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Editor

Oil Refining and the Petroleum Industry

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OIL REFINING AND THE PETROLEUM INDUSTRY

MATTHEW H. BROUWER
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**OIL REFINING AND THE
PETROLEUM INDUSTRY**

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PREFACE

The U.S. petroleum refining industry experienced what some have called a "golden age" during the years 2004-2007. During this period, the demand for petroleum products, especially gasoline, increased rapidly both in the United States and world markets. Refiners found favorable price-spreads between heavy and light crude oils, as well as between crude oil and refined products. The industry operated plants at nearly maximum capacity and posted record profit levels. This book examines current production capacity of refineries operating in the U.S. and the sources and changes in crude oil supply; the changing characteristics of petroleum and petroleum product markets and a discussion of the policy and regulatory factors that are likely to affect the structure and performance of the industry during the next decade.

Chapter 1- A decade ago, 158 refineries operated in the United States and its territories and sporadic refinery outages led many policy makers to advocate new refinery construction. Fears that crude oil production was in decline also led to policies promoting alternative fuels and increased vehicle fuel efficiency. Since the summer 2008 peak in crude oil prices, however, the U.S. demand for refined petroleum products has declined, and the outlook for the petroleum refining industry in the United States has changed.

Chapter 2- The petroleum refining industry provides products that are critical to the functioning of the economy. Virtually all transportation, land, sea, and air, is fueled by products that are refined from crude oil. Industrial, residential, and commercial activities, as well as electricity generation, use petroleum-based products. Along with volatile changes in crude oil prices, the industry has faced evolving health, safety, and environmental requirements which have changed and multiplied product specifications and required capital investment in refineries.

Chapter 3- The antitrust laws and statutes to prohibit “price gouging” each aim to serve the same end — realization of lower or reasonable prices for consumers, but they do so from different perspectives. Antitrust law operates on the premise that vigorous and unfettered marketplace competition will yield the most advantageous result for consumers. Statutes concerning “price gouging,” by contrast, are direct consumer-protection measures, generally making no reference to competition. Statutes to limit the extent of vertical integration in the petroleum industry (common ownership of different stages of production, marketing, or retailing) have been proposed at the federal level, and exist at the state level, but contrary to the expectations of proponents, the price of gasoline in those states that prohibit refiners from operating retail gasoline stations is generally higher than in states without similar prohibitions. Although the potential for anticompetitive actions by vertically integrated entities has been noted by, among others, the Federal Trade Commission (FTC), it also states in a 2005 report, that “the vast majority of the FTC’s investigations [into the petroleum industry] have revealed market factors to be the primary drivers of both price increases and price spikes.” The Energy Policy Act of 2005 required an FTC investigation “to determine if the price of gasoline is being artificially manipulated by reducing refinery capacity or by any other form of market manipulation or price-gouging practices”; the 110th Congress enacted the Energy Independence and Security Act of 2007 with a provision authorizing the FTC to promulgate a rule concerning market manipulation. Also in the 110th Congress, the House has passed H.R. 1252, which would define “price gouging” as “excessively unconscionable” or “unreasonably” increased prices during Presidentially declared “energy emergencies,” incorporates the FTC Act, directs FTC enforcement, and provides for civil and criminal penalties (several, similar measures are pending in the Senate Commerce Committee); and H.R. 6074 to make “oil-producing and exporting cartels illegal” under U.S. antitrust laws. This report, attempts to provide the antitrust context for the prohibited practices, notes prior congressional action concerning vertical divestiture in the petroleum industry, and provides information on the state “divorcement” statutes.

Chapter 4- World consumption growth for middle distillate fuels (diesel fuel, heating oil, kerosene, and jet fuel) has exceeded the consumption growth for gasoline for some time, and the United States is no exception. Although the decrease in the ratio of total gasoline consumption to consumption for middle distillate fuels has been small in the United States, recent legislation requiring increased use of renewable fuels has resulted in forecasts that project a decline in consumption for petroleum-based gasoline from refineries, which would

accelerate the decline in the gasoline-to-middle distillate ratio from what has been seen historically. Rising fuel economy standards for light duty vehicles are also expected to exert significant downward pressure on gasoline demand relative to diesel demand. In addition, price incentives to produce more middle distillate fuels have changed in recent years, with middle distillate margins exceeding those of gasoline more often than in the past.

