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EIA's U.S. Crude Oil Import Tracking Tool: Selected Sample Applications

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Table of Contents

Figures

Preface

U.S. oil production has grown rapidly in recent years. U.S. Energy Information Administration (EIA) data, which reflect combined production of crude oil and lease condensate, show a rise from 5.6 million barrels per day (bbl/d) in 2011 to 7.5 million bbl/d in 2013. EIA's *Short-Term Energy Outlook* (STEO) projects continuing rapid production growth in 2014 and 2015, with forecast production in 2015 averaging 9.4 million bbl/d. While EIA's *Annual Energy Outlook* (AEO) projects further production growth, its pace and duration remain uncertain, as shown by the significant differences between Reference case and High Oil and Gas Resource case projections, which differ in both the timing and level of the highest volume of U.S. crude oil production. EIA's next update to the AEO will raise projected production significantly in the Reference case.

Recent and forecast increases in domestic crude production have sparked discussion on the topic of how rising crude oil volumes will be absorbed. All of the net growth in U.S. domestic crude oil production between 2011 and mid-2014 has consisted of light crude with an API gravity measure that exceeds 35 degrees. Given the forecast continued growth in domestic crude production, and the expectation that additional onshore production will be dominated by light crudes, issues surrounding the absorption of domestic crude by increased runs, by like-for-like replacement of import streams with similar characteristics, or by adjustments in and displacement of other types of crude imports, are of great interest.

While EIA collects and publishes extensive data on crude imports in its monthly Company Level Imports data, use of that spreadsheet is difficult for many interested stakeholders and analysts. To assist both its own analysis and to better enable policymakers, outside analysts, and the public to track crude oil imports, EIA has developed and published a new *U.S. Crude Oil Import Tracking Tool*. The tool allows users to sort and display crude oil imports in monthly or annual time series, by crude type (i.e., light, medium, heavy), country source, receiving terminal, processing company, processing facility, and more. It includes a built-in tutorial section providing step-by-step instructions. This tool could also be used to provide timely data during emergency response situations, including how much crude is imported through a given port, what types of imported crude enter that port, and which refineries are serviced by that port.

This paper provides examples of the application of EIA's *U.S. Crude Oil Import Tracking Tool*. The development of this tool, which sheds light on import adjustments being made in response to growing production of crude oil within the United States, is one part of EIA's ongoing effort to assess the effects of a possible relaxation of current limitations on U.S. crude oil exports, which is another avenue to accommodate domestic production growth. EIA is undertaking further work that bears on this larger question, and expects to issue further analysis reports over the coming months.

Summary

This paper provides several examples of the application of EIA's *U.S. Crude Oil Import Tracking Tool.* The examples were selected to illustrate its various capabilities to access information from EIA's monthly Company Level Import database at various levels of temporal, regional, company, and quality aggregation. The application of the tool yielded the following insights regarding recent trend in U.S. crude oil imports.

Volume and quality of U.S. crude oil imports: U.S. crude oil imports have declined since 2010, with nearly all of the decline occurring in light sweet grades. In particular, U.S. light crude imports fell 70.5% between 2010 and the year-to-date 2014 through August, to only 652,000 bbl/d.

Source of U.S. crude oil imports: Imports of light crude from Africa have declined by 92.7%, particularly from Nigeria and Algeria. Imports from Saudi Arabia have varied as that country continues to fulfill its role as swing producer and has adjusted its supplies of light crude to the U.S. according to changes in other producing areas such as Libya.

Light crude oil imports by region: The largest decline occurred on the Gulf Coast (PADD 3), down 94% from 2010 to the year-to-date 2014 through August, and dropped to nearly zero by July 2014. Light crude oil imports by East Coast (PADD 1) refiners were down 69% from 2010 to the year-to-date 2014 through August, reflecting both their increased use of domestic crudes and modestly lower refinery runs.

Refinery-level trends in light crude imports: Imports by the 10 largest refineries using light crude imports in 2003 accounted for 55% of total U.S. light crude imports, with the remaining 45% scattered among more than 100 other refineries. The largest source for light crude imports among this group of 10 refineries was Canada, followed by Nigeria and Mexico. Of these 10 refineries, 3 are located on the East Coast, 2 in the Midwest, 3 on the Gulf Coast, and 2 on the West Coast.

Refinery-level trends in imports other than light sweet crude: There is evidence that some refineries have recently reduced imports of medium and heavy grades of crude oil in order to accommodate increasing light domestic production while other refiners, which have made changes in processing equipment to accommodate heavier crudes, have decreased their demand for light crude.

