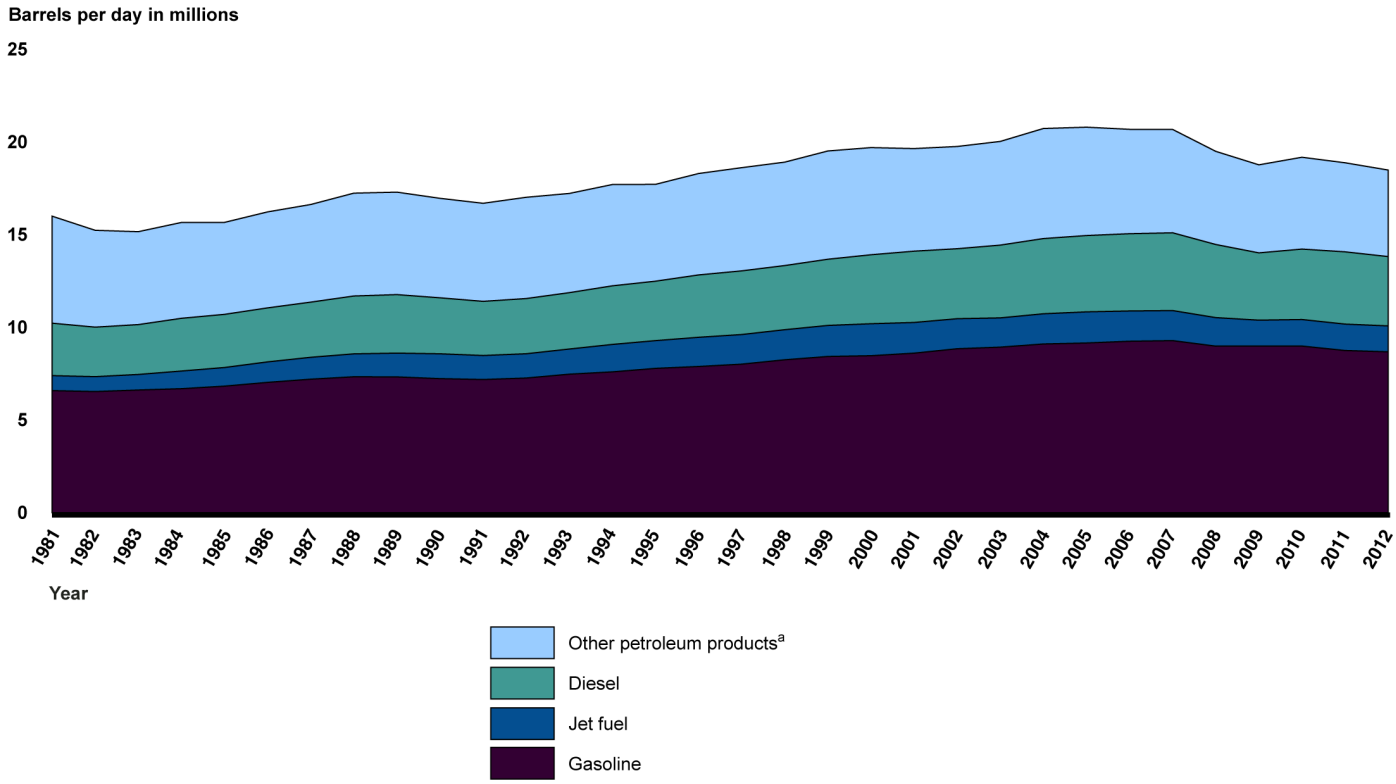
refineries can use these crude oils, but some have invested in new equipment in order to do so. For example, representatives of one refiner told us they had invested over $2.2 billion in a project including a new coking unit at a refinery to refine heavier and more sour crude oil from Canada.

Domestic Consumption of Petroleum Products Has Declined

After decades of generally increasing domestic consumption of petroleum products, consumption has declined since 2005, resulting in a smaller domestic market for refiners, according to several stakeholders we contacted. Overall, consumption of gasoline, diesel, and other petroleum products in the United States increased from 1983 through 2005. In 2007, EIA projected that U.S. consumption would increase by nearly 30 percent between 2005 and 2030. As we reported in late 2007, trends in domestic refining capacity had not kept pace with consumption growth, though it was unclear whether and for how long that market tightness would continue.[38] However, as shown in figure 8, domestic consumption of petroleum products overall peaked in 2005 at 20.8 million barrels per day, and it declined by 11 percent through 2012. Consumption of gasoline, diesel, and jet fuel peaked in 2007 and declined by over 8 percent through 2012. More recent data indicate that these trends may now be starting to shift, as EIA estimated that petroleum product consumption increased in the first 11 months of 2013 compared with the first 11 months of 2012.

[38] See GAO-08-14.

Figure 8: Domestic Consumption of Gasoline, Diesel, and Other Petroleum Products, 1981-2012



Source: GAO analysis of Energy Information Administration data.

Note: Data presented here include final consumption of fuels including petroleum-based fuels that have been blended with renewable fuels.

[a]Other petroleum products include kerosene, natural gas liquids, and other petroleum products.

According to several stakeholders we contacted and information we reviewed, a number of factors can affect consumption of petroleum products, including economic activity and crude oil and petroleum prices. For example, the recession of 2007 to 2009 reduced economic activity and demand for gasoline, and historically high gasoline prices have discouraged the use of gasoline. Stakeholders and information we reviewed also cited the effect of more stringent fuel economy standards and the RFS, which are discussed in the next section.

Several stakeholders told us that this broad shift from growing to falling consumption of petroleum products has affected the domestic refining industry because it has resulted in a smaller domestic market. The U.S. market is important for domestic refineries because U.S. refiners have

historically primarily sold their products domestically. On average, the United States exported almost 1 million barrels per day of domestic petroleum products from 2000 through 2005—less than 6 percent of U.S. refinery production. As discussed below, the refining industry has shifted sales to export markets amid a declining domestic market.

Two Key Regulations Have Likely Contributed to Declining Fuel Consumption and Compliance with One Has Increased Some Refiners' Costs

According to stakeholders and the information we reviewed, two recently strengthened key environmental regulations—the coordinated CAFE and GHG vehicle emission standards, and the RFS—have likely affected the refining industry by reducing the consumption of petroleum fuels, and compliance with the RFS has recently increased costs for some refiners, as well as other challenges. The other three key environmental regulations we reviewed have had minimal effects to date because they have either not yet been implemented or have generally not affected the industry in a major way, according to several stakeholders and information we reviewed.

CAFE and GHG Vehicle Emission Standards

According to information we reviewed and two stakeholders we contacted, CAFE and GHG vehicle emission standards have contributed to reductions in the consumption of petroleum fuels, but the extent is unclear. These standards aim to reduce oil consumption, and although they do not require changes at the refinery level, they can affect refineries indirectly by contributing to improvements in the overall efficiency of the vehicle fleet and, therefore, reducing fuels consumption. However, the National Academy of Sciences reported that it is difficult to isolate the effect of CAFE and GHG vehicle emissions standards from other factors that also affect consumption, such as higher fuel prices and changing driving habits.[39]

Stakeholders had different views on the extent to which CAFE and GHG vehicle emission standards have affected consumption of petroleum products. We reported, in 2007, that CAFE standards—along with higher fuel prices and other factors—contributed to a reduction in transportation

[39]See: National Research Council, *Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards* (Washington, D.C.: The National Academies Press, 2002).

fuel consumption of 2.8 million barrels per day in 2002.[40] CAFE standards for cars largely did not change from 1990 through 2010, but they were strengthened beginning with model year 2011. According to EPA and DOE officials, since the standards did not change until recently, CAFE and GHG vehicle emissions standards did not cause the shift from growing consumption to declining consumption discussed previously. Regarding the strengthened standards, EPA estimated in 2010 that vehicles were expected to save 1.3 billion gallons of gasoline in 2013 compared with model year 2011 standards.[41] This is equivalent to about 1 percent of EIA's projection of gasoline consumption in 2013. A stakeholder told us that the CAFE and GHG vehicle emissions standards have likely had a relatively large impact on petroleum demand declines in the past few years, but it is unclear how much declining demand overall can be attributed to these standards versus other factors such as the recent economic recession and higher fuel prices. On the other hand, EPA and DOE officials, and a refinery representative told us that the most recent changes to CAFE and GHG vehicle emissions standards have had a marginal effect on petroleum demand so far. DOE officials also told us that the impact of the standards has been limited because they affect new car sales, and there are a relatively small number of new vehicles in the overall fleet.

RFS

Several stakeholders we contacted and information we reviewed cited three main effects that the RFS has had on the domestic petroleum refining industry or individual refiners—compliance has increased costs, declining domestic consumption, and investment uncertainty. In addition, EPA has been late in issuing annual RFS standards, and several factors contribute to the delays.

[40]See: GAO, *Vehicle Fuel Economy: Reforming Fuel Economy Standards Could Help Reduce Oil Consumption by Cars and Light Trucks, and Other Options Could Complement These Standards*, GAO-07-921 (Washington, D.C.: Aug. 2, 2007). Other factors contributing to reduced transportation fuel consumption include higher fuel prices. See: National Academies of Sciences, 2002.

[41]See: EPA, *Final Rulemaking to Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards Regulatory Impact Analysis*, EPA-420-R-10-009 (Washington, D.C.: April 2010).

RFS Has Had Three Main Effects

Stakeholders we contacted and information we reviewed identified three main ways the RFS has affected U.S. petroleum refiners: (1) compliance has recently increased costs for some refiners, (2) required blending of renewable fuels has contributed to declining domestic consumption of petroleum-based transportation fuels, and (3) EPA's delays in issuing annual RFS standards may have contributed to investment uncertainty for some refiners. First, compliance with the RFS has recently increased costs for some refiners, according to information we reviewed and several stakeholders we contacted. Under the RFS regulations, refiners and other obligated parties are required to ensure U.S. transportation fuels include certain amounts of renewable fuels. To comply, refiners generally have two options—they can purchase and blend renewable fuels themselves, or they can pay others to blend or use renewable fuels by purchasing credits.[42] These credits can be freely traded, and prices for credits are established based on the market and generally reflect the stringency of requirements and the costs of incorporating additional renewable fuels into the transportation fuel system to comply with the RFS—if costs increase, credits prices would tend to increase as well. According to EIA, corn-based ethanol credit prices were low—between $0.01 and $0.05 per gallon between 2006 and much of 2012—because it was generally economical to blend up to or above the level required by the RFS. However, in 2013, prices for these credits increased to over $1.40 per gallon in July before declining to about $0.20 per gallon as of mid-November 2013.