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Chapter 1

**THE U.S. OIL REFINING INDUSTRY:
BACKGROUND IN CHANGING
MARKETS AND FUEL POLICIES***

*Anthony Andrews, Robert Pirog
and Molly F. Sherlock*

SUMMARY

A decade ago, 158 refineries operated in the United States and its territories and sporadic refinery outages led many policy makers to advocate new refinery construction. Fears that crude oil production was in decline also led to policies promoting alternative fuels and increased vehicle fuel efficiency. Since the summer 2008 peak in crude oil prices, however, the U.S. demand for refined petroleum products has declined, and the outlook for the petroleum refining industry in the United States has changed.

In response to weak demand for gasoline and other refined products, refinery operators have begun cutting back capacity, idling, and, in a few cases, permanently closing their refineries. By current count, 124 refineries now produce fuel in addition to 13 refineries that produce lubricating oils and asphalt. Even as the number of refineries has decreased, operable refining capacity has actually increased over the past

* This is an edited, reformatted and augmented version of a Congressional Research Service publication, CRS Report for Congress R41478, from www.crs.gov, dated November 22, 2010.

decade, from 16.5 million barrels/day to over 18 million barrels/day. Cyclical economic factors aside, U.S. refiners now face the potential of long-term decreased demand for their products. This is the result of legislative and regulatory efforts that were originally intended, in part, to accommodate the growing demand for petroleum products, but which may now displace some of that demand. These efforts include such policies as increasing the volume of ethanol in the gasoline supply, improving vehicle fuel efficiency, and encouraging the purchase of vehicles powered by natural gas or electricity.

Since the Clean Air Act Amendments, 15 distinctly formulated boutique fuels are required in portions of 12 states. H.R. 392, the Boutique Fuel Reduction Act of 2009, would further amend the Clean Air Act to add temporary waivers for boutique fuels due to unexpected problems with distribution and give EPA authority to reduce the number of boutique fuels. The 2005 Energy Policy Act created the Renewable Fuel Program to substitute increasing volumes of renewable fuel for gasoline. The 2007 Energy Independence and Security Act expanded the program to cover transportation fuels in general, extended the program to calendar year 2022, and increased the target volume to 36 billion gallons renewable fuel annually. The 2008 Food, Conservation and Energy Act of 2008 reduced some of the federal subsidies and tax breaks favoring ethanol production. A 2007 U.S. Supreme Court ruling found that EPA has the authority under the Clean Air Act to regulate carbon dioxide (CO₂) emissions from automobiles. Though the ruling applied to automobiles, it had wider implications. In response to the FY2008 Consolidated Appropriations Act (H.R. 2764; P.L. 110-161), EPA issued the Mandatory Reporting of Greenhouse Gases Rule that requires suppliers of fossil fuels or industrial greenhouse gases (GHG), manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons or more per year of GHG emissions to submit annual reports to EPA. H.R. 2454, The American Clean Energy and Security Act of 2009 (passed in the House June 26, 2009) would amend the Clean Air Act by establishing a "cap-and-trade" system designed to reduce greenhouse gas emissions (GHG) and would cap emissions from refineries and allow trading of emissions permits ("allowances"). As proposed, H.R. 2454 would require U.S. refiners to purchase emission credits for both their stationary emissions and the subsequent combustion of their fuels (predominantly consumed in the transportation sector). S. 3663, introduced in August 2010, would establish a Natural Gas Vehicle and Infrastructure Development Program to promote natural gas as an alternative transportation fuel in order to reduce domestic oil use.

The prospect of declining motor-fuel demand may persuade operators to idle, consolidate, or permanently close refineries.

INTRODUCTION

The U.S. petroleum refining industry experienced what some have called a “golden age” during the years 2004-2007. During this period, the demand for petroleum products, especially gasoline, increased rapidly both in the United States and world markets. Refiners found favorable price-spreads between heavy and light crude oils as well as between crude oil and refined products. The industry operated plants at nearly maximum capacity and posted record profit levels. Unexpected events such as hurricanes that shut down Gulf Coast refineries, concerns over “peak oil” production, and crude oil price speculation likely contributed to spikes in gasoline prices. During the period, many policy makers expressed the concern that U.S. refining capacity was not increasing rapidly enough to keep up with the expected growth in demand for petroleum products.