Analysis

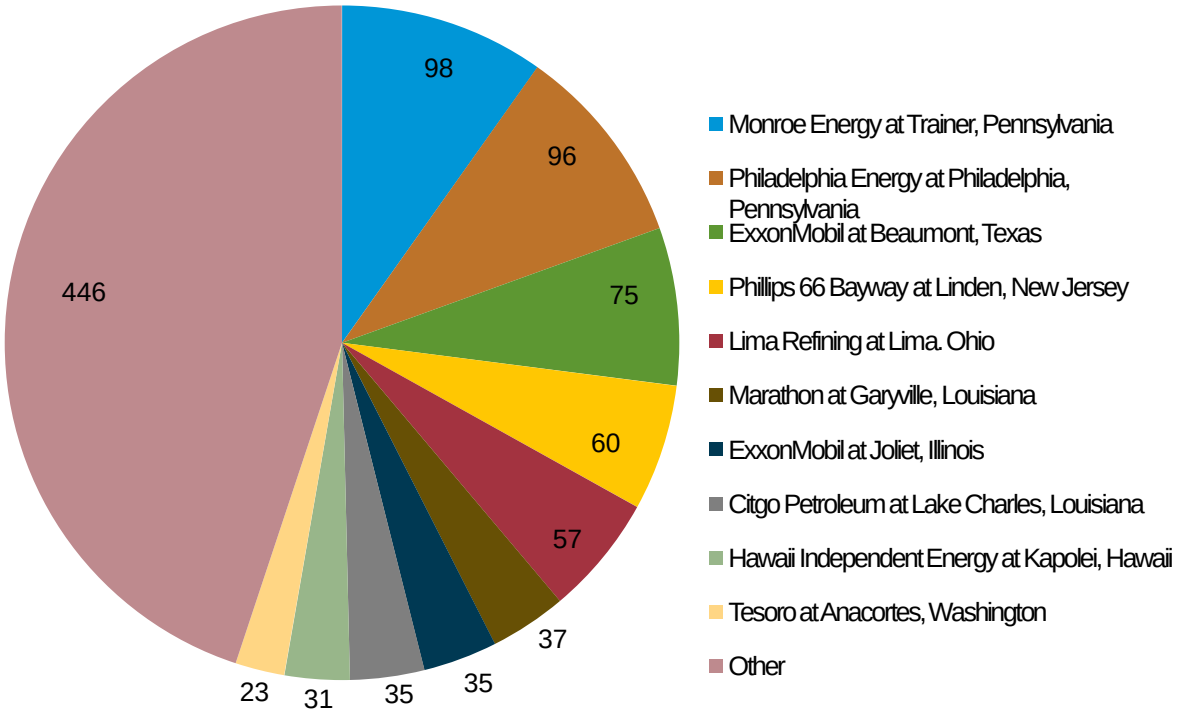
Light crude imports by refinery facilities

In 2013, U.S. imports of light crude oil averaged 1.0 million bbl/d. The 10 refineries importing the largest amounts of light crude were responsible for 55% of U.S. light crude imports, or 548,000 bbl/d, with the remaining 45% scattered among more than 100 other refineries. This same group of 10 refineries represented 42% of total light crude imports in 2011, but the level of their light crude imports was 164,000 bbl/d higher in 2011 than in 2013. The largest declines in annual light crude imports were Citgo Petroleum Corporation, Lake Charles, Texas, down 89,000 bbl/d or 71%, and ExxonMobil Refining Company, Beaumont, Louisiana, down 74,000 bbl/d or 50%.

Of these 10 refineries, 3 are located on the East Coast, 2 in the Midwest, 3 on the Gulf Coast, and two on the West Coast.

Figure 1. 2013 light (API ≥ 35°) crude oil imports by U.S. refineries

thousand barrels per day



Source: U.S. Energy Information Administration, *Petroleum Supply Annual*.

In 2013, the two largest light crude importing refineries were the Monroe Energy Trainer, Pennsylvania refinery and the Philadelphia Energy Solutions Philadelphia, Pennsylvania refinery. The third largest importer of light crude was ExxonMobil's refinery in Beaumont, Texas, importing 8% of the total. The

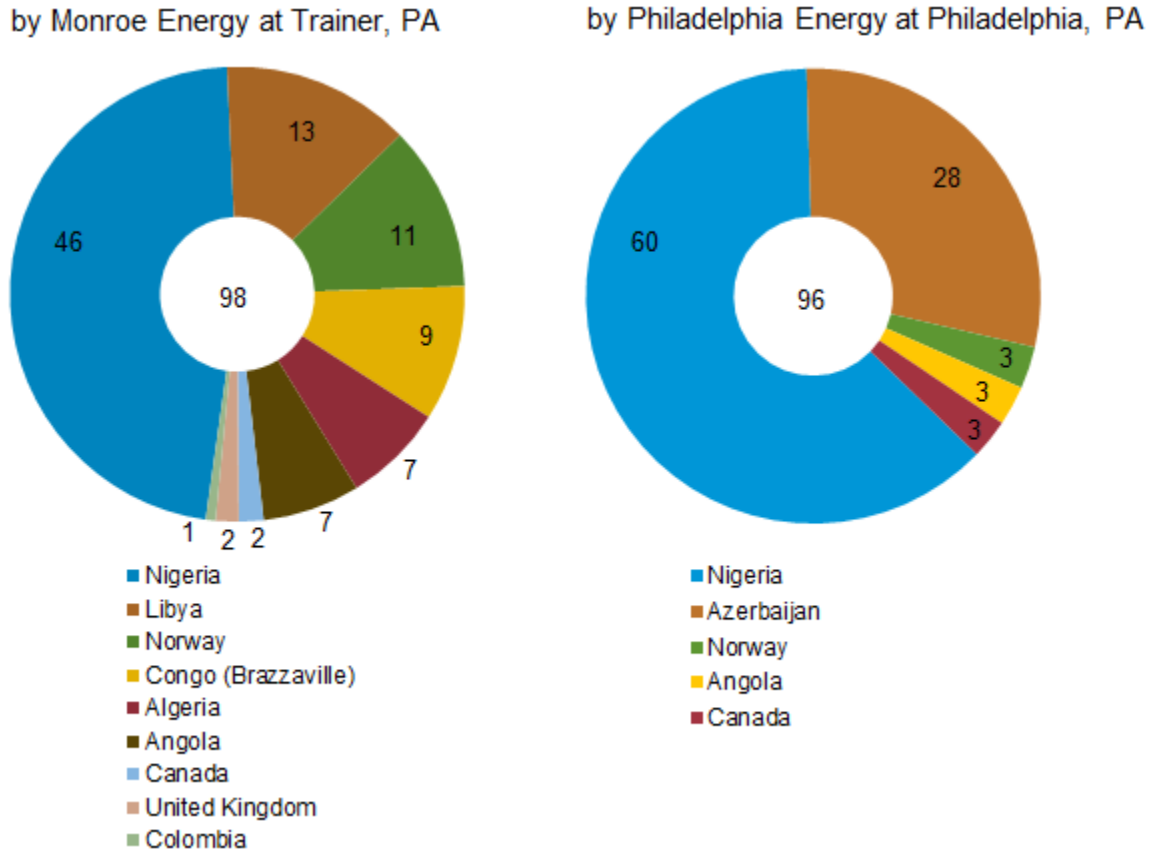
next two highest importers were Phillips 66 Bayway Refining, Linden, New Jersey and Lima Refining, Lima, Ohio, each of which imported 6% of the total.