Several stakeholders told us this increase in credit prices was primarily due to RFS requirements exceeding the capability of the transportation fuel infrastructure to distribute and the fleet of vehicles to use renewable fuels, referred to as the "blend wall." A refiner we spoke with also attributed the decline in credit prices in the second half of 2013 to EPA's statements expressing its desire to address the blend wall. We have

[42]EPA uses renewable identification numbers to track compliance with the RFS. In this report, we refer to these as credits. Renewable fuel producers, refiners, and fuel blenders, among others, can acquire credits under the RFS, though only refiners and importers of petroleum-based transportation fuels are obligated under the RFS. If a company generates more credits than it needs for compliance in a given year, excess credits can be sold to others, or saved for the following compliance year, subject to certain constraints.

Examples of the Effect of Increasing Renewable Fuel Standard (RFS) Credit Costs on Refiners

- According to company financial regulatory filings, the cost of credits increased almost 10-fold in the first 9 months of 2013 for one refiner compared with a similar period in 2012, and credit costs for another refiner more than doubled.
- A refining company representative told us that credit costs under the RFS exceeded the company's entire operating budget, including labor and electricity, for a period in 2013.
- As a result of higher credit costs, representatives of a refiner told us they have begun to consider the point at which their revenue may cease to cover the cost of purchasing credits. Representatives told us that, at a certain point, the company might need to decrease production levels, and thereby reduce its renewable fuel blending obligations.
- An ExxonMobil official said that RFS credit costs did not have a significant impact on the company's financial performance during the second quarter of 2013 because ExxonMobil meets the majority of its obligation by blending renewable fuels itself.

Source: GAO.

previously reported on the blend wall and other challenges to the increasing use of renewable fuels.[43]

While the RFS applies to all refiners in the same way, the effect of the rise in credit prices may depend on each refiner's situation. However, in comments to this report EPA stated that refiners experience the same compliance costs. As a result of higher costs, several stakeholders told us refiners could reduce production, produce more jet fuel, which is not subject to RFS requirements, or increase exports to nations where the RFS does not apply. (See app. III for more information about the blend wall, RFS credits, and views on how they have affected U.S. refiners.)

Second, the RFS has contributed to the declining domestic consumption of petroleum-based transportation fuels. Under the RFS regulation, refiners and other obligated parties are required to ensure U.S. transportation fuels include certain amounts of renewable fuels. As a result, refiners and other industry participants have blended increasing amounts of renewable fuels. For example, consumption of ethanol has increased almost 8-fold since 2000, from 1.7 billion gallons in 2000 to 12.9 billion gallons in 2012. According to EIA, increased ethanol use since 2007 displaced over 4 billion gallons of petroleum-based gasoline, or about 3 percent of gasoline consumption in 2012. As discussed previously, decreases in consumption affect refiners by decreasing the size of the domestic market. Since the RFS was established in light of concerns about the nation's dependence on imported crude oil, decreased consumption of petroleum products may further some of the objectives of the RFS.

Third, the RFS has contributed to investment uncertainty for refiners according to several stakeholders because EPA has not issued annual

[43]See: GAO, *Biofuels: Challenges to the Transportation, Sale, and Use of Intermediate Ethanol Blends*, GAO-11-513 (Washington, D.C.: June 3, 2011), and *Biofuels: Potential Effects and Challenges of Required Increases in Production and Use*, GAO-09-446 (Washington, D.C.: Aug. 25, 2009).

RFS standards on time since 2009.[44] Beginning in calendar year 2009 and through calendar year 2022, EPA is required to set annual blending percentages for total renewable fuels, advanced biofuels, cellulosic biofuels, and biomass-based diesel fuels by November 30 of the preceding calendar year.[45] However, as shown in figure 9, EPA has missed the statutory deadline to set annual percentages since 2009.[46] Most recently, EPA issued 2013 standards in August 2013—over 8 months late—and has not issued the 2014 standards. EPA proposed the 2014 standards on November 29, 2013, and EPA officials told us that they plan to finalize the standards in Spring 2014. The RFS compliance period—the time during which refiners and other parties incur obligations under RFS and can take steps to incorporate additional renewable fuels to create credits for compliance—is set by statute to be a full calendar year, and delays do not change this compliance period.[47] As a result, when the RFS standards are issued late, the industry has less time to plan and budget effectively. Several representatives of refiners told us

[44]The RFS has also posed compliance challenges for refiners and other market participants because of concerns over fraud in the market for RFS compliance credits. Credits must be validly generated in order for renewable fuel producers to be able to transfer or use them for compliance purposes. For example, EPA has issued several notices of violation alleging that five companies generated more than 170 million gallons of invalid credits without producing qualifying renewable fuels. These invalid credits had been used for compliance by many refining companies. EPA recently issued a Notice of Proposed Rulemaking, which describes a voluntary program known as the Quality Assurance Program to help assure that credits are validly generated. The notice proposes that voluntary third parties verify the validity of credits through steps such as verification of type of feedstocks, verification that volumes produced are consistent with amount of feedstocks processed, and verification that credits generated are appropriately categorized and match the volumes produced.

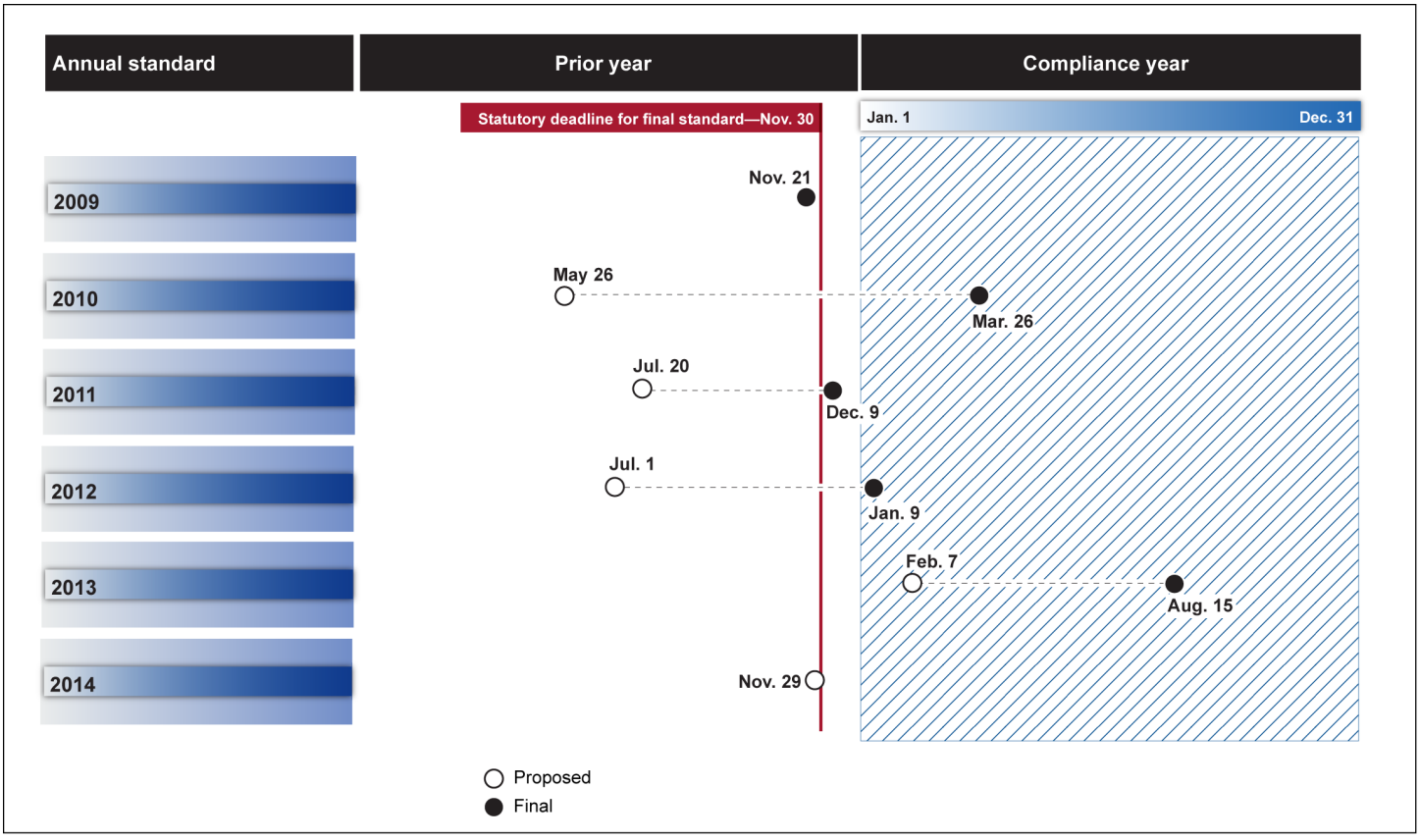
[45]The requirement for cellulosic biofuel began in calendar year 2010.

[46]For calendar years after 2012, EPA is also required to set biomass-based diesel volumes at least 14 months in advance. Though not shown in figure 9, EPA has also been late in issuing final standards for biomass-based diesel. EPA issued the final volume standards for 2013 in September 2012—about 10 months late. As of March 2014, EPA is 16 months late in finalizing standards for 2014 and 4 months late in finalizing standards for 2015. EPA proposed standards for 2014 and 2015 on Nov. 29, 2013, which have not been finalized.

[47]The RFS compliance deadline—the date by which refiners and other obligated parties must demonstrate compliance to EPA—is established by EPA through implementing regulations and has been adjusted by EPA. For example, EPA extended the compliance deadline for the 2013 compliance year from February 28, 2014 to June 30, 2014. The extension provided more time for refiners and other obligated parties to purchase and allocate credits.

that delays in issuing annual RFS standards increase uncertainty for refiners and renewable fuel producers, making it more difficult to make long-term planning decisions. One refining company representative told us that the company has reduced capital investments due to uncertainty related to the RFS. In contrast, EPA officials told us that there is no indication that delays have caused significant problems for refiners. They also noted that delays could actually make annual standards more robust since EPA then has more data upon which to base decisions.

Figure 9: Timeline of EPA's Issuance of Proposed and Final RFS Standards (2009-2014)



Source: GAO analysis of proposed and final regulations.