U.S. gasoline consumption began declining in 2008, by almost 99 million barrels from the previous year, and another 10 million barrels in 2009.¹ Paradoxically, the United States began importing more gasoline—81 million barrels in 2009.² U.S. renewable fuel production (in the form of ethanol) exceeded 256 million barrels, and ethanol imports added nearly 4.6 million barrels.³

The concern has now shifted to fears that refining overcapacity may exist in the United States, as the state of, and the outlook for, the petroleum refining industry have changed significantly. Current market conditions have resulted in lower capacity utilization rates and refinery closures. These most recent changes in the conditions facing the industry are consistent with a past performance that has been cyclic. However, mandates for a renewable fuel standard (RFS) and increased corporate average fuel economy (CAFE) could influence permanently reduced refining capacity in coming years.

During an era of increasing crude oil prices and concerns for declining domestic crude oil production, many policy makers advocated energy self-sufficiency. Renewable fuels offered the promise of at least offsetting an increasing demand for transportation fuel. Now, though, the prospect of declining motor-fuel demand may mean that the use of more renewable fuels may influence operators to idle, consolidate, or permanently close refineries.

This report begins by looking at the current production capacity of the refineries operating in the United States, and the sources and changes in crude oil supply. It then examines the changing characteristics of petroleum and petroleum product markets and identifies the effects of these changes on the refining industry, including tax considerations. The report concludes with

discussion of the policy and regulatory factors that are likely to affect the structure and performance of the industry during the next decade.

BACKGROUND—REFINERIES AND CAPACITY

After a volatile decade marked by record crude oil prices and profit margins, U.S. refiners now face the prospect of possibly long-term decreased demand for their products. Refiners are responding by cutting costs, reducing capacity utilization, and closing facilities.

A decade ago, 158 refineries operated in the United States and its territories. By the Congressional Research Service's count, the number has declined to 124 refineries that process crude oil into fuels, and in addition, 13 refineries that produce lubricating oils and asphalt.⁴ These numbers include three refinery complexes, each made up of two formerly independent refineries joined by pipeline.

Although the number of refineries has decreased, operable refining capacity has increased over the past decade from 16.5 million barrels/day to over 18 million barrels/day. By the Energy Information Administration's (EIA) definition, "operable capacity" includes both operating refineries and idle refineries which shut down temporarily for repair or "turn around" for seasonal adjustment in the product slate (for example, reformulating gasoline from winter to summer blends). In addition, some refinery operators have indefinitely idled their refineries to wait for improving demand.⁵

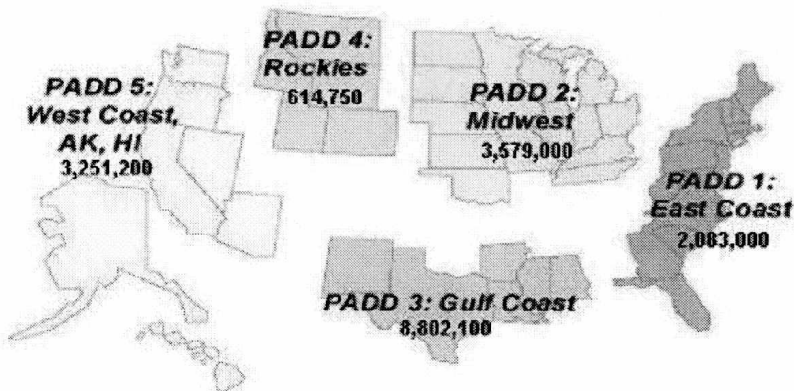
Petroleum Administration for Defense Districts

During World War II, the War Department (now the Department of Defense) delineated "Petroleum Administration for Defense Districts" (PADD) to facilitate oil allocation. At one time, refineries in each PADD processed crude oil and distributed petroleum products for use in the district. The high rate of merchant-marine tankers lost to Nazi submarines operating along the Eastern seaboard prompted construction of the Virginia and Colonial product pipelines to link the Gulf Coast with the Northeast United States. A network of crude oil and petroleum product pipelines now interlinks the PADDs, making them interdependent.