The 10 refineries shown above imported an average of 548,000 bbl/d of light crude in 2013, of which 26% came from Canada, 19% from Nigeria, 13% from Mexico, 11% from Saudi Arabia, and the other 31% from a variety of other producers including Libya, Azerbaijan, Angola, and Algeria.

Of the 10 refineries importing the largest amount of light crude, the top 2 are in Pennsylvania, with Nigeria as the largest supplier (Figure 2). Four others, located in the Midwest and on the West Coast, received most or all of their light imports from Canada (Figure 3). The other 4 are located on the Gulf Coast or the West Coast and have a variety of suppliers (Figure 4).

Figure 2. 2013 light (API ≥ 35°) crude oil imports by top Pennsylvania refineries

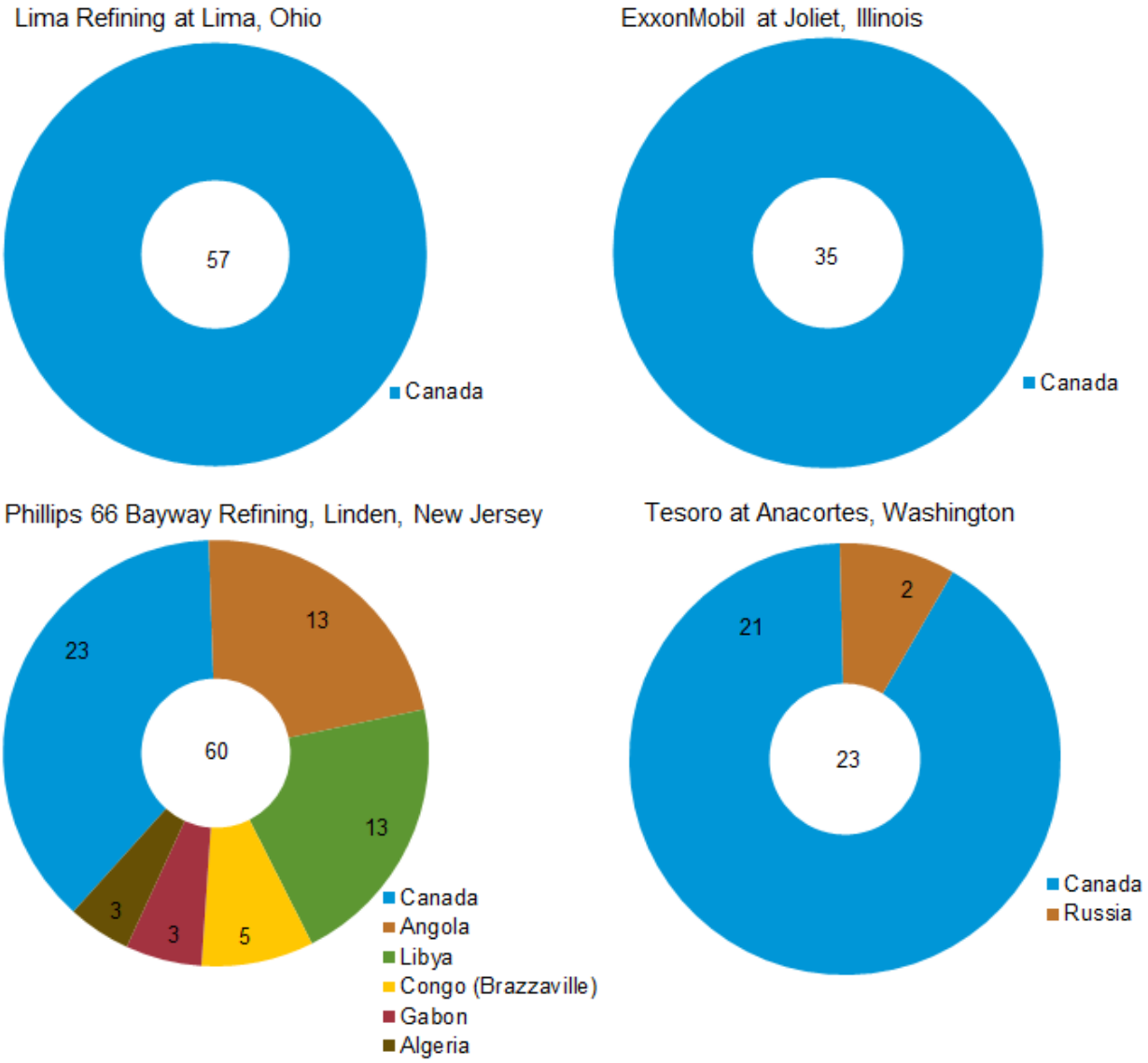
thousand barrels per day



Source: U.S. Energy Information Administration, *Petroleum Supply Annual*.