Note: The proposed and finalized dates are the regulations' publication dates in the Federal Register, not the dates EPA signed the regulations and publicly released them.

Regulatory Development Processes Contribute to EPA Delays in Issuing RFS Standards

EPA officials told us that delays in issuing RFS standards have largely been due to the length of the regulatory development process, which includes interagency and public reviews. Under the interagency review process, EPA is to follow certain procedures before publishing proposed or final regulations that establish annual RFS standards, including submitting draft proposed and final regulations to the Office of Management and Budget (OMB), which coordinates review of the draft regulations by other agencies, as well as conducting its own review. The interagency review process is to ensure that regulations are consistent with the President's priorities, among other things, and that decisions made by one agency do not conflict with the policies or actions taken or planned by another. Under the public review process, EPA must publish a proposed standard in the Federal Register, provide the public with the opportunity to review and comment on the proposal, and address comments received before finalizing the regulation. According to EPA officials, the interagency and public review processes can be time consuming because the RFS standards involve complex and controversial issues and balance competing agricultural, energy, and environmental policy interests.

In 2009, we recommended that EPA and other agencies track their performance for developing significant regulations against targeted milestones to identify opportunities for improvement.[48] We found that monitoring actual versus estimated performance could help agency managers identify steps in the process that account for substantial time and provide information necessary to evaluate whether time was well spent. In this regard, EPA stated in comments to our 2009 report that it uses an agency-wide Action Development Process that tracks 14 milestones as it develops proposed rules and additional milestones in developing final regulations. For example, EPA tracks when its senior management approves of a document describing the scope of the regulation and the analytical work necessary to develop it, known as the detailed analytic blueprint. In comments to our 2009 report, EPA stated that it used an internal tracking system along with additional information

[48]See GAO, *Federal Rulemaking: Improvements Needed to Monitoring and Evaluation of Rules Development as Well as to the Transparency of OMB Regulatory Reviews,* GAO-09-205 (Washington, D.C.: Apr. 20, 2009).

to develop regulatory management reports to EPA managers and executives. EPA stated at the time that this process helps management identify regulations that are off-track so that corrective steps can be taken to expedite their completion. EPA officials told us that they develop RFS regulations using the same procedures used for developing all EPA regulations. However, even with these systems, EPA has not met its statutory deadlines under the RFS in the five annual standards since 2009. EPA has not conducted a systematic review of its experience issuing RFS regulations to identify the underlying causes of repeated delays and has not identified changes in its approach that may help to avoid these delays in the future. Without such analyses and a plan to address the underlying causes of the delays, EPA risks repeating them.

Other Key Regulations

The other key regulations that we reviewed—Tier 3 standards, stationary source GHG requirements, and LCFS—have had minimal effects to date because these regulations either have not yet been implemented (Tier 3 standards) or, with respect to the other two, have not affected industry operations or costs in a major way, according to stakeholders and information we reviewed. Specifically:

- *Tier 3 standards*. Tier 3 standards were proposed on May 21, 2013, and EPA announced final standards on March 3, 2014; therefore, they have had not had a direct effect on industry to date.

- *Stationary source GHG requirements*. Representatives of two refiners told us that stationary source GHG requirements have been burdensome to refiners; however, several other stakeholders told us they have not had a major effect, and EPA officials told us they were aware of only three refineries that have received major source GHG permits since the GHG permitting program was implemented in 2011.[49] A refining company representative expressed concerns to us about the lengthy permitting process to authorize GHG emission increases. However, stationary source GHG requirements do not apply unless an existing refining facility proposes a major modification

[49]These refineries are the Hyperion Refinery and Energy Center in South Dakota, the Sinclair Wyoming Refinery in Wyoming, and the Diamond Shamrock, Valero McKee Refinery in Texas.

or a new refinery is proposed for construction.[50] An EPA official said that, in most cases, best available control technologies selected to comply with GHG requirements for refining facilities involve energy efficiency improvement measures that could help refiners reduce fuel consumption and save money. Further, EPA officials also explained that, in some cases, delays can occur when the refinery applicant has not provided EPA with the proper information to proceed with processing the permit.[51] The Clean Air Act requires that EPA approve or deny such permits within 12 months of receiving a complete application.

- *LCFS*. CARB, the entity responsible for implementing LCFS, said the regulation has had a modest effect to date—increasing fuel prices by about $0.01 per gallon. LCFS is the subject of several ongoing lawsuits,[52] which resulted in a 4-month delay in some regulatory activities and uncertainty about the status of the regulation.[53] According to a study conducted by a consultant on behalf of industry, the ongoing legal challenge to LCFS is creating uncertainty that

[50]A major modification refers to a physical or operational change that would result in a significant net increase in emissions of a regulated pollutant. However, in our prior work, we noted that it can be difficult for unit owners and regulators to know whether an air pollution permit is needed, because permitting rules governing applicability are complex and because applicability is determined on a case-by-case basis. See: GAO, *Air Pollution: EPA Needs Better Information on New Source Review Permits,* GAO-12-590 (Washington, D.C.: June 22, 2012).

[51]State permitting agencies may also issue GHG permits to refineries subject to EPA guidance.

[52]In a consolidated lawsuit, a Midwest ethanol group and an association of petroleum refiners claimed that LCFS discriminates against petroleum and ethanol firms from outside the state, and that the regulation was preempted by the Clean Air Act. Following appeal of an adverse District Court decision, in September 2013, the Ninth Circuit Court of Appeals largely upheld the LCFS by remanding one issue back to the district court for trial. Groups representing the energy industry and farmers, among others, have petitioned for the case to be reheard before the full Ninth Circuit. LCFS was also challenged in state court on administrative procedural grounds, which we describe above. CARB officials told us that they were optimistic about the outcome of these legal challenges, and said that their expectation is that if the courts do find against CARB on any particular issues, they would be able to narrowly adjust the regulations in order to address the court's findings and did not anticipate needing to wholesale replace or rework the regulations.

[53]In December 2011, a federal judge granted a preliminary injunction against the implementation of the LCFS, among other rulings. CARB appealed the decision and the Ninth Circuit Court of Appeals stayed the injunction in April 2012 and later reversed the District Court on these rulings.

discourages new investments by industry.[54] A refining industry trade association representative told us many refiners that previously invested in new components for their California facilities to process heavy crude oils may not be able to make an adequate return on investment since the LCFS disincentivizes the use of carbon intensive heavy crude oils. However, a CARB official noted that LCFS does not specifically prohibit any crude oil from being processed in California refineries, but rather it ensures that the LCFS' goal to reduce carbon intensity in transportation fuels is not affected by increased use of higher carbon intensity crude oils. Nevertheless, California refiners have thus far been able to comply with LCFS requirements by blending lower carbon intensive renewable fuels—such as Brazilian sugar-cane ethanol—or purchasing carbon credits as an alternative method of compliance.

Industry Outlook Depends on a Number of Factors

Stakeholders we contacted and information we reviewed generally suggest that the outlook of the U.S. refining industry depends on a number of factors, in particular: (1) future domestic consumption of petroleum products; (2) the extent to which key environmental regulations raise costs for domestic refiners; and (3) the extent to which domestic refiners will be able to export and compete in international markets.

Uncertain Future Domestic Consumption

The outlook of the U.S. refining industry depends on future domestic consumption of petroleum products, which is uncertain, according to stakeholders we contacted and information we reviewed. As discussed above, domestic petroleum product consumption declined by 11 percent from 2005 through 2012, and forecasts we reviewed project consumption of three major petroleum products—gasoline, diesel, and jet fuel—will be stable to slightly increasing through 2020, but not returning to high levels of the past.[55] Most of the scenarios in forecasts we reviewed from IHS

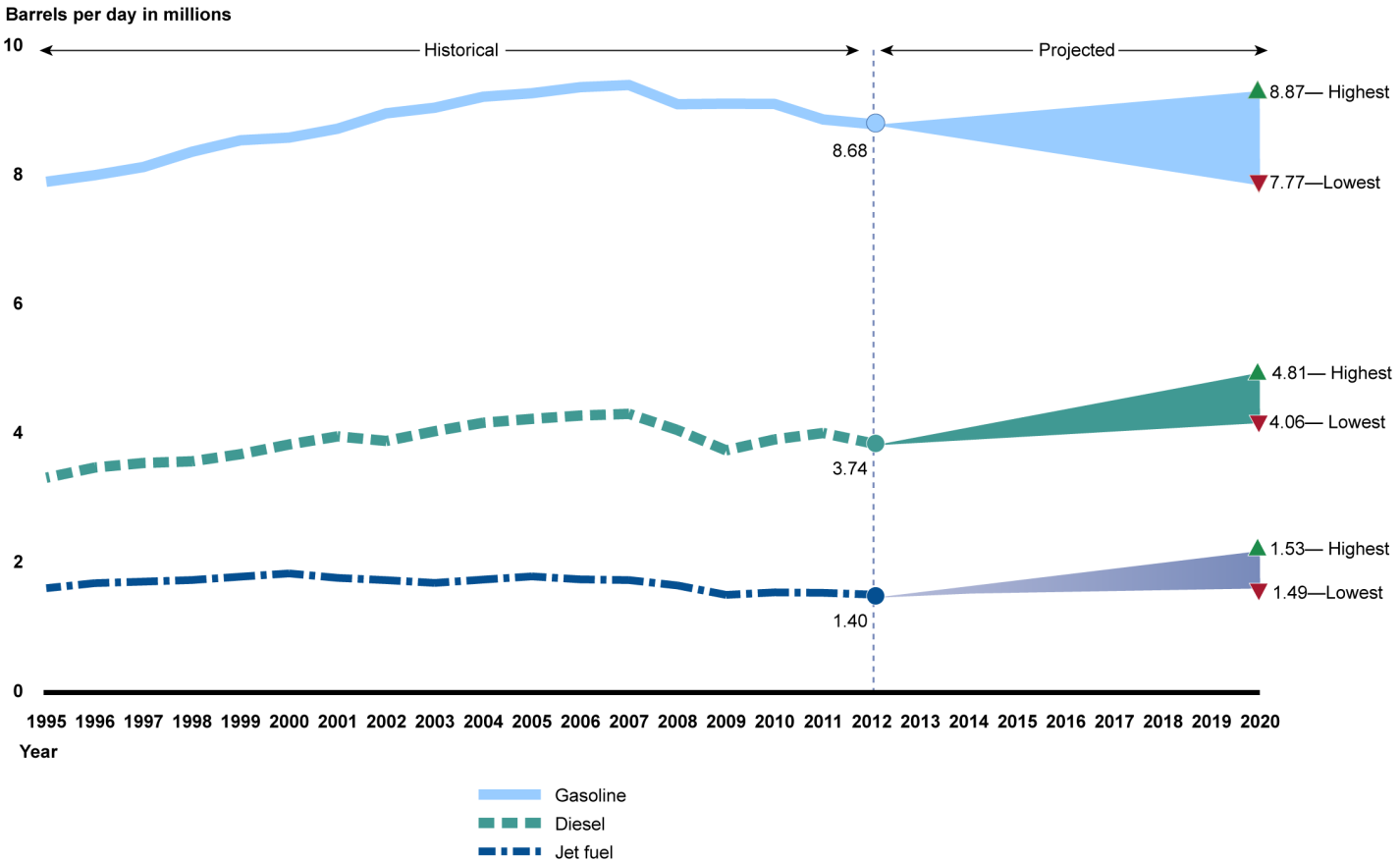
[54]The Boston Consulting Group, *Understanding the impact of AB 32* (Boston, MA: June 2012).