Crude oil sourcing for U.S. refineries varies over time, but in general, the PADD 1 (East Coast) refineries process crude oil shipped from all over the world. PADD 2 (Midwest) and PADD 4 (Rocky Mountains) increasingly depend on crude oil produced and moved by pipeline from Canada and PADD 3 (Gulf Coast) as well as production from the Rocky Mountain states. PADD 3, the largest refining region, obtains crude oil from the Gulf Coast outer continental shelf, Mexico, Venezuela, and the rest of the world. Permitting issues currently stall a pipeline that would deliver Canadian syncrude (from oil sands) to Gulf Coast Refineries. PADD 5 (West Coast) obtains crude oil primarily from Alaska (by tanker) and California, and through imports. No crude oil pipelines link PADD 1 or PADD 5 with the rest of the country.

Most of the country's gasoline is refined in the Gulf Coast (PADD 3), which makes up nearly 45% of the U.S. refining capacity with 45 refineries processing more than 8 million barrels per day (bbl/d). It is followed by the Midwest (PADD 2) and the West Coast (PADD 5) in refining capacity.⁶ The East Coast (PADD 1) has been losing capacity, with gasoline imports meeting a growing portion of demand. **Figure 1** below breaks-out refining capacity by PADD.

A 95,000-mile network of petroleum product pipelines serves most of the United States. This network, separate from the network of crude oil pipelines, distributes refined products to balance the demand and supply conditions in each region. Regional differences in mandated fuel gasoline specifications, however, limit the flexibility of distribution by pipeline. Additionally, PADD 5 is largely isolated from the rest of the United States, especially from the large refineries in PADD 3, resulting in a market that has exhibited higher prices and reduced availability under some market conditions.



PADD	Fuel Refineries	Bbl/Day
1	12	2,083,000
2	25	3,579,000
3	44	8,802,100
4	15	614,750
5	27	3,251,200
Total	123	18,330,050

Source: CRS.

Note: During World War II, the then-War Department delineated PADDs to facilitate oil allocation.

Figure 1. Fuel Refining Capacity by Petroleum Administration for Defense Districts.

Refinery Closures

After crude oil prices peaked in the summer of 2008, the U.S. demand for refined petroleum products began to decline. In response, U.S. refiners began cutting back capacity and in some cases temporarily idled or permanently closed refineries.

Valero closed its Delaware City (DE) refinery in late 2009 and furloughed 550 workers.⁷ In April 2010, Valero sold the refinery to Connecticut-based PBF Energy Partners LLC (Petroplus) for \$220 million. Valero will reportedly write off more than \$1.7 billion of assets.⁸ PBF plans to invest another \$125 million to \$150 million in refurbishing the refinery with plans to reopen it in the spring of 2011.⁹ Sunoco permanently closed its Eagle Point (NJ) refinery in early 2010 and furloughed 400 workers.¹⁰ Sunoco had purchased Eagle Point in 2004 for about \$250 million. In 2010, Western Refining idled its 16,800 bbl/day refinery in New Mexico and its 70,000 bbl/day Yorktown (VA) refinery.

Operable Refineries

Figure 2 through Table 5, below, identify operable fuel refineries by PADD.