Figure 3. 2013 light (API ≥ 35°) crude oil imports by selected refineries

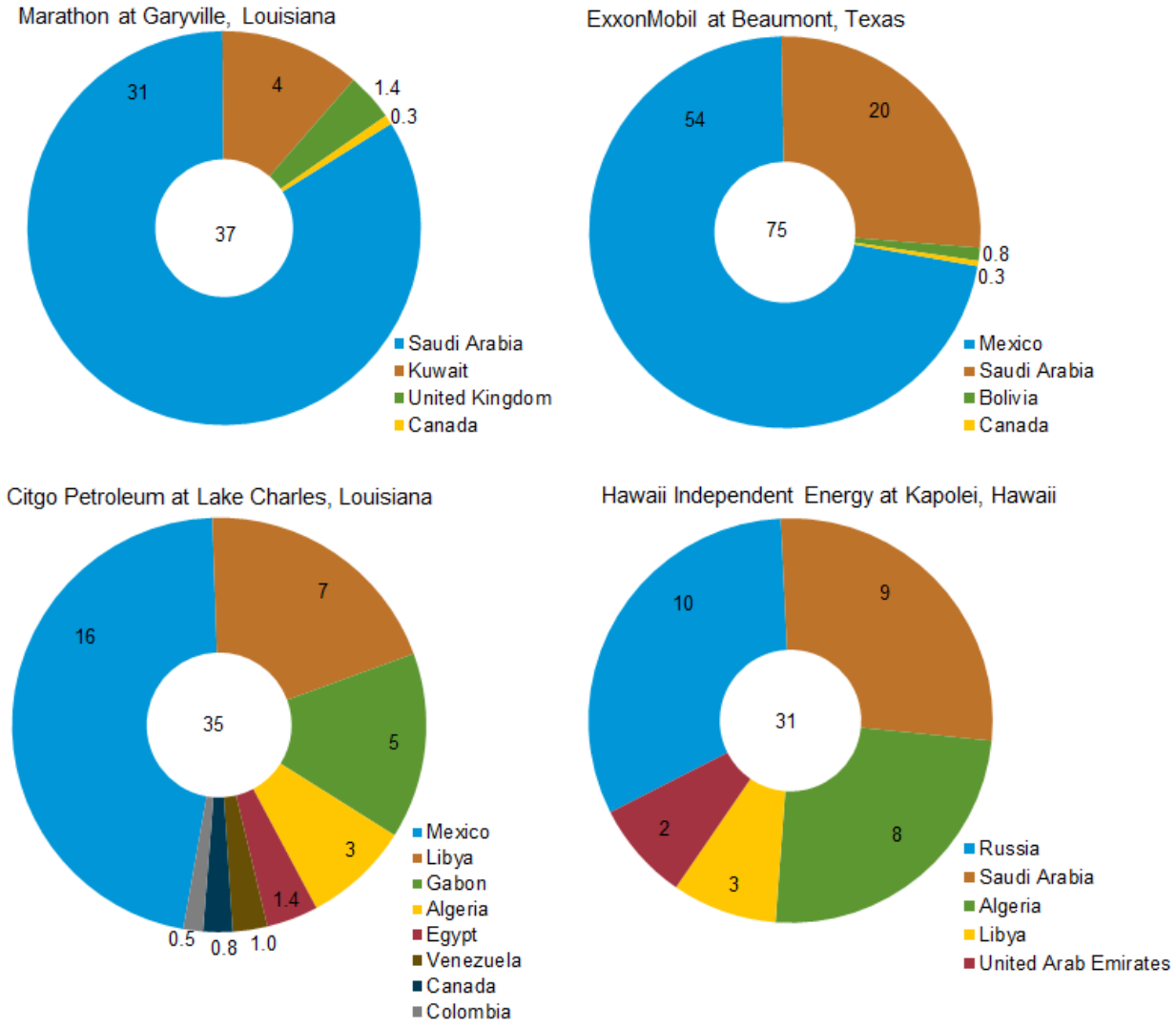
thousand barrels per day



Source: U.S. Energy Information Administration, *Petroleum Supply Annual*.

Figure 4. 2013 light (API ≥ 35°) crude oil imports by selected refineries

thousand barrels per day



Source: U.S. Energy Information Administration, *Petroleum Supply Annual*.

Light crude imports by country of origin

Light crude oil imports into the United States fell 70.5% between 2010 and the year-to-date 2014 through August, from 2.2 million bbl/d to 652,000 bbl/d.

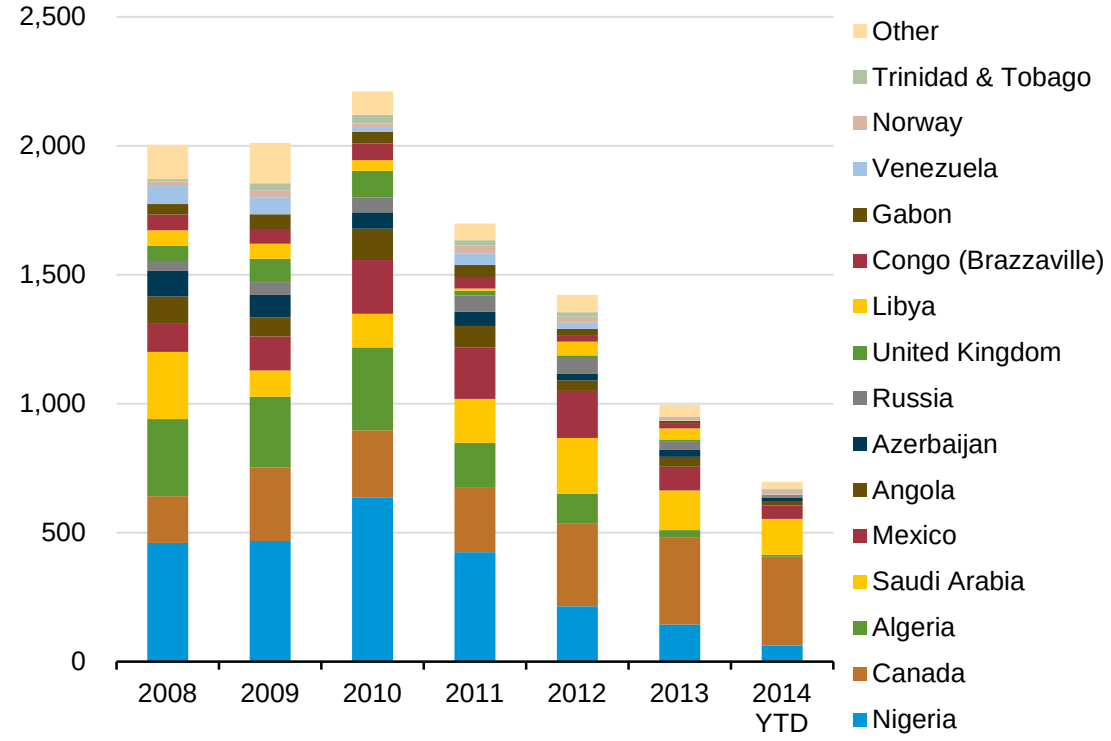
During this period, crude oil imports from Africa declined 92.7%. Nearly all U.S. crude imports from Africa are light and sweet (defined as having sulfur level 0.5% or lower), particularly from the countries of Nigeria and Algeria. Industry reports suggest that volumes from Africa that were formerly shipped to U.S. refiners are now being diverted mostly to Asia and Europe.