[55]The IEA forecast that we reviewed did not include a projection of U.S. consumption. EIA data track "product supplied," which approximately represents consumption of petroleum products because it measures the disappearance of these products from sources such as refineries, bulk terminals, and pipelines. Because the future depends on a multitude of factors that can be difficult to predict, EIA's 2013 and initial 2014 forecast include 28 scenarios with different assumptions about future conditions, such as economic growth or policy changes. (See app. I for additional information on our methodology.)

and EIA project total consumption of gasoline, diesel, and jet fuel to increase slightly by 2020, with projections ranging from a decline of 2 percent to an increase of 7 percent compared with 2012 consumption.[56] Expectations differ somewhat by fuel, with all EIA scenarios projecting gasoline consumption to decline or remain stable and diesel and jet fuel consumption to increase from 2012 to 2020 (see fig. 10). IHS projects an increase in the consumption of both gasoline and diesel, with more robust growth projected for diesel. Scenarios in the forecasts we reviewed generally project consumption to decline after 2020.

[56]Forecasts with more recent data and revised assumptions can indicate somewhat different levels of consumption. For example, in its 2013 forecast, IHS projected higher domestic consumption in 2020 than its previous year's forecast. EIA recently released initial results of its 2014 forecast, in which EIA projected lower domestic consumption in the reference scenario compared with the reference scenario in the 2013 forecast also discussed in this report. EIA attributed the difference, in part, to reduced expectations for vehicles miles traveled.

Figure 10: Historical (1995-2012) and Projected (2020) U.S. Consumption of Gasoline, Diesel, and Jet Fuel



Sources: GAO analysis of Energy Information Administration and IHS data.

Note: This figure displays the highest and lowest projections of U.S. consumption of gasoline, diesel, and jet fuel in the IHS and EIA forecast scenarios we reviewed. Specifically, for gasoline, the highest projection is IHS's forecast, and the lowest is EIA's "low or no net imports" scenario, which builds numerous assumptions to generate a hypothetical situation in which the United States eliminates net imports of liquid fuels. For diesel, the highest projection is EIA's "high economic growth" scenario, which assumes stronger growth in gross domestic product than in the reference scenario, a business-as-usual estimate that assumes current laws and policies are unchanged. The lowest projection for diesel is IHS. For jet fuel, the highest projection is EIA's "high economic growth" scenario, and the lowest is EIA's 2014 "reference" scenario.

Forecasts indicate that the level of future domestic consumption—the size of the domestic market for petroleum products—may affect future U.S. refinery production. In higher consumption scenarios, EIA's projections suggest higher refinery production than in scenarios with lower domestic consumption. Specifically, EIA projects that inputs to refineries—which track trends in refinery production—in 2020 would be about 1 million barrels per day higher in scenarios with higher domestic consumption—a

difference of about 7 percent of 2012 inputs. This difference is equivalent to about eight average-size U.S. refineries.

Several stakeholders we contacted and information we reviewed highlighted various factors that can affect future domestic consumption levels and thereby the size of the largest market for the production of U.S. refineries, including the following:

- *Economic growth*. Faster economic growth tends to increase consumption, and EIA's forecast scenario with higher economic growth assumptions projects greater future consumption of petroleum products than a scenario with low economic growth.
- *Crude oil and petroleum product prices*. Higher prices for crude oil and petroleum products tend to decrease consumption. For example, of the forecast scenarios we reviewed, the scenario that assumes high future oil prices projects lower domestic consumption of petroleum products.
- *Shifts in consumer behavior and demographic trends*. Changes in consumer behavior, such as reduced driving, along with demographic trends, such as an aging population and fewer young people with driving licenses, may reduce future consumption, according to EIA.
- *Key regulations*. Three of the key regulations we reviewed—CAFE and GHG vehicle emission standards, RFS, and LCFS—are expected to reduce domestic consumption of petroleum products in the future according to information we reviewed, though it is uncertain by how much. CAFE and GHG vehicle emission standards will require more efficient vehicles in the future, which may reduce future consumption of fuels. EPA estimated that the model year 2012-2025 standards are projected to reduce U.S. consumption of crude oil by 2.2 million barrels per day by 2025, equivalent to almost 15 percent of crude oil

used by refineries in 2012.[57] Similarly, under the RFS statute, unless waived by EPA, renewable fuels blending is required to double by 2022, which EPA estimated would reduce gasoline and diesel demand by 13.6 billion gallons, equivalent to about 10 percent of consumption in 2012.[58] Furthermore, CARB projected that the LCFS would help decrease future gasoline consumption in California. However, the extent to which these regulations will reduce future consumption depends on actions by regulators and market and other developments. For example, as discussed above, EPA has proposed to reduce renewable fuel requirements for 2014 due to an inadequate supply in light of the blend wall and other issues. EPA stated that the framework it applied to determine the proposed percentage standards could be appropriate for later years. Therefore, the potential for RFS to reduce petroleum-based fuel consumption will depend on the percentages finalized by EPA, which, in turn will depend on the development of advanced renewable fuel sources and market infrastructure and could be affected by legal challenges, as well as any legislative action to modify the RFS.[59]

Costs of Key Regulations

Stakeholders we contacted and information we reviewed generally suggest that the outlook of the U.S. refining industry will also depend on the extent to which some key regulations—RFS, Tier 3, stationary source GHG requirements, and LCFS—increase costs for refiners. In general, increasing costs for refiners may be absorbed by refiners themselves

[57] *The American Energy Initiative, Part 22: EPA Greenhouse Gas Regulations, Before the Subcomm. on Energy and Power of the H. Comm. on Energy and Commerce*, 112th Cong. (2012) (statement of EPA Assistant Administrator for Air and Radiation, Regina McCarthy). In addition, EPA specifically projected that the 2012-2016 CAFE and GHG vehicle emission standards would reduce domestic-refined gasoline consumption by about 7 billion gallons per year by 2020 and shrink domestic refining by about 3 percent by 2020. (See: EPA, *Final Rulemaking to Establish Light-Duty Vehicle Greenhouse Emission Standards and Corporate Average Fuel Economy Standards, Regulatory Impact Analysis* (Washington, D.C.: April 2010.)

[58] See EPA, *Renewable Fuel Standard Program (RFS2) Regulatory Impact Analysis*, EPA-420-R-10-006 (Washington, D.C.: February 2010).

[59] Similarly, while EPA issued GHG vehicle emission standards through 2025, NHTSA is required to set CAFE standards only 5 years at a time. CAFE standards for model years 2022-2025 have been presented by NHTSA as "augural" standards in the interest of aiding manufacturers in future product planning, as well as harmonization. A midterm evaluation by NHTSA and EPA may result in modifications to both EPA standards and NHTSA's augural standards. In addition, as discussed below, future requirements under the LCFS—and their effect on refiners—are uncertain due to various factors.

(i.e., by reducing their profits), be passed on to consumers through higher product prices, or both. The requirements on domestic refiners from the key regulations we reviewed generally are expected to collectively have a greater effect in the future, for example, by affecting more refiners (such as the stationary source GHG requirements to the extent that more refineries make modifications over time), or becoming more stringent in the future (such as the RFS), potentially increasing costs for refiners. In addition, several stakeholders told us that the uncertainty surrounding these regulations—and what costs they will impose—can affect the market climate within which refiners and other market participants make investment decisions such as whether to expand a refinery's ability to process different crude oils, or to build new advanced biofuel processing facilities. Such uncertainty can discourage investments in the industry overall.

- *RFS*. RFS may increase costs for some refiners depending on the percentages of renewable fuels required by EPA and on other factors. As discussed previously, costs for some refiners to comply with RFS rose in 2013, which some of the stakeholders we contacted attributed to concerns about the blend wall. The blend wall may remain a concern into the future because statutory renewable fuel blending requirements continue to increase—they more than double from 2012 to 2022—while the consumption of petroleum products is expected to increase only slightly. Several stakeholders told us that the effect of the RFS depends in particular on how EPA addresses the blend wall in the annual standards it issues in the future. Furthermore, EPA's timeliness in issuing the standards could also affect costs to the extent that delays affect the supply of renewable fuels, RIN prices, and refiners' ability to plan and budget effectively for compliance. Several representatives of refiners told us that future delays would contribute to investment uncertainty and higher costs for refiners. EPA officials said that they did not believe delays have affected market participants, and that the market for RFS credits has provided flexibility to refiners and other obligated parties. The extent to which the RFS increases costs in the future could also be affected by the outcome of any relevant litigation and of legislative proposals to change the RFS or how EPA implements it.

