



A PROFESSIONAL CONSULTING FIRM SERVING THE ENERGY, CHEMICAL, AND RELATED INDUSTRIES WORLDWIDE

## HOW WILL THE BAN ON VENEZUELA CRUDE AFFECT U.S. REFINERS?

**February 6, 2019**

A few days ago, the U.S. Treasury Department announced new sanctions on Petróleos de Venezuela, S.A. (PDVSA), the national oil company of Venezuela, that effectively halt imports of Venezuelan crude oil into the U.S. Given that the Venezuelan crude imported to the U.S. is of the heavy sour variety, which is not produced in large amounts in the U.S. (except for California), certain refineries along the Gulf Coast are left scrambling to find alternative sources of feedstock for their facilities. Today, we evaluate historical crude oil imports from Venezuela, refineries that are most heavily impacted, and the potential effects of the sanctions on U.S. refiners.

Refineries in Petroleum Administration for Defense District (PADD) 3, which includes the Gulf Coast, processed an average of 9 MMb/d of crude oil in 2018, and of that total approximately 1.6 MMb/d was of the heavy sour variety. Of the heavy sour portion, ~420 Mb/d came from Venezuela. Some may wonder how a country that supplies less than 5% of PADD 3's crude slate could cause industry headaches; today, we'll explain why.

First, we'll look at the volumes and qualities of crude oil U.S. refineries have been receiving from Venezuela in recent years. Between 2007 and 2018 (through October), the U.S. reduced the quantity of crude oil imported from Venezuela from 1.4 MMb/d (bars to far left in both charts in Figure 1) down to ~500 Mb/d last year. Some of this reduction is due to the 2012 shutdown of the Hovensa refinery in the U.S. Virgin Islands (chart to left, light blue bar segments), as well as the shutdown of some asphalt plants in PADDs 1 (East Coast) and 3. Other reductions have coincided with increasing quantities of Canadian crudes being available and reduced Venezuelan production. The remaining Venezuelan imports have been destined for the Gulf Coast (left chart, green bars) where the refining infrastructure is highly complex and has the capability to convert heavy sour crude (the predominant Venezuelan grade now being imported; right chart, brown bar segments) into valuable refined products.



A PROFESSIONAL CONSULTING FIRM SERVING THE ENERGY, CHEMICAL, AND RELATED INDUSTRIES WORLDWIDE

### U.S. Imports of Crude Oil from Venezuela

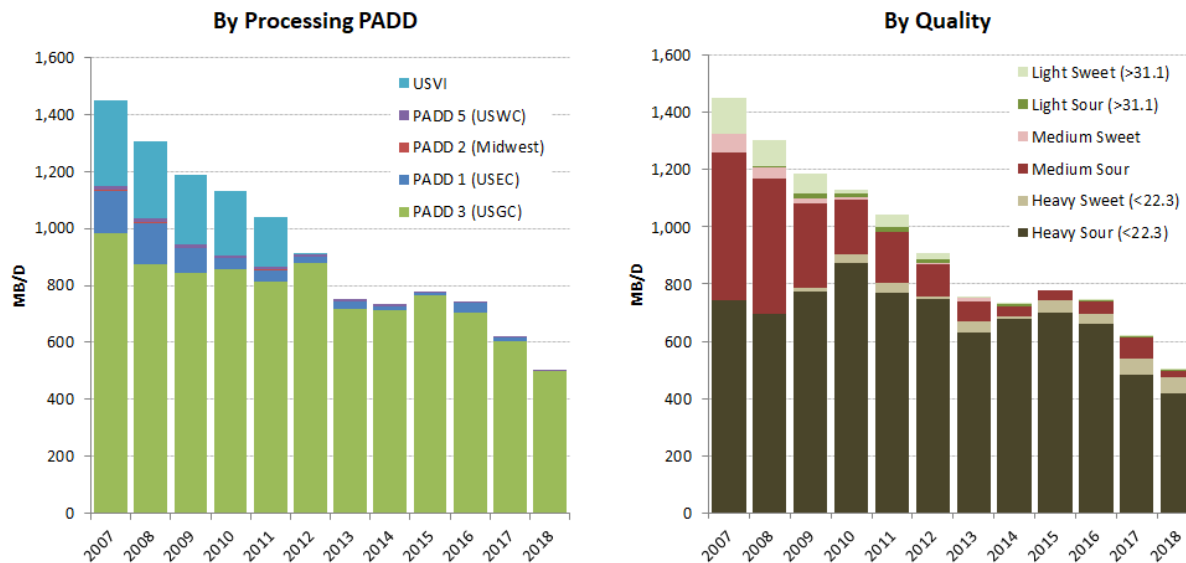


Figure 1. Sources: Energy Information Administration and Baker & O'Brien Analysis

Certain companies, by nature of their refineries' configurations and business relationships with PDVSA, have typically imported more Venezuelan crude oil than others. In 2018, these companies included CITGO, Valero Energy, Chevron, and PBF Energy. Here's more on each of them:

- It should come as no surprise that CITGO, PDVSA's U.S. refining arm, is among the largest importers of Venezuelan crude oil (dark brown bar segments and wedges in Figure 2 charts). CITGO owns and operates three refineries in the U.S.; they are located in Corpus Christi, TX; Lake Charles, LA; and Lemont, IL (near Chicago). Taken together, the two Gulf Coast refineries processed an average of 185 Mb/d of Venezuelan crude oil in 2018 (right chart, dark brown wedges). Lemont has not received physical supplies of Venezuelan grades for many years and instead, given its location, has been relying on a diet of Canadian and U.S. crude oils.
- The second-largest processor of Venezuelan crude oil in the U.S. is Valero (blue bar segments in left chart and four blue-shaded wedges in right chart). While Valero operates a number of refineries around the U.S., its coastal refineries in Texas (Port Arthur, Texas City, and Corpus Christi) as well as Louisiana (St Charles) account for the bulk of its imports from Venezuela.
- The third-largest processor of Venezuelan crude oil is Chevron's refinery in Pascagoula, MS, which imported 66 Mb/d in 2018 (lavender bar segments and wedges). Chevron has been a long time partner with PDVSA in the production of an ultra-heavy crude, Boscan (API gravity of ~10 degrees, sulfur content of 5.4%).
- PBF's Chalmette, LA refinery imported 41 Mb/d in 2018 (maroon bar segments wedge). The supply to this refinery reflects its legacy: it was formerly owned by a joint venture (JV) of ExxonMobil and PDVSA, but was sold to PBF in 2015.
- Historically, Phillips 66's Sweeny, TX, refinery (orange bar segments) processed significant amounts (over 100 Mb/d) of Venezuelan crude oil as a result of an old JV between Phillips 66 and PDVSA related to financing of a new coker project. However, in 2015 that deal was officially



A PROFESSIONAL CONSULTING FIRM SERVING THE ENERGY, CHEMICAL, AND RELATED INDUSTRIES WORLDWIDE

dissolved by a court order. In the ensuing years, the Sweeny refinery reduced its processing of Venezuelan crude oil and did not process any in 2018.

- Other smaller processors of Venezuelan crude oil include LyondellBasell Houston, Motiva Port Arthur, Marathon Garyville, and Total Port Arthur (right chart, smaller wedges).