OPEC members' share of total U.S. light crude imports from OPEC countries dropped 30 percentage points, from 63% in 2008 to 33% in the year-to-date 2014 through August. Light crude imports from Saudi Arabia have varied from a high of 261,000 bbl/d in 2008 to a low of 101,000 bbl/d in 2009, and to 153,000 bbl/d in 2013. This variation may reflect Saudi Arabia's traditional role as swing producer whose production has responded to disruptions affecting other producers, such as Libya, during this period.

Light crude imports from Mexico, which flow primarily to the Gulf Coast, have also declined substantially while light crude imports from Canada, which flow primarily to the Midwest, have been growing. After a 28% increase in 2012, imports of light crude from Canada stabilized at 342,000 b/d during 2013–2014.

Figure 5. Light (API ≥ 35°) crude imports

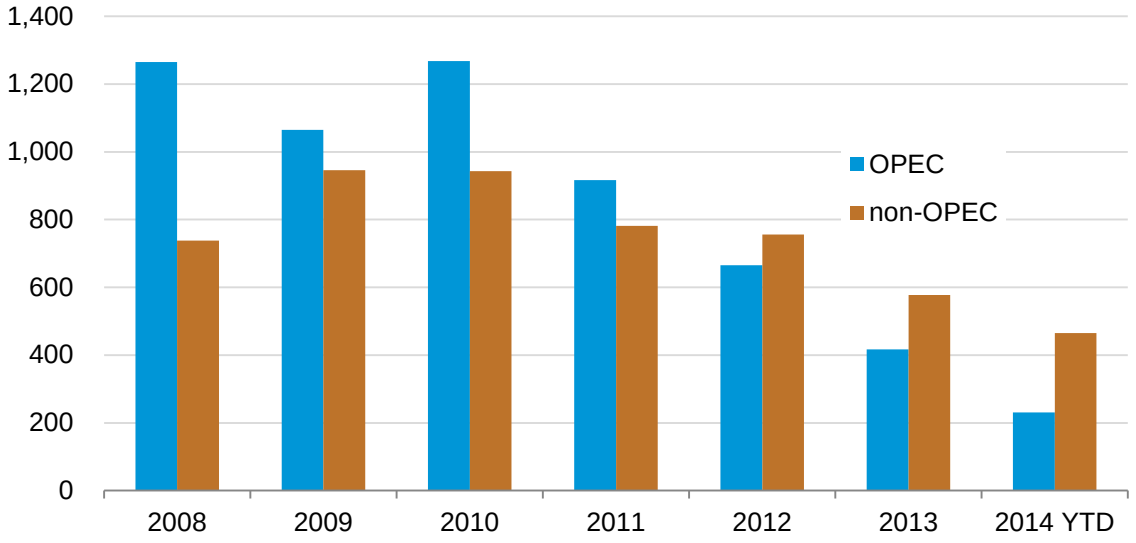
thousand barrels per day



Source: U.S. Energy Information Administration, *Petroleum Supply Annual and Petroleum Supply Monthly*.

Figure 6. Light (API ≥ 35°) crude oil imports

thousand barrels per day



Source: U.S. Energy Information Administration, *Petroleum Supply Annual and Petroleum Supply Monthly*.

Light crude imports by processing region

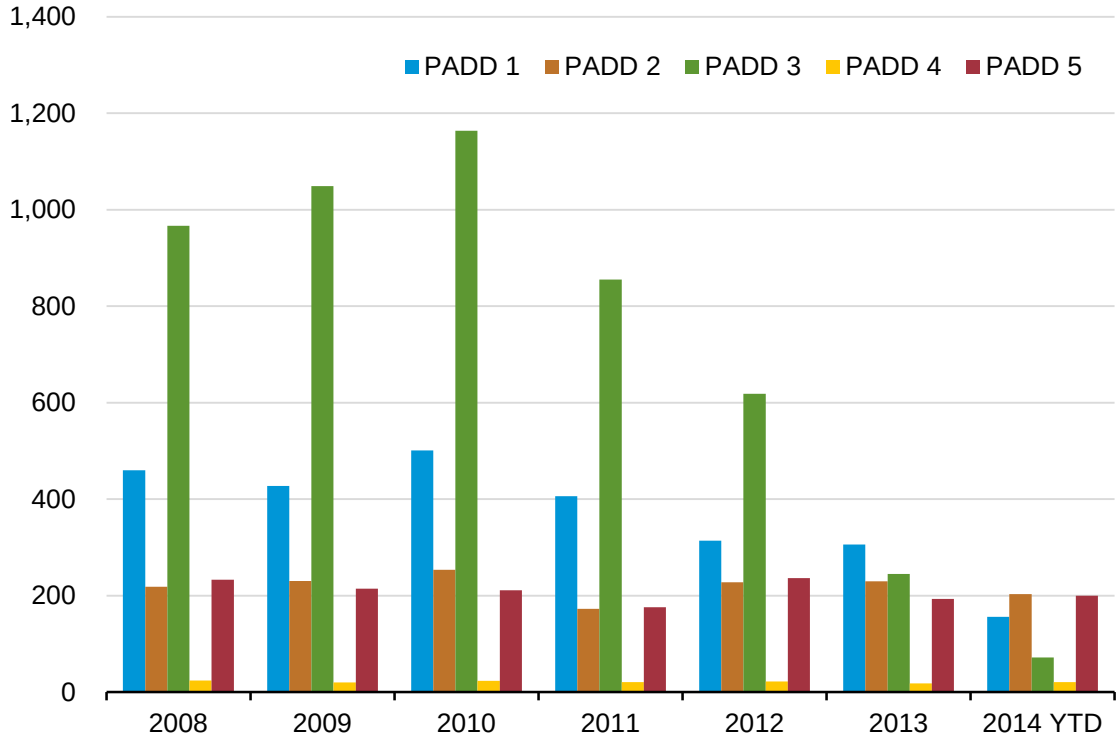
The largest decline of light crude oil imports has occurred in the Gulf Coast (PADD 3), down 91% from 2010 to the year-to-date 2014 through August, followed by the East Coast (PADD 1), down 66% in the same period.