- *Tier 3*. According to EPA, to meet the Tier 3 fuel sulfur standards, refiners would need to install or upgrade hydrotreating capacity or

take other steps to reduce the sulfur content in fuels, which will likely increase industry-wide costs.[60] EPA projected that 67 out of 108 refineries would modify or purchase some equipment, and the capital costs of installing this equipment and operating costs to run it would average about $0.0065 per gallon, and total $804 million in 2017. An industry study of the Tier 3 proposal estimated that the regulation would increase costs by up to $0.09 per gallon for the highest-cost refinery, and several refinery representatives told us that Tier 3 would increase their costs.[61] The extent to which the refining industry will be affected by Tier 3 standards would have been greater had EPA decreased the per-gallon maximum allowable sulfur levels in gasoline—known as caps. In the final standards, EPA maintained the current 80 ppm cap, but had sought comment on whether it should decrease the cap to as low as 20 ppm. A stakeholder told us that Tier 3 would be manageable if EPA maintained the current caps, but far more difficult if the caps were lowered. One study we reviewed estimated that industry could incur additional capital expenses to achieve lower sulfur caps, ranging from $2 billion to over $6 billion dollars depending on the sulfur cap level in the final standards.[62]

- *Stationary source GHG requirements*. Several of the refining industry representatives we contacted expressed concerns that stationary source GHG requirements could become more stringent in the future. The current permitting framework is a case-by-case determination that takes into account costs, among other factors, and places no requirement on existing refineries unless they undertake a major modification. However, EPA entered a settlement in which the agency agreed to develop national performance standards—called New Source Performance Standards—for GHG emissions from new and modified refineries, and GHG emissions guidelines for certain facilities at existing refineries.[63] Although EPA has no current schedule to issue these standards, EPA committed in its settlement to issue them, and

[60]Hydrotreating removes sulfur by converting the sulfur into hydrogen sulfide gas and then to elemental sulfur.

[61]Baker & O'Brien Incorporated, *Addendum to Potential Supply and Cost Impacts of Lower Sulfur, Lower RVP Gasoline* (March 2012).

[62]Turner, Mason & Company, *Economic and Supply Impacts of a Reduced Cap on Gasoline Sulfur Content* (Dallas, Texas: February 2013).

[63]See: Settlement Agreement, *State of New York, et al, v. Environmental Protection Agency*, No. 08-1279 (D.C. Cir. Dec. 29, 2010).

several stakeholders expressed concern that future standards could impose more strict controls involving higher costs at refineries. A stakeholder told us that until EPA clarifies its approach for NSPS, many refiners will be reluctant to make certain investments in their refineries out of concerns that their investments may be unprofitable given future requirements. In addition, some companies may preemptively factor in the cost of emissions control technologies in their investment analyses.

- *LCFS*. Two stakeholders and a refining industry trade association told us that California refiners could face higher costs or compliance challenges unless CARB adjusts future low carbon fuel requirements. CARB has estimated that the cost of LCFS on gasoline and gasoline-substitute fuels is likely to range between an increase of $0.09 per gallon, and a decrease of $0.13 per gallon by 2020.[64] However, an industry study estimated that the LCFS could cost the refining industry an average of $0.70 per gallon by 2020.[65] The study also projected that 5 to 7 of 14 California refineries could cease production by 2020, and the LCFS could raise other compliance challenges because of insufficient supplies or consumer uptake of cellulosic, Brazilian sugar-cane ethanol, and other low carbon intensity fuels or vehicle technologies. CARB officials told us that if it proves more difficult than expected to meet LCFS requirements, CARB could introduce cost containment provisions to increase the availability of credits, such as through a "safety valve" to release additional credits at a set price, or by providing extra credits to certain compliance approaches.[66] Stakeholder told us that the decisions CARB makes with respect to the LCFS may affect California refiners' ability to stay in business and compete with refiners in other states and countries.

Extent to Which Refiners Can Export and Compete in Foreign Markets

While the domestic refining industry has increasingly relied on export markets, stakeholders and forecasts we reviewed indicate that the industry's future competitiveness is uncertain and that foreign markets present both challenges and opportunities for U.S. refiners.

[64]California Air Resources Board, *Low Carbon Fuel Standard 2011 Program Review Report* (Sacramento, CA: December 2011).

[65]Boston Consulting Group, *Understanding the Impact of AB32* (Boston, MA: June, 2012).

[66]For example, an electric car could receive three additional credits, thus reducing the need for low carbon fuels with limited availability.

Refiners Projected to Continue to Rely on Foreign Markets

Forecasts and data we reviewed from EIA and IEA suggest that future domestic refinery production levels may depend on exports of petroleum products.[67] Petroleum products are increasingly global commodities, and EIA data indicate that as domestic consumption has declined, refiners have looked to foreign markets to sell products. Since 1949, the United States had been a net importer of petroleum products, but this long-term trend reversed in 2011 when the United States became a net exporter of total petroleum products. According to EIA data, the United States recently exported more petroleum products than other leading exporters, including Russia, India, and Singapore, and petroleum product exports have represented an increasing share of U.S. refinery production. Exports of petroleum products represented 7 percent of refinery production in 2007 but increased to 17 percent in 2012. Major markets for U.S. exports include Central and South America, Mexico, and Europe, to which U.S. refiners sent nearly all diesel exports in 2012. The United States exports more diesel than gasoline, though U.S. refiners have been increasing exports of gasoline to Central and South America and Africa.[68]

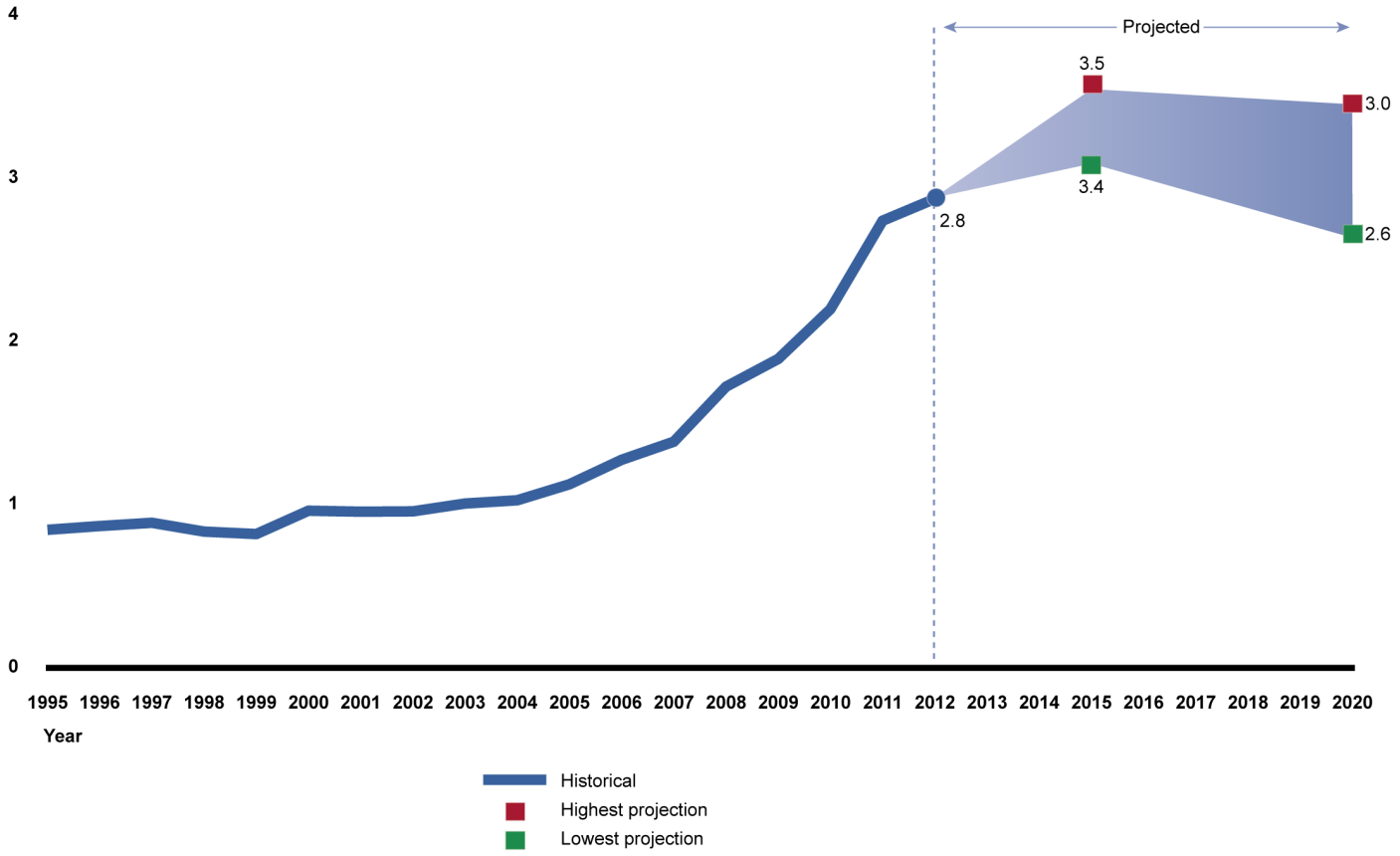
Forecasts that we reviewed generally project that exports will remain strong. According to most of the EIA and IHS forecasts we reviewed, exports of petroleum products are expected to increase until 2015, but the extent of the increase is unclear. As shown in figure 11, EIA scenarios project export levels from 2.6 to 3.4 million barrels per day by 2020, a relatively wide range.[69] Even the lowest projection for petroleum product exports in 2020 is above 2010 levels, indicating a general expectation that exports will remain strong.

[67]Unless noted otherwise, exports of petroleum products in this section refer specifically to finished petroleum products, natural gas liquids and liquid refinery gases, oxygenates (excluding fuel ethanol), and motor gasoline blending components. Finished products include finished motor gasoline, finished aviation gasoline, kerosene-type jet fuel, kerosene, distillate fuel oil, residual fuel oil, and other products.

[68]According to EIA, U.S. exports of diesel reached a record monthly high in July 2013, at 1.4 million barrels per day, and remained strong in August and September 2013. Continued growth in global diesel consumption has supported U.S. exports.

[69]We did not include IHS data in this figure because they are not public.

Figure 11: Historical (1995-2012) and Projected (2015 and 2020) U.S. Exports of Petroleum Products



Sources: GAO analysis of Energy Information Administration and IHS data.

Note: This figure displays the highest and lowest projections of U.S. petroleum product exports by the EIA forecast scenarios we reviewed. Specifically, the highest projection is from EIA's "greenhouse gas $25 and low gas prices" scenario, which assumes a fee for carbon emissions starting at $25 per metric ton in 2014, as well as high crude oil and natural gas resources consistent with EIA's "high oil and gas resource case." The lowest projection is from EIA's "low oil and gas resource" scenario, which assumes lower crude oil and natural gas resources than in the "reference" scenario.