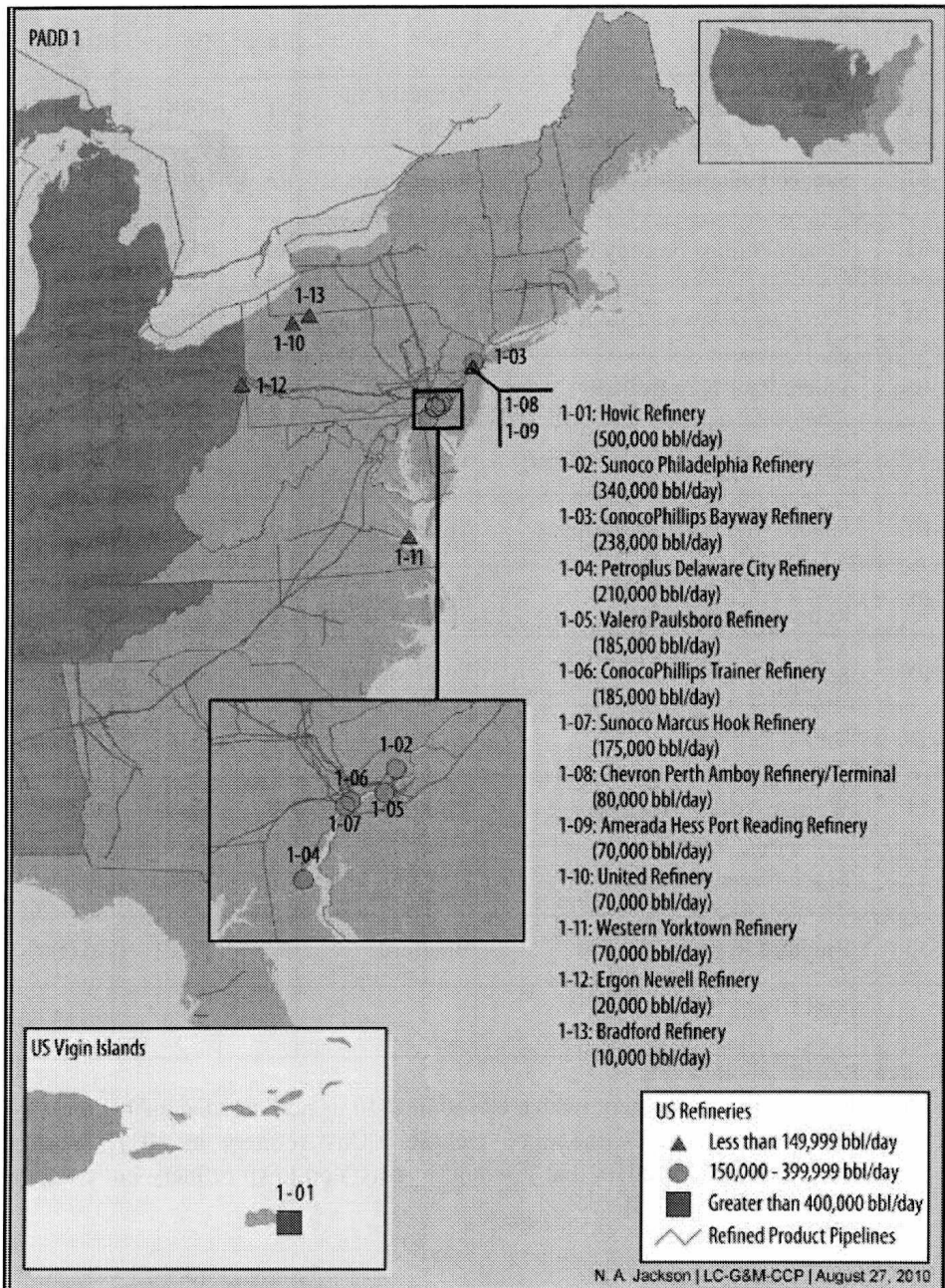


Figure 2. Operable Refineries in PADD 1.

PADD #	Facility	City	State	Zip	Bbl/day
1-01	Hovic Refinery	Kingshill, St Croix	VI	00851	500,000
1-02	Sunoco Philadelphia Refinery	Philadelphia	PA	19145	340,000
1-03	ConocoPhillips Bayway Refinery	Linden	NJ	07036	238,000
1-04	Petroplus Delaware City Refinery*	Delaware City	DE	19270	210,000
1-05	Valero Paulsboro Refinery	Paulsboro	NJ	08066	185,000
1-06	ConocoPhillips Trainer Refinery	Trainer	PA	19061	185,000
1-07	Sunoco Marcus Hook Refinery	Marcus Hook	PA	19601	175,000
1-08	Chevron Perth Amboy Refinery/Terminal	Perth Amboy	NJ	08861	80,000
1-09	Amerada Hess Port Reading Refinery	Port Reading	NJ	07064	70,000
1-10	United Refinery	Warren	PA	16365	70,000
1-11	Western Yorktown Refinery*	Yorktown	VA	23692	70,000
1-12	Ergon Newell Refinery	Newell	WV	26050	20,000
1-13	Bradford Refinery	Bradford	PA	16701	10,000
				Total	2,153,000

Source: Refiner publications.

Notes: The Eagle Point Refinery, which closed in 2010, is not included on this map.

* Petroplus plans to reopen the idled Delaware City refinery in 2011. Western announced August 5, 2010, that it would idle its Yorktown refinery but continue to operate it as a terminal.