Remarkable growth in PADD 3 crude production has been responsible for the import decline in the region. In just the two years between 2011 and 2013, PADD 3 production grew by 34.6% and was responsible for almost 62% of the total production growth in the U.S. during that period.

The decline of light crude imports to PADD 1 is the result of two primary factors: reduced refinery runs and the increased availability of domestic crude oil production, primarily from the Midwest (PADD 2). Between 2010 and the year-to-date 2014 througmh August, total PADD 1 crude runs have declined by 60,000 bbl/d, but runs of domestic crude have increased by 394,000 bbl/d. While it is more difficult to deliver the new domestic supply from PADD 2 to PADD 1, due to the lack of pipeline infrastructure, crude rail shipments have become a growing alternative to deliver Bakken crude oil to the East Coast, reducing light crude oil imports to the area.

Figure 7. Light (API ≥ 35°) crude oil imorts by processing area

thousand barrels per day



Source: U.S. Energy Information Administration, *Petroleum Supply Annual and Petroleum Supply Monthly*.

The availability of railroad track capacity means shipping crude by rail entails a lower capital investment than new construction of pipelines. Crude-by-rail construction requires investment only in building crude rail terminals and unit train cars. Less construction demand in turn shortens permitting and development time. Higher rail rate enables investors to pay off invested capital in much shorter period, typically 2–3 years.

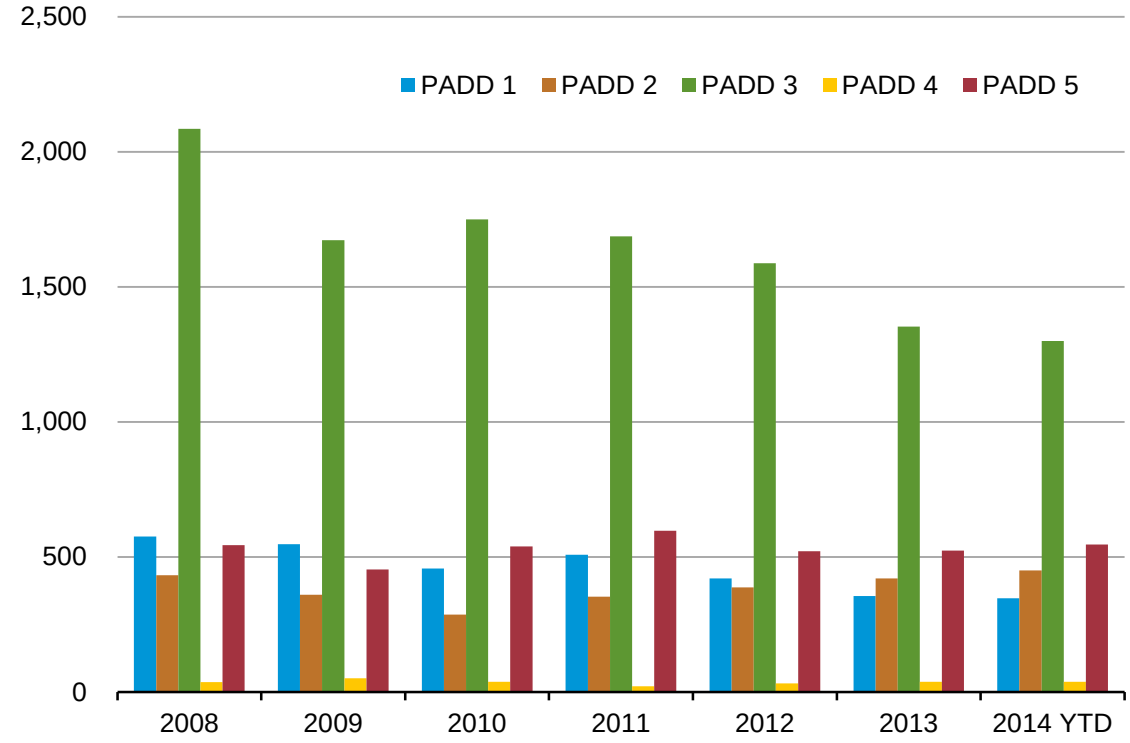
While light crude imports into the West Coast (PADD 5 have changed little in recent years, rail crude shipments have started to deliver crude oil to PADD 5, and could result in significant declines in light crude imports into the region.

Medium/heavy crude imports by processing region

While increased domestic light crude production has displaced some light crude imports, there have also been changes affecting the import of medium crudes (27–35 degrees API gravity) and heavy crudes (less than 27 degrees API).