Foreign Markets Could Present Both Challenges and Opportunities for U.S. Refiners

The extent to which domestic refiners are able to export their products will depend on the competitiveness of domestic refiners compared with foreign refiners, and stakeholders we contacted and information we reviewed highlighted both challenges that may inhibit competitiveness and opportunities that may increase it in the future. To sell products abroad, refiners need to be competitive—that is, they must be able to supply fuels that foreign purchasers want to buy at prices that are

attractive. Stakeholders and information we reviewed suggest that various factors may affect the U.S. refining industry's future competitiveness, including: (1) the balance between global refining capacity and global demand for petroleum products, (2) costs associated with environmental regulations, (3) exports to nations with stringent fuel standards, and (4) increasing domestic and Canadian crude oil production. More specifically:

- *Balance between global refining capacity and demand*. IEA data indicate that competition from foreign refiners may increase as global refining capacity is projected to exceed global consumption, creating an imbalance between global supply and demand that may affect U.S. refiners. According to IEA, global consumption of petroleum products was about 78.9 million barrels per day in 2012 and is projected to grow an additional 6 million barrels per day by 2020—with growth concentrated in Asia and the Middle East and consumption declining in Europe. But IEA projects refining capacity may grow even faster, resulting in excess capacity (refining capacity beyond that needed to meet consumption) of nearly 15.5 million barrels per day by 2020, in contrast to an estimated 4.8 million barrels per day of excess capacity in 2012.[70] Excess refining capacity is likely to result in greater competition in foreign markets overall, and some regions may present particular challenges. A large share of the new capacity is expected in China, India, and the Middle East, and representatives of two refiners indicated concern that capacity additions in some of those regions may present competition for U.S. refiners. Several other stakeholders were optimistic about domestic refiners' ability to compete in the future. According to IEA, capacity additions in China and India are intended to keep pace with growing consumption in those regions, but new Middle Eastern refineries are intended to be export facilities and may present increased competition to U.S. refiners.

- *Costs associated with environmental regulations*. As discussed above, the key environmental regulations we reviewed could collectively impose additional costs on the domestic refining industry. These costs could affect the industry's ability to compete internationally to the extent that foreign refiners do not face similar costs. In addition, regulatory uncertainty can affect refiners'

[70]Excess capacity may result in some refinery closures. IEA's New Policies Scenario projects 6.3 million barrels per day of global refining capacity may be at risk of closure in 2020, but the projected capacity at risk is outside of North America.

competitiveness if it inhibits the industry from making investments that would otherwise lower costs. Not all of the key regulations we reviewed would be expected to affect the industry's competitiveness. In particular, CAFE and GHG vehicle standards do not impose requirements on refiners. In addition, although RFS and Tier 3 standards could impose requirements with potential associated costs on some refiners, they would not apply to exported fuels—they apply only to fuels sold in the United States regardless of where they are produced.

- *Potential for increased exports to nations with stringent fuel standards*. In general, U.S. refineries are among the most sophisticated in the world and have generally been optimized to produce large proportions of cleaner-burning gasoline. IEA has pointed out that refiners in many parts of the world face challenges producing fuels that meet high product quality and environmental performance standards.[71] Therefore, some U.S. refiners may benefit from any trend toward higher quality and more stringent environmental performance standards. In this regard, actions refiners may take to reduce gasoline sulfur to comply with proposed Tier 3 standards could enable them to export to markets—such as Japan and much of Europe—that already require low sulfur gasoline.[72] On the other hand, representatives of a refiner pointed out that refiners could undertake such investments on their own—without Tier 3—if such exports were sufficiently economically attractive.

- *Increasing domestic and Canadian crude oil production*. As discussed above, increasing U.S. and Canadian crude oil production has led to lower cost crude oil for some refiners, providing a competitive advantage.[73] All of the forecast scenarios we reviewed from EIA, IEA, and IHS anticipate increases in U.S. crude oil production, but the projections are uncertain and vary widely—from 6.8 to 9.8 million

[71]See International Energy Agency, *World Energy Outlook 2013* (Paris, France: November 2013).

[72]According to EPA, Japan, the 30 nations that comprise the European Union, Albania, and Bosnia-Herzegovina have 10 ppm gasoline sulfur caps in place.

[73]Closely associated with this trend has been the increasing availability and lower costs of natural gas, which has also provided a benefit to U.S. refiners.

barrels per day in 2020 as shown in figure 12.[74] Projections are revised each year, and expectations for U.S. crude oil production in 2020 have increased in more recent forecasts. For example, the reference scenario in EIA's most recent forecast projects domestic crude oil production to approach a historical high of 9.6 million barrels per day in 2020, higher than the reference scenario from the prior year.[75] Canadian crude oil production—which accounted for about 16 percent of the crude oil used by U.S. refineries in 2012—is expected to increase as well: the reference scenario in EIA's international forecast projects that Canadian petroleum liquids production will increase more than 30 percent from 2012 levels, reaching approximately 5 million barrels per day in 2020.[76] The extent of the increase in future crude oil production can have implications for future petroleum product exports. For example, EIA's scenario that assumes more domestic crude oil and natural gas resources projects higher export levels than a scenario that assumes low crude oil and natural gas resources. Several stakeholders told us that various issues could mitigate U.S. refiners' ability to take advantage of growing crude oil supplies. In particular, it is unclear whether planned expansions in pipelines and rail transportation will keep pace with growing production, and these infrastructure expansions could be affected by regulatory actions to address pipeline and rail safety.[77] Similarly, several stakeholders told us that potential future increases in crude oil

[74]EIA expects most of the increase to come from onshore tight oil formations in the Bakken, Eagle Ford, and Permian Basin regions, though increases are likely in domestic offshore production as well.

[75]EIA's most recent forecast, the Annual Energy Outlook 2014 Early Release, contains reference scenario projections only. Projections for other scenarios were not available at the time of this report's publication.

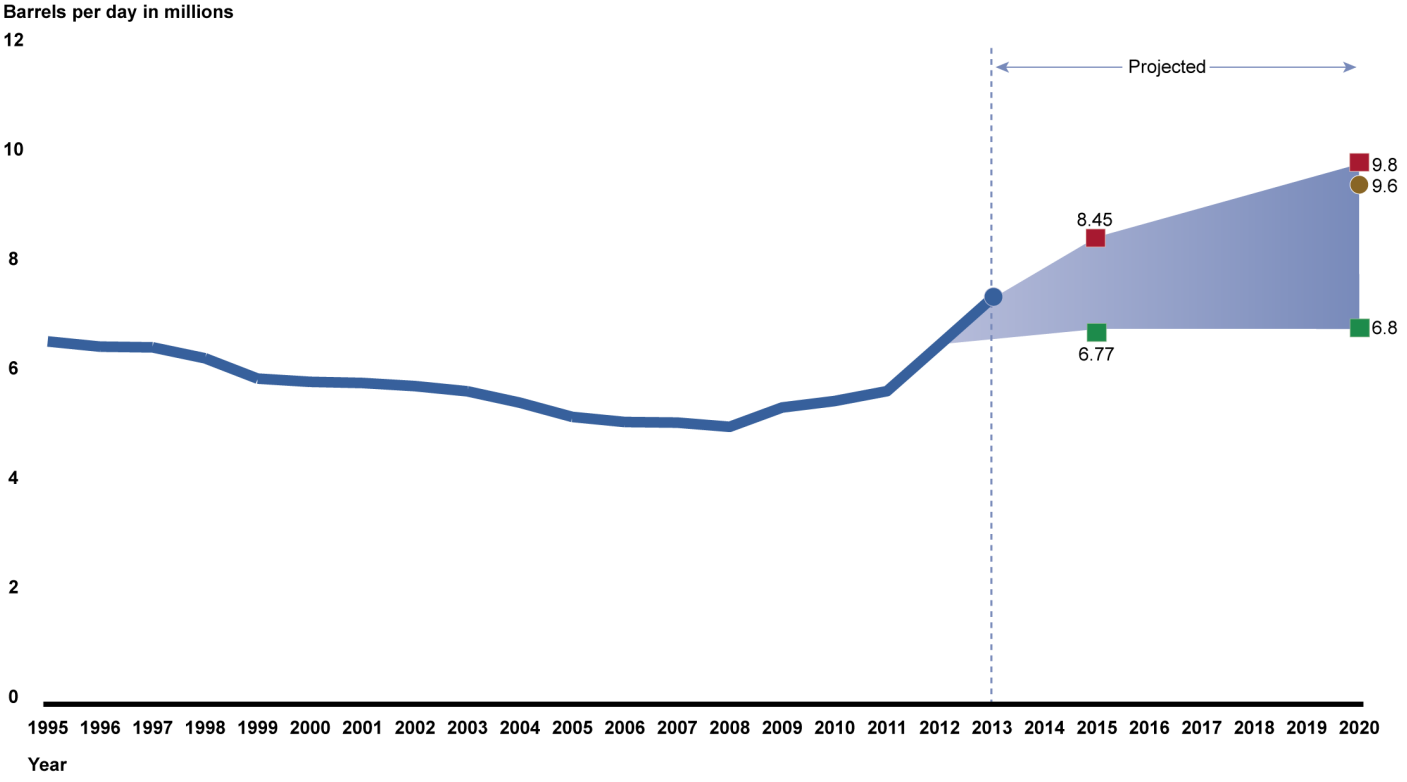
[76]According to EIA, petroleum liquids include crude oil and lease condensate as well as natural gas plant liquids, bitumen, extra-heavy oil, and refinery gains.

[77]For example, in July 2013, a deadly explosion occurred after a railcar carrying crude oil derailed in Quebec. In response to petitions it received following the accident, DOT's Pipeline and Hazardous Materials Safety Administration is considering whether to revise its regulations to improve railcar safety standards. See 78 Fed. Reg. 54849 (Sept. 6, 2013).

exports, which are currently minimal, could put pressure on regional crude oil prices, reducing the price advantage of U.S. refiners.[78]

[78]According to EIA data, total crude oil exports totaled 67,000 barrels per day in 2012—1 percent of total 2012 production. U.S. exports of crude oil must be licensed by the Department of Commerce, Bureau of Industry and Security. Current regulations specify limited conditions in which license applications will be approved, for example, for exports to Canada for use or consumption in Canada and that are transported other than through the Trans-Alaska Pipeline, for which some restrictions apply. Other applications for export licenses are to be reviewed on a case-by-case basis and generally will be approved if determined to be consistent with the national interest and the purposes of the Energy Policy and Conservation Act, and any additional statutory controls are satisfied. See generally 15 C.F.R. § 754.2 (2013).

Figure 12: Historical (1995-2013) and Projected (2015 and 2020) U.S. Crude Oil Production



Sources: GAO analysis of EIA and IHS data.