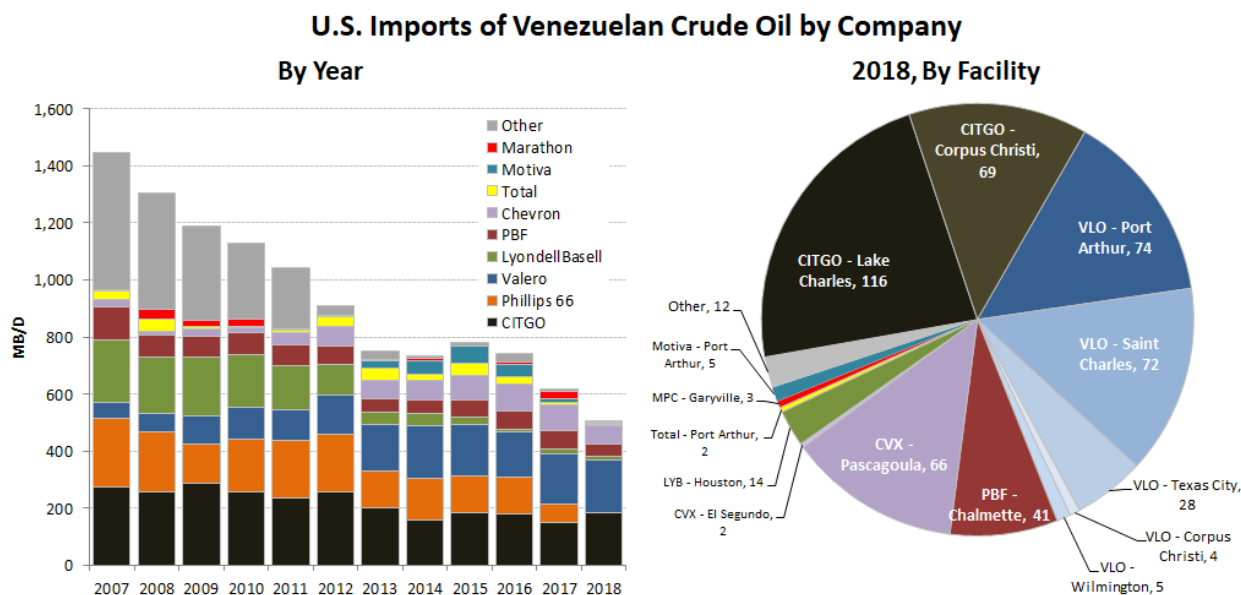


Figure 2. Sources: EIA and Baker & O'Brien Analysis

Assuming refiners in the USGC need to replace the 2018 import volume of heavy sour Venezuelan crude with alternative sources, where would they get it? This is where things get tricky. First, let's take a look at where the U.S. Gulf Coast has been receiving its heavy sour crude oils from over the last decade (Figure 3):

- Mexico (purple bar segments) has been the primary supplier of heavy sour crude oils to the Gulf Coast, but these imports have declined from 1.1 MMb/d in 2007 to ~600 Mb.d in 2018, driven primarily by declines in Mexican production.
- Venezuela (dark red bar segments) comes in second, supplying (as we said ) 420 Mb/d of heavy sour crude oil to PADD 3 in 2018.
- Canada (yellow bar segments) is in the third spot, with 315 Mb/d in 2018; its increasing export volumes have helped offset some of the declines in Mexico and Venezuela crude imports in recent years. However, due to pipeline constraints, the marginal barrels of Canadian crude oil are moving to PADD 3 via rail since a near-term solution to Canada's pipeline issues does not seem to be feasible.
- Colombia (green bar segments) ranks #4, supplying 144 Mb/d of heavy crude oil to the Gulf Coast in 2018. Colombia has supplied as much as 216 Mb/d heavy crude oil to the Gulf Coast over the past decade, but coastal refineries face competition from the U.S. West Coast (PADD 5) for these barrels.
- The remaining suppliers of heavy sour crude to PADD 3 include a mix of countries, including Brazil, Ecuador, and Guatemala, as well as Kuwait, Saudi Arabia, Iraq, and Russia.



A PROFESSIONAL CONSULTING FIRM SERVING THE ENERGY, CHEMICAL, AND RELATED INDUSTRIES WORLDWIDE

### PADD 3 Imports of Heavy Sour Crude Oil by Country

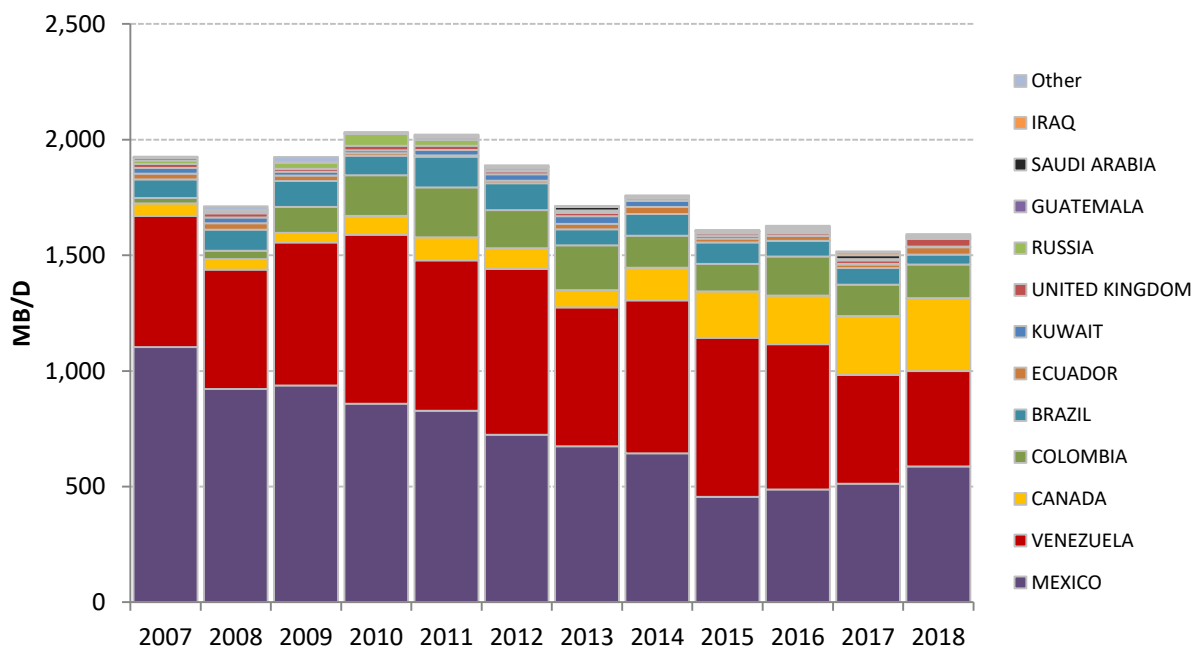


Figure 3. Sources: EIA and Baker & O'Brien Analysis. (For this analysis, "Heavy" is defined as crude oil less than 22.3° API.)

Now we know the countries that PADD 3 refineries have been receiving crude from, but "heavy sour" encompasses a lot of different varieties. Figure 4 gets a little complicated, so bear with us while we provide some set up. First, we created a bubble chart of all U.S. receipts of heavy (<22.3oAPI, bottom axis) sour (>0.5% sulfur, left axis) crude oil from 2007 to October 2018 in the EIA's Company Level Imports database by country, excluding Venezuela. The bubble sizes represent the relative annual average import volume for that country and/or grade. Then we added a series that represents Venezuela imports into PADD 3 in 2018 only (red dots) to show what Gulf Coast refineries may need to replace. Major crude oil streams or source countries have been labeled on the chart.



A PROFESSIONAL CONSULTING FIRM SERVING THE ENERGY, CHEMICAL, AND RELATED INDUSTRIES WORLDWIDE

## U.S. Imports of Heavy Sour Crude Oils by Country (2007-Present)

PADD 3 Imports from Venezuela in 2018 shown in Red

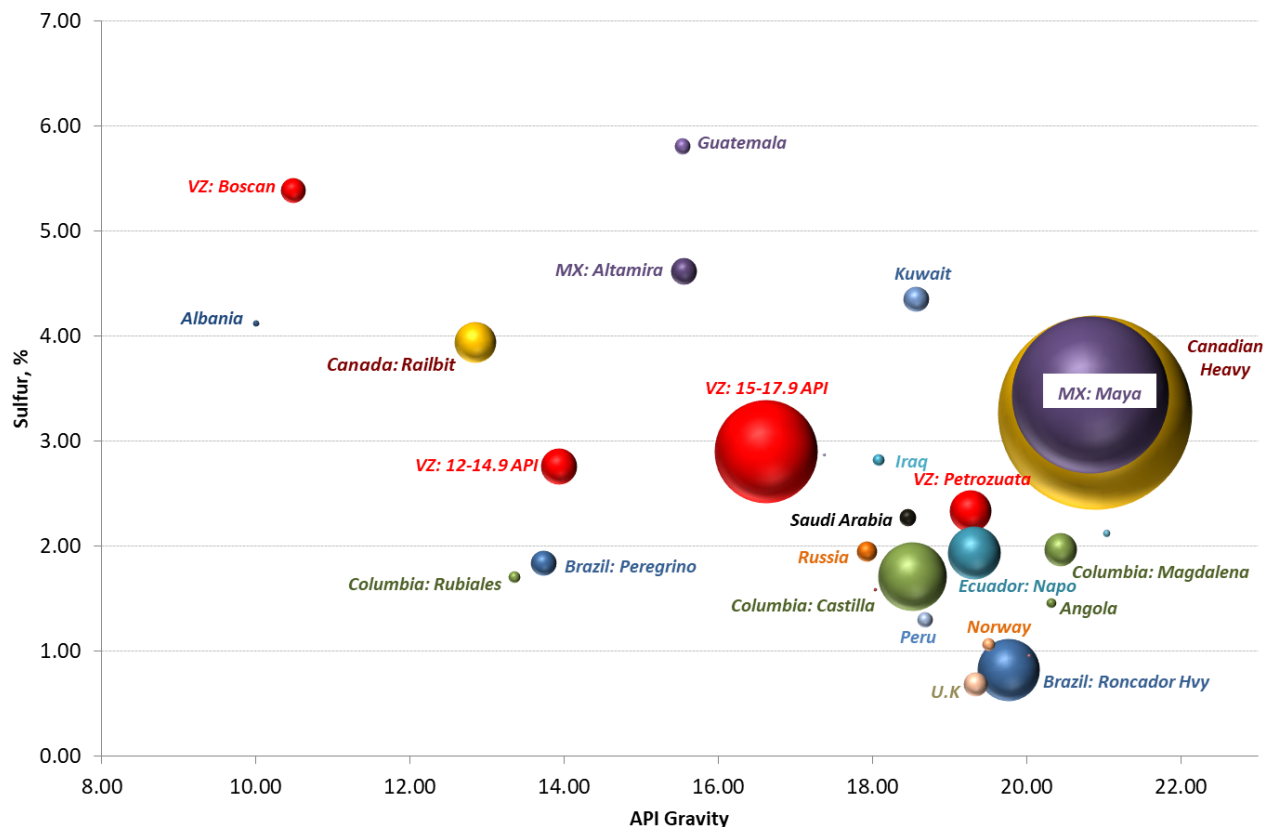


Figure 4. Sources: Baker & O'Brien Analysis of EIA Data. (Bubble size represents relative import volume.)

Generally, heavy crude oils with an API between 18 and 22 have been popular grades imported in the U.S. (numerous dots on right-most third of chart). These would include crudes such as Maya from Mexico, Canadian heavy crudes such as WCS, Napo from Ecuador, Magdalena and Castilla from Colombia, and Roncador Heavy from Brazil. However, approximately 78% (324 Mb/d) of the heavy sour imports from Venezuela in 2018 (again, the red dots) were less than 18 degrees API. Most of these streams don't have a drop-in, like-kind replacement. This leaves refiners evaluating streams such as Castilla and Rubiales from Colombia, Peregrino from Brazil, and Altamira from Mexico. If those streams are unavailable, refiners would have to evaluate streams from the Middle East and Russia and hope to bid them away from their natural homes in the Asia-Pacific region.

What does all this mean? Substituting crude oils on short notice, especially heavy grades that are generally less fungible (from a quality standpoint) and likely already under contract to other buys, is a tricky process. It requires linear program (LP) modeling in conjunction with commercial intelligence to determine the "next best" grade(s) to purchase, which of course depends on each refinery's specific configuration. Assuming Gulf Coast refiners can't increase imports of Canadian and Mexican crude oils by meaningful amounts (due to Canadian delivery constraints and Mexican production declines), coking refiners there will be scrambling to get their hands on alternative heavy crude oil streams. Grades closer to home in South America are a potential albeit limited source, so we'll likely see some





A PROFESSIONAL CONSULTING FIRM SERVING THE ENERGY, CHEMICAL, AND RELATED INDUSTRIES WORLDWIDE

increases in imports from the Middle East and Russia. With this supply crunch, the light-heavy differential along the Texas and Louisiana coast should remain narrow (in other words, heavy crude oil stays relatively expensive) and also have a domino effect on medium sour grades (e.g. Mars), as we've already seen. . Refiners will adapt, but processing profits may take a hit in the near term — especially for refineries highly dependent on Venezuela grades. Things may change as we get closer to January 2020, when IMO 2020 takes effect. We'll continue to track this, and provide an update when appropriate.

*Note: The article was authored by Amy Kalt of Baker & O'Brien and published on RBN Energy's Daily Energy Post on February 6, 2019.*

*This article is copyrighted © 2019 by Baker & O'Brien, Inc. and publication or distribution of this article without the express written consent of Baker & O'Brien, Inc., is prohibited.*