Figure 8. Medium (27°< API gravity < 35°) crude oil imports by processing area

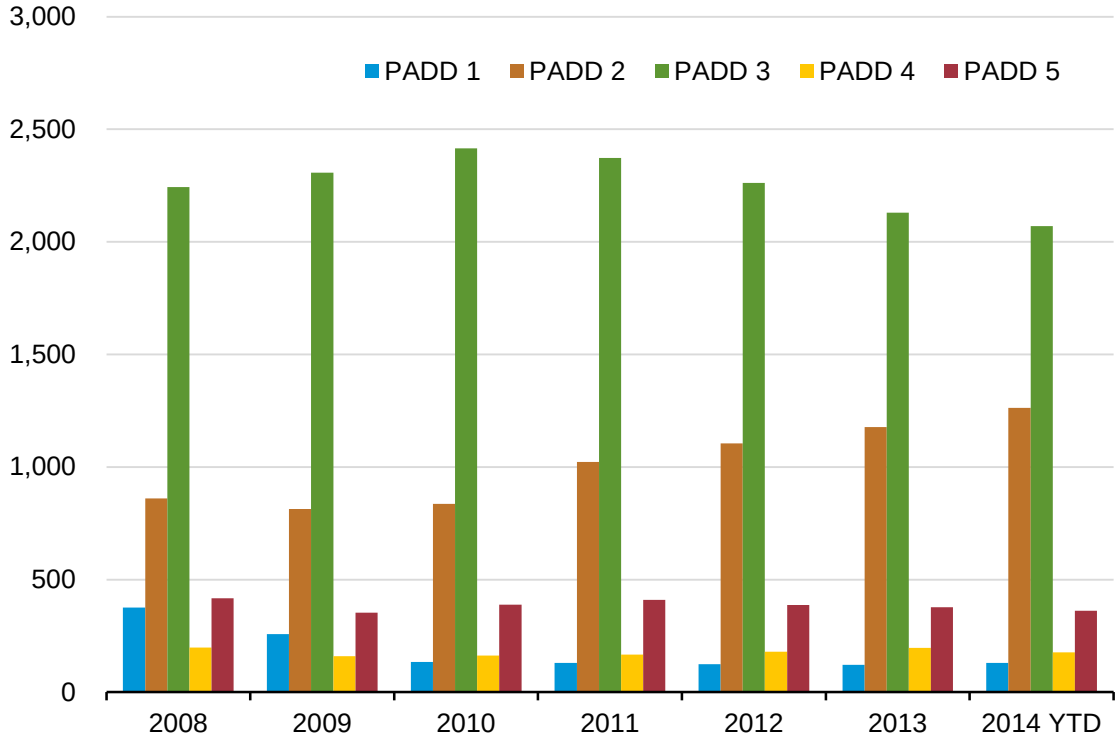
thousand barrels per day



Source: U.S. Energy Information Administration, *Petroleum Supply Annual and Petroleum Supply Monthly*.

Figure 9. Heavy (API gravity ≤ 27°) crude oil imports by processing area

thousand barrels per day



Source: U.S. Energy Information Administration, *Petroleum Supply Annual and Petroleum Supply Monthly*.

In PADD 1, increased domestic light crude availability, brought about by increased rail capacity since 2012, has not only displaced 158,000 bbl/d of light crude imports but also 74,000 bbl/d of medium crude imports. Most of the reductions in medium crude imports took place at the Philadelphia Energy Solutions refinery. In addition, this domestic crude availability has allowed an increase in refinery crude runs in the region of 150,000 bbl/d.

In PADD 2, refinery investments since 2010 have had the effect of lowering demand for light crude and increasing demand for medium and heavy crude. Domestic and imported light crude runs in the region have declined by 343,000 bbl/d while imports of medium and heavy crude are up by 590,000 bbl/d. Approximately 60% of the increased imports of heavy crude into the region were accounted for by three refineries: WRB Refining at Wood River, Illinois, Marathon Petroleum at Detroit, Michigan, and BP Products North American at Whiting, Indiana.

In PADD 3, since 2010, increased domestic light crude oil runs have reduced light crude imports by 94%, medium crude imports by 26%, and heavy crude imports by 14%. As a result of this change to crude inputs, PADD 3 in August 2014 had the lightest average crude gravity (31.74 degrees API) since February of 1999. In addition, light domestic crude availability has allowed for an increase in PADD 3 utilization of almost 700,000 bbl/d, or 9.4%.

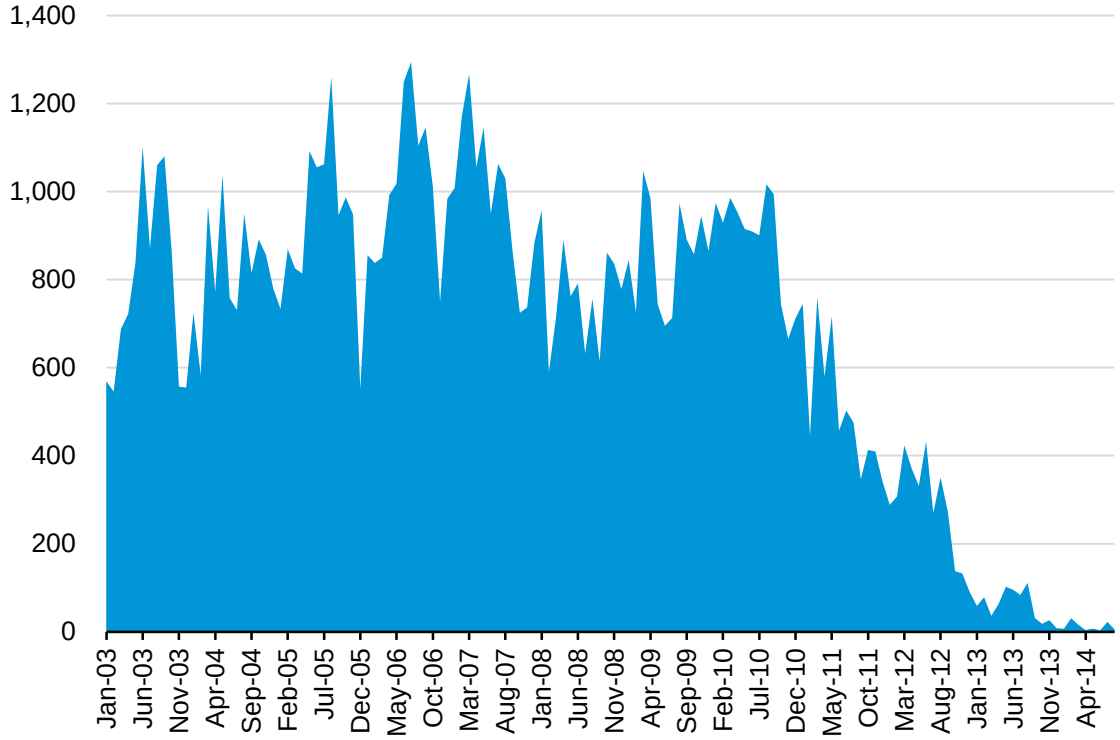
PADDs 4 and 5 have seen little change in their imports as a result of increasing domestic light crude production, but recent additions to rail facilities in PADD 5 will allow for more availability to the region which in turn could affect imports in the future.