Note: This figure displays the highest and lowest projections of U.S. crude oil production by the IHS and EIA forecast scenarios we reviewed. Historical data for 2013 is the 9-month average of production through September. Specifically, the highest projection is EIA's "greenhouse gas $10 and low gas prices" scenario, which assumes 100 percent higher oil recovery and 50 percent higher undiscovered resources than in the reference scenario, as well as a policy change that applies a $10 per metric ton fee for carbon emissions throughout the economy beginning in 2014. The lowest projection, EIA's "high net imports" scenario, assumes 50 percent lower crude oil recovery than the reference scenario, along with changes that would create the need for increased imports. Also displayed is EIA's 2014 forecast reference scenario that assumes current laws and regulations are unchanged.

Conclusions

The domestic petroleum refining industry has been and is expected to continue to be affected by several profound changes. Some of these changes, such as the growth in crude oil production in the United States

and Canada, are reshaping the industry and creating new business opportunities. To take advantage of some of these opportunities, refiners and other market participants will need to invest—to upgrade refineries to be able to process different crude oils or to build pipelines or rail connections to move more crude oil from production to refining centers. Uncertainty can affect the market climate within which these investment decisions will be made. In this context, EPA's timeliness in issuing annual percentage standards under the RFS is important to help inform the investment decisions of the refining industry. In issuing annual percentage standards, EPA may waive the statutory volumes in whole or in part according to statutory criteria, which EPA has identified as potentially factoring in the blend wall, market developments, and other issues. However, EPA has missed the annual deadline for issuing annual standards under the RFS in most years. EPA has some systems in place to monitor and evaluate progress in developing regulations, which could provide useful information for understanding delays in RFS. But EPA has not identified the underlying causes of delays, and it has not developed a plan to address delays and, therefore, risks repeating delays. EPA delays in issuing RFS standards are important because delays do not change refiners' compliance periods accordingly and they therefore create uncertainty in the marketplace, potentially harming investment. Uncertainty among refiners, renewable fuel producers, and other market participants about how EPA will address the blend wall, which can be exacerbated by the prospect of litigation, can affect investment decisions and ultimately the availability and prices of the fuels they produce.

Recommendations for Executive Action

To improve EPA's ability to meet the annual statutory deadline for issuing annual RFS standards, we recommend that the Administrator of the EPA take the following two actions:

- Assess past experience to identify the underlying causes of delays in issuing annual RFS standards.
- Develop and implement a plan to address the causes of delays and help ensure RFS annual standards are issued on time.

Agency Comments and Our Evaluation

We provided drafts of this report to DOE, DOT, and EPA for review and comment. The three agencies provided technical comments on early or final drafts, which we incorporated as appropriate.

EPA also provided a letter in which it generally agreed with our findings and recommendations and clarified three topics discussed in the report.

First, regarding the effects of compliance with RFS, EPA asserted that refiners experience the same compliance costs regardless of whether they are fully integrated, with blending capabilities, or merchant refiners that purchase credits for compliance. Based on our work, we found the views of several stakeholders differed from EPA's. For example, in a 2011 study, DOE identified the degree to which a small refiner can actively blend production with renewable fuels is a large component that could contribute to economic hardship from compliance with the RFS.[79] In theory, market-based compliance systems—such as the RFS credit system—provide incentives for market participants to make decisions that would tend to equalize additional compliance costs over time. However, there can be physical infrastructure or contractual constraints, among various other factors, that could result in different outcomes in the short run. We added additional language to explain EPA's views in the report and in Appendix III.

Second, regarding the time-frame for RFS compliance, EPA stated that the RFS compliance deadline—the date by which refiners and other obligated parties must demonstrate compliance to EPA—is established through implementing regulations, not statute. EPA stated that it adjusted the 2013 deadline to provide additional time to demonstrate compliance. We acknowledge that EPA can extend the compliance deadline. However, the compliance period refers to the time during which refiners and other parties incur obligations under RFS and can take steps to incorporate additional renewable fuels to generate credits for compliance. This period is set by statute to be a full calendar year. We clarified language in the report to acknowledge EPA's ability to adjust the compliance deadline, essentially providing additional time for obligated parties to purchase credits, and its inability to adjust the compliance period.

Third, regarding Tier 3 standards, EPA announced the final standards while our draft was with the agency for comment. EPA stated that the final Tier 3 program is very similar to what it proposed, though EPA made

[79]Department of Energy, Office of Policy and International Affairs, *Small Refinery Exemption Study: An Investigation into Disproportionate Economic Hardship*, March, 2011.

some changes based on public input and updated its analyses. EPA provided technical comments to incorporate information from the final rule which we incorporated into the report, as appropriate. However, we were not able to obtain stakeholder and other views on the final Tier 3 rule for this report. See appendix IV for EPA's letter.

As agreed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time we will send copies to the appropriate congressional committees and to the Secretaries of Energy and Transportation and the Administrator of the EPA. In addition, the report will be available at no charge on the GAO website at http://www.gao.gov.

If you or your staff members have any questions about this report, please contact me at (202) 512-3841 or ruscof@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix V.

Frank Rusco
Director, Natural Resources and Environment

Appendix I: Scope and Methodology

This report provides information on the domestic petroleum refining industry and its market and regulatory environment. Specifically, it addresses what is known about (1) major changes—including key environmental regulations—that have recently affected the domestic petroleum refining industry and (2) major factors that may affect the future of the domestic petroleum refining industry—including its production, profitability, and competitiveness in foreign markets.

To provide information on major changes that have affected the domestic petroleum refining industry and the future of the industry, we reviewed information including the following:

- studies by federal agencies and consultants,
- company financial regulatory filings, and
- proposed and final regulations and regulatory impact analyses.

To identify studies and other literature, we conducted searches of various databases, such as ProQuest and PolicyFile, for studies since published 2009. We also asked agency officials and other stakeholders we contacted to recommend studies.

Based on our research and information from stakeholders, we identified five key regulations that were recently strengthened or proposed: (1) the Environmental Protection Agency's (EPA) Renewable Fuels Standard regulations, (2) the Department of Transportation's Corporate Average Fuel Economy and EPA's greenhouse gas vehicle emission standards; (3) EPA's Tier 3 Motor Vehicle Emission and Fuel Standards; (4) EPA's stationary source greenhouse gas requirements; and (5) the state of California's Low Carbon Fuel Standard. We reviewed agency regulatory impact assessments and industry and other studies on the effect of these regulations on industry. Other regulations may also affect the industry.

We also summarized the results of semistructured interviews with a nonprobability sample of 32 stakeholders. (See app. II for a list of these stakeholders.) Stakeholders included representatives from refining companies, environmental organizations, consultants, and officials from federal and state agencies. We also visited several refineries of selected refining companies. We selected these stakeholders to represent broad and differing perspectives on these issues based on recommendations from agencies and industry associations, along with other information. For example, to select refiners, we considered, among other factors, the size

and location of their refineries, and whether they were vertically integrated or merchant refiners. When possible, we used a standard set of questions in interviewing stakeholders, including questions about the effect of the key regulations we reviewed. However, as needed, we also sought perspectives on additional questions tailored to these stakeholders' expertise and sought opinions from stakeholders on key issues, such as their views on the potential effects of exports on industry. Because we used a nonprobability sample, the views of these stakeholders are not generalizable to all potential stakeholders, but they provide illustrative examples of the range of views. Similarly, the conditions at the refineries we visited are not generalizable to all refineries. The stakeholder views we summarize were not necessarily supported by all types of stakeholders, though we identify differing views where appropriate. Stakeholders and information we reviewed identified a number of changes that have affected the industry and a number of factors that may affect its future, and we report on those that were most often cited.

To illustrate major changes over time and to describe the domestic petroleum refining industry, we summarized historical data from the Energy Information Administration (EIA) regarding such issues as capacity and location of refineries, crude oil production, and consumption of petroleum products. To assess the reliability of EIA data, we took several steps including reviewing documentation, interviewing EIA staff, and consulting with stakeholders. We determined the EIA data to be sufficiently reliable for the purposes of this report.

To provide information about the future of the domestic petroleum refining industry and major factors that could affect it, we also reviewed forecasts from EIA, the International Energy Agency (IEA), and IHS, and summarized projections through 2020 under different scenarios.[1] We selected these forecasts because they made projections through 2020, contained information broadly relevant to our report, covered multiple scenarios or offered a counterpoint scenario, and contained well-documented discussions of methodologies used and assumptions made.

[1]Department of Energy, Energy Information Administration, *Annual Energy Outlook 2013 with Projections to 2040*, DOE/EIA-0383(2013) (Washington, D.C.: April 2013); Department of Energy, Energy Information Administration, *Annual Energy Outlook 2014 with Projections to 2040, Early Release*, DOE/EIA-0383ER(2014) (Washington, D.C.: December 2013); International Energy Agency, *World Energy Outlook 2013* (Paris, France: November 2013); IHS, *US Energy Outlook 2013* (Englewood, CO: November 2013).

While forecasts are subject to inherent uncertainties, we found these forecasts to be reasonable for describing a range of views about potential conditions of the domestic refining industry and major factors that will help determine these conditions. We reviewed and compiled data from relevant scenarios and compared them where appropriate. Specifically, we reviewed all 27 scenarios in EIA's 2013 forecast, the reference scenario in EIA's 2014 initial forecast,[2] and IHS's forecast, and, in particular, highlight the scenarios representing the highest and lowest projection of gasoline, diesel, and jet fuel consumption; petroleum product exports; and crude oil production.[3] We identified some differences in the metrics reported in the four forecasts and did not make direct comparisons in these instances.

We conducted this performance audit from November 2012 to March 2014 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

[2]EIA's 2014 Annual Energy Outlook Early Release contains reference scenario projections only. Other scenarios were not available at the time of this report's publication.

[3]We highlight the following scenarios in the report: reference (2014), low or no net imports, high net imports, high economic growth, low oil and gas resource, greenhouse gas $25 and low gas prices, and greenhouse gas $10 and low gas prices.

