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U.S. Senate Committee on Energy and Natural Resources

Full Committee Oversight Hearing of IMO 2020

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The American Fuel & Petrochemical Manufacturers ("AFPM") appreciates the opportunity to provide testimony on the International Maritime Organization ("IMO") 2020 marine sulfur standard ("IMO 2020"). AFPM's members operate approximately 110 refineries, accounting for more than 90 percent of U.S. refining capacity, that produce the gasoline, diesel, jet fuel, and petrochemical building blocks for the thousands of products that make innovation and progress possible. Marine fuel is approximately 7 percent of global transportation fuel demand.

AFPM supports an on-time and uniform global implementation of IMO 2020, which presents a challenging but unique opportunity to enhance U.S. energy security while delivering substantial environmental benefits. The U.S. refining sector is the most complex and technologically advanced refining sector in the world, having invested nearly $100 billion over the past decade to increase processing capacity, improve operating efficiency, increase crude slate flexibility, and produce cleaner fuels, including low sulfur fuels like those needed for IMO 2020. Despite early concerns about potential impacts on national and local markets, it is increasingly clear that the U.S. refining sector is prepared to deliver IMO compliant fuel to meet not only the needs of U.S. shippers, but also an increasing share of marine fuel globally.

I. BACKGROUND ON MARPOL, IMO 2020, AND U.S. IMPLEMENTATION

The IMO is an agency of the United Nations that sets global standards for the safety, security and environmental performance of international shipping. The organization provides a regulatory framework for shipping with respect to safety, environment, legal matters, technical co-operation, maritime security and efficiency of shipping. IMO adopted the International Convention for the Prevention of Pollution from Ships, otherwise known as MARPOL, in 1973. MARPOL itself is comprised of a series of annexes that address different pollution concerns. The Marine Environment Protection Committee (MEPC) is the working arm of IMO that "addresses environmental issues under IMO's remit," including "oil, chemicals carried in bulk, sewage, garbage and emissions from ships, including air pollutants and greenhouse gas emissions."[1] The MEPC meets at least once each year to work through issues under its purview.

Regulations for sulfur dioxide, nitrous oxide, and other conventional air pollutants are codified in Annex VI, which was agreed to in 1997 and became effective in 2005. More stringent revisions were adopted in 2008, including designation of local Emissions Control Areas ("ECAs") and the worldwide marine sulfur standard for all marine traffic set to take effect in 2020 ("IMO 2020").

[1] Archive of Marine Environment Protection Cmte Meeting Summaries, IMO, http://www.imo.org/en/MediaCentre/MeetingSummaries/MEPC/Pages/Default.aspx (last visited Dec. 8, 2019).

The U.S. and Canada requested that IMO establish a North America ECA, effectively requiring a lower sulfur content for ships calling on U.S. and Canadian ports or traveling within 200 nautical miles of most of the gulf, west and east coast of those countries. The first phase of the ECA sulfur standard began in 2012, limiting sulfur content in U.S. waters to no more than 1% and falling to no more than 0.1% starting in 2015. Additional ECAs are in place in the Baltic Sea, North Sea, and elsewhere, with other areas under consideration.

IMO 2020 will cover emissions for ships operating outside the ECAs, in open ocean, and limits sulfur content of ship's fuel oil to no more than 0.5% starting January 1, 2020. The regulation was originally adopted in 2008, with a requirement that IMO review the availability of low sulfur fuel oil to determine whether the effective date would remain January 1, 2020 or be deferred until January 1, 2025. The MEPC met in October 2016 and decided to maintain the 2020 implementation. In October 2018, the MEPC met and approved a carriage ban that becomes effective March 1, 2020. The carriage ban effectively prevents ships from carrying non-compliant fuel in tanks that store fuel for on-board combustion, but does not ban the carriage of higher sulfur fuels as cargo. It also does not apply to ships that use an alternative compliance method, such as an exhaust gas cleaning system, also known as scrubber.

The IMO and MEPC do not have the authority to enforce regulations. That authority rests with flag-state and port-state authorities. In the United States, the MARPOL treaty was accepted, signed, and incorporated into U.S. law by the *Act to Prevent Pollution from Ships*, 33 U.S.C. §§1901-1905 ("APPS"). The U.S. Coast Guard ("USCG") is the primary agency responsible for enforcement of both the U.S. ECA and IMO 2020, and entered into a Memorandum of Understanding with the Environmental Protection Agency ("EPA") that provides that the USGC and the EPA will jointly and cooperatively coordinate inspections, investigations, and enforcement actions if a violation is detected. The efforts to ensure compliance with Annex VI and APPS include oversight of marine fueling facilities, on board compliance inspections, and record reviews.

U.S. regulatory agencies are a world-class model and well-prepared to enforce the IMO 2020 standards. The USCG has an existing inspection and enforcement system for the U.S. ECA and EPA has engaged in a process this year to update its regulations to allow the storage and sale of IMO-compliant fuel. EPA proposed regulations in September to allow for the distribution of diesel fuel that complies with the January 1, 2020 global marine sulfur standard. The final rule is expected by EPA to be promulgated this month.

II. THE U.S REFINING INDUSTRY HAS A COMPETITIVE ADVANTAGE, HAVING INVESTED $100 BILLION TO INCREASE U.S. COMPETITIVENESS AND PRODUCE CLEANER FUELS IN THE LAST DECADE

As a general matter, compliance with IMO 2020 is the responsibility of ship owners and operators, who can comply by three main methods. First, they may switch to a petroleum fuel with a sulfur content of 0.5% or less. That fuel can be a distillate fuel like diesel, or a heavier fuel like very low sulfur fuel oil. Second, they may continue using high-sulfur fuel oil and install

an exhaust gas cleaning system, or "scrubber," that will reduce emissions to a level consistent with emissions from a 0.5% sulfur fuel. Finally, they may use alternative low sulfur fuels such as liquified natural gas. AFPM's testimony will focus on the first option and the U.S. refining industry's readiness to meet demand for IMO-compliant fuels.

The U.S. is home to approximately 20 percent of global refining capacity and has the most efficient and complex refining industry in the world. Refinery complexity is a measure of refinery sophistication. More complex refineries are configured to produce more products that are of higher value – and from lower quality crude oils. Higher value products include ultra-low sulfur diesel and gasoline. Lower quality crudes include those that are higher in sulfur and contain a higher fraction of heavy fuel oil. U.S. refiners, on average have the ability to run these higher sulfur crudes to produce substantially more gasoline, diesel, jet fuel, and other high value products. This flexibility is not an accident—according to data tracked by IIR, the U.S. refining industry has invested more than $100 billion over the last decade to make it possible to make cleaner fuels from a range of crude qualities.

For example, PBF Energy is restarting a coking unit at its Chalmette, Louisiana refinery and will build a hydrogen plant at its Delaware City refinery.[2] In February 2019, PBF Logistics LP and Maersk announced an agreement for PBF to make approximately 10 percent of Maersk's annual fuel demand.[3] In June 2019, Phillips 66 announced that it would make modifications to hydrotreaters at its Linden, NJ and Roxana, IL refineries to reduce high-sulfur fuel oil production, and add more storage to its Ferndale, WA refinery to increase capability to process higher sulfur crudes.[4] Marathon Petroleum announced in May 2019 that it would expand its coking capacity at its Garyville, LA refinery to increase capacity to run heavy/sour crude oils.[5] Of course, refiners around the world are finding ways to increase output.[6] BP built an additional hydrotreater at its Whiting refinery in Indiana, enabling it to produce lower sulfur gasoline and

[2] Argus Media, *PBF Energy Seizing IMO 2020 Opportunities*, WWW.ARGUSMEDIA.COM, Oct. 22, 2019, https://www.argusmedia.com/en/news/2000142-pbf-energy-seizing-imo-2020-opportunities; *see also* Timothy Puko, *Refiners Poised for Boost from Clean-Fuel Rules*, WALL ST. J. (May 26, 2019 5:30 am ET). https://www.wsj.com/articles/refiners-poised-for-boost-from-clean-fuel-rules-11558863000.

[3] PBF Logistics, *Maersk and PBF Logistics LP announce agreement for production and storage of 0.5% sulphur fuel on the U.S. East Coast*, https://www.pbflogistics.com/press-releases/2019/02-14-2019.

[4] Argus Media, *Phillips 66 Modifies Refineries for Marine Fuel Rule*, WWW.ARGUSMEDIA.COM, Jun. 19, 2019, https://www.argusmedia.com/en/news/1924837-phillips-66-modifies-refineries-for-marine-fuel-rule.

[5] Bunker Spot, *Americas: Marathon Petroleum's Coker Expansion Project to Benefit from IMO 2020*, WWW.BUNKERSPOT.COM, May 9, 2019, https://www.bunkerspot.com/americas/48085-americas-marathon-petroleum-s-coker-expansion-project-to-benefit-from-imo-2020

[66] Chen Aizhu et. al, *Fact Box: Global Refiners Raise Cleaner Shipping Fuel Output Ahead of 2020*, REUTERS (Nov. 2019 2:27 a.m.), https://www.reuters.com/article/us-global-oil-imo-factbox/factbox-global-refiners-raise-cleaner-shipping-fuel-output-ahead-of-imo-2020-idUSKBN1XU0RK.

diesel.[7] In addition to overhauling its coker and hydrotreating units at its Beaumont refinery in 2018, ExxonMobil has announced investments in Singapore, Antwerp, Rotterdam, and the UK.[8]

Relatively complex refineries take advantage of these flexibilities in many ways, but the most significant are optimizing crude slates, changing product mixes, increasing utilization, and processing high sulfur fuel oil that less complex refineries cannot further refine. Refineries have been preparing for years, making long-term capital expenditures to increase this flexibility. The refining sector has also planned and executed near-term work to prepare to meet increased demand, including going through major "turnarounds" in fall 2019. A turnaround is a highly intensive maintenance process that involves shutting down a refinery for an extended period of time and bringing in several thousand workers to debottleneck refinery units to increase efficiency, shift product yields, add capacity, and perform required periodic maintenance of refining units to ensure optimal operations. This turnaround procedure allows refineries to increase throughput, efficiency, and utilization, and enhance safety through comprehensive inspection and maintenance.

Crude Slate Optimization. The first flexibility available to refiners is the ability to shift and optimize crude slates. Crude oil is classified by physical characteristics, including chemical composition, gravity, and viscosity. For example, low-sulfur crudes common in U.S. shale fields are low density (light) and low in sulfur (sweet), so called "light/sweet" crudes. These light/sweet crudes require less processing to produce clean fuels and as a result are favorable crudes for less complex refineries. All other things being equal, their lower sulfur content will make them higher valued. Brent crude and WTI crudes