Light sweet crude imports to the Gulf Coast have been virtually eliminated

As production of domestic shale and tight crude oil continues to rise, U.S. crude oil imports decrease accordingly. With light sweet crude oil production from the Eagle Ford region and the Permian basin rising to almost 3.2 million bbl/d in August 2014 and oil pipeline networks enhanced substantially, light sweet crude oil imports to the Gulf Coast have dropped to nearly zero.

Figure 10. Light sweet (API ≥ 35°, sulfur ≤ 0.5%) crude oil imports to the Gulf Coast

thousand barrels per day

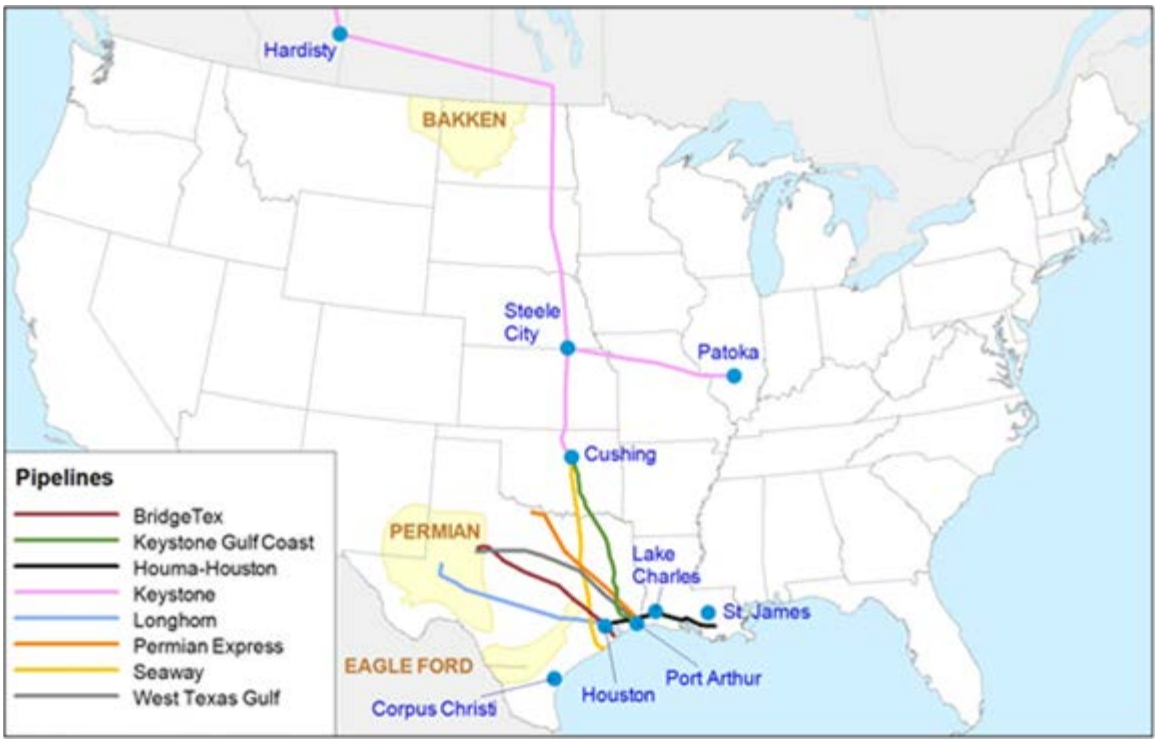


Source: U.S. Energy Information Administration, *Petroleum Supply Annual and Petroleum Supply Monthly*.

Historically, Gulf Coast refineries have imported significant amounts of light sweet crude oil (as much as 1.3 million bbl/d). Beginning in 2010, however, sustained increases in production in the region and improvements to the crude distribution system have significantly impacted light crude imports. Since 2010, domestic crude runs in PADD 3 have more than doubled, from 2.1 million bbl/d to 4.2 million bbl/d and now represent almost 53% of total regional crude input. Absorbing this increased light crude production has lightened the average quality of crude runs in PADD 3 to 31.37 degrees API in July 2014, the lightest crude slate since May of 2000.

Among the changes to the distribution system was the reversal of the Seaway pipeline, which formerly ran from the Gulf Coast to Cushing, but now delivers crude from the midcontinent region to the Gulf Coast. In addition, there have been a series of other pipeline reversals and new constructions, providing capacity for the flow of crude oil from the Midwest to Texas, and from West Texas to South Texas and then to Louisiana. Such a network of reversed pipelines effectively ships domestically produced crude oil and Canadian imports to refineries at the Gulf Coast. As a result, total crude oil imports to the Gulf Coast dropped to 3.3 million bbl/d in Q2 2014, down 1.5 million bbl/d from 4.8 million bbl/d in Q4 2011.

Figure 11. Pipeline reversals and new constructions on the Gulf Coast



Source: U.S. Energy Information Administration

As of the end of Q3 2014, crude oil production has increased to 1.7 million bbl/d in the Permian formation and 1.5 million bbl/d in the Eagle Ford formation. Almost all this production is light sweet crude and is largely delivered by pipeline to regional refineries. As a result, light sweet crude oil imports to the Gulf Coast have been virtually eliminated.