Appendix II: List of Stakeholders

Federal Agencies	1. Department of Energy[1]
	2. Department of Transportation
	3. Environmental Protection Agency
Refiners	4. Chevron
	5. CVR Refining
	6. HollyFrontier Corporation
	7. Marathon Petroleum Corporation
	8. Monroe Energy
	9. PBF Energy
	10. Philadelphia Energy Solutions
	11. Phillips 66
	12. Shell
	13. Tesoro Corporation
	14. Valero Energy Corporation
Other	15. American Fuel and Petrochemical Manufacturers
	16. American Petroleum Institute
	17. Baker & O'Brien Incorporated
	18. Prof. Severin Borenstein, University of California Energy Institute
	19. California Air Resource Board
	20. California Energy Commission
	21. Citigroup Global Markets Inc.
	22. Energy Policy Research Foundation (EPRINC)
	23. Environmental Integrity Project
	24. IHS
	25. Prof. Christopher Knittel, Massachusetts Institute of Technology

[1]We also obtained views from officials at the Energy Information Administration within the Department of Energy.

26. Prof. Erich Muehlegger, Harvard Kennedy School
27. Muse Stancil
28. National Association of Clean Air Agencies
29. Natural Resources Defense Council
30. Sierra Club
31. Stillwater Associates
32. Turner, Mason & Company

Appendix III: Further Information Regarding the Renewable Fuel Standard, Compliance Credits, and the Blend Wall

To demonstrate compliance with the Environmental Protection Agency's (EPA) annual blending requirements under the Renewable Fuel Standard (RFS), refiners use renewable identification numbers (RIN), which we refer to in this report as credits. A RIN is a unique 38-character code that renewable fuel producers and importers assign to each gallon of renewable fuel produced or imported. To demonstrate compliance with the RFS, refiners and importers must provide sufficient RINs for the volume of gasoline and diesel they produce for use in the contiguous United States and Hawaii. For example, to comply with the 2013 total renewable fuels standard requiring that renewable fuels compose at least 9.74 percent of gasoline and diesel, a refiner selling 100 million gallons of gasoline would have to provide 9.74 million total RINs to EPA. Refiners can obtain RINs by purchasing and blending renewable fuels themselves, or they can purchase RINs from renewable fuel producers, importers, blenders, other refiners, or other RIN-holding entities. RINs are valid for the calendar year in which they were generated, and up to 20 percent of a year's standard can be met with RINs from the previous year. Refiners and other obligated parties with more RINs than needed to meet the year's blending standard can hold them for use in the following year or sell them to another party that needs additional RINs to comply with the blending standard.

Prices for RINs reflect the cost of renewable fuels compared with the petroleum fuels they displace, the stringency of annual blending percentage standards, and other factors, and have varied over time. According to the Energy Information Administration (EIA), between 2006 and much of 2012, corn-based ethanol RIN prices were low—between $0.01 and $0.05 per gallon—because it was generally economical to blend up to or above the level required by the RFS. However, RIN prices for corn-based ethanol increased to over $1.40 per gallon in July 2013. Several stakeholders told us this increase in RIN prices was primarily due to RFS requirements exceeding the capability of the transportation fuel infrastructure to distribute and the fleet of vehicles to use renewable fuels, referred to as the "blend wall." EPA officials told us that high corn prices, which made ethanol more expensive relative to gasoline, also contributed to higher RIN prices during this period. These RIN prices have since come down to about $0.20 per gallon as of mid-November 2013. A refiner attributed this decline to EPA's statements expressing its desire to address the blend wall.

The blend wall exists because blending more than 10 percent ethanol with gasoline (called E10) is affected by constraints such as the limited availability of vehicles that can use higher ethanol blends.[1] In addition, higher ethanol blends are less widely available than E10 and must be priced at a discount to encourage greater consumption, according to EIA. EPA officials recently said the blend wall would be reached in 2014 when about 13.2 billion gallons of E10 could be consumed.[2] Blending additional renewable fuels can be difficult and costly once the blend wall is reached because significant volumes of non-ethanol renewable fuels must be available, consumers must be encouraged to purchase additional higher blends of ethanol, and other market participants must develop the infrastructure to deliver those fuels.

Compliance with the RFS has recently increased costs for some refiners, according to information we reviewed and several stakeholders we contacted. While the RFS applies to all refiners in the same way, effects of rising or falling RIN prices may vary depending on each refiner's situation. For example, those refiners that have incorporated renewable fuel blending into their operations may have benefited from the rising prices relative to those refiners that are less well positioned. According to several stakeholders, RFS compliance has been most difficult for refiners with less of a retail presence, known as merchant refiners, because they do not blend their own fuel and must purchase RINs from others, increasing their cost of compliance. On the other hand, some industry participants may be relatively advantaged when the price of RINs rises. For example, an ExxonMobil official said that RIN costs did not have a significant impact on the company's financial performance during the second quarter of 2013 because ExxonMobil meets the majority of its obligation by blending its renewable fuels itself.

EPA officials told us, however, that the RFS program affects all refiners equally because obligations are the same regardless of whether refiners blend renewable fuels themselves or purchase RINs. In particular, EPA stated that refiners experience the same costs. If a company generates

[1]We have previously reported on various aspects of the blend wall and other challenges to the increased use of renewable fuels. See GAO-11-513 and GAO-09-446.

[2]The RFS requirements are "nested" in that renewable fuels other than ethanol could be used to meet the total renewable fuels requirement.

its own RINs, there is a cost associated with doing so, namely the cost for the renewable fuel compared to the petroleum fuel it displaces.

Appendix IV: Comments from the Environmental Protection Agency

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR - 5 2014

OFFICE OF
AIR AND RADIATION

Mr. Frank Rusco
Director
Natural Resources and Environment
U.S. Government Accountability Office
Washington, DC 20548

Dear Mr. Rusco:

Thank you for the opportunity to review and comment on GAO's draft report "Petroleum Refining: Industry's Outlook Depends on Market Changes and Key Environmental Regulations." As stated in the draft report, GAO's objectives were to examine: (1) major changes—including key environmental regulations—that have recently affected the domestic petroleum refining industry; and (2) major factors that may affect the future of the domestic petroleum refining industry—including its production, profitability, and competitiveness in foreign markets.

I am responding on behalf of the EPA, as the primary office which participated in this review is the EPA's Office of Air and Radiation. The EPA generally agrees with the report's two recommendations and findings. Below, I am providing an overview of three important clarifications on the technical findings, as well as our response to the report's recommendations. Under separate cover, I have asked staff to submit suggested modifications to the technical findings in the draft report that might provide more clarity and completeness.

RFS Compliance Costs

The report states that "…compliance costs have increased recently for some refiners…" and "according to several stakeholders, RFS compliance has been most difficult for refiners with less of a retail presence, known as merchant refiners, because they do not blend their own fuel and must purchase RINs from others, increasing their cost of compliance."

In response to the report, we assert that obligated parties under the Renewable Fuel Standard (RFS) program are experiencing the same compliance costs regardless of whether the refiner is "fully integrated," with blending capabilities, or is a "merchant" refiner that is purchasing RINs (Renewable Identification Numbers- tradable credits used for demonstrating compliance with the program). The cost of the RIN to the obligated party is equivalent to the cost of blending the renewable fuel itself. In other words, obligated parties have the choice to blend the renewable fuel themselves or essentially pay another party to blend the fuel by purchasing a RIN from them. If a company generates its own RINs, there is a cost associated with doing so, namely, the cost for the renewable fuel compared to the petroleum it displaces. Omitting this information from the report is potentially misleading.

Impact of the EPA promulgating RFS annual standards later than the statutory deadlines

The report states that "The RFS compliance period is set by statute, so delays do not change refiners' compliance dates."

In response to the report, we note that while the statute does include deadlines for the EPA to establish annual applicable volumes under the RFS program, the compliance deadline for obligated parties under the RFS program is not set in the Clean Air Act, but rather through the implementing regulations (see 40 CFR 80.1451). For example, the EPA extended the compliance deadline for the 2013 compliance year to June 30, 2014, to provide additional compliance time, and allow parties to take their 2014 obligations into consideration as they determined compliance with the 2013 standards.

Tier 3 Standards

The EPA issued the Tier 3 final rulemaking on March 3, 2014. While the final Tier 3 program is very similar to what we proposed, we made some changes to the final rule based on public input and updated analyses. In the attached comments and edits to the draft report, we have updated the report's findings to incorporate information from the final rule.

GAO Recommendations

To improve the EPA's ability to meet the annual statutory deadline for issuing annual RFS standards, GAO recommended that the Administrator of the EPA take the following two actions:

1) Assess past experience to identify the underlying causes of delays in issuing annual RFS standards.
2) Develop and implement a plan to address the causes of delays and help ensure RFS annual standards are issued on time.

EPA Response

The EPA generally agrees with GAO's recommendations. We agree that identifying the cause of delays and developing and implementing a plan to address the delays may help to ensure that the annual RFS volume standards are issued on time. The EPA strives to issue the RFS standards according to the statutory deadlines, and we are continually seeking the best approaches to achieve that goal.

As GAO is aware, the Agency has a comprehensive process, known as the *Action Development Process* (ADP), for developing regulations. To monitor progress and ensure quality, the ADP employs numerous development milestones during the preparation of proposed and final regulations. The ADP is utilized internally by management to ensure that projected milestones are achieved, and some of the milestones are also made available to the public on the EPA's website (http://yosemite.epa.gov/opei/RuleGate.nsf/). As we respond to GAO's recommendations and try to reduce the delay in issuing the annual standards, the EPA will consider whether the ADP milestones are being utilized and managed appropriately.

As GAO states, the RFS touches a range of complex environmental, energy, and agricultural issues, and the need for interagency review and public comment adds to the timelines for issuing such standards.

The EPA is currently considering how to improve our internal regulatory review processes in order to meet established deadlines. The first step in this process will be to identify the causes of delays, and then develop a corrective plan to address them. The EPA will also be engaging our interagency partners, including OMB, during the course of this process to identify any areas that could be streamlined for a more efficient and timely review.

Thank you again for the opportunity to review and respond to the draft report. If you have any questions or require further information, please contact Venu Ghanta at (202) 564-1374.

Sincerely,

Janet G. McCabe
Acting Assistant Administrator

Enclosure
1. EPA edits and comments to GAO's draft report

Appendix V: GAO Contact and Staff Acknowledgments

GAO Contact

Frank Rusco, (202) 512-3841 or ruscof@gao.gov

Staff Acknowledgments

In addition to the individual named above, Christine Kehr (Assistant Director), Elizabeth Beardsley, Catherine Bombico, Keya Chateauneuf, Nirmal Chaudhary, Quindi Franco, Cindy Gilbert, Katharine Kairys, Michael Kendix, Armetha Liles, and Alison O'Neill made key contributions to this report.

Related GAO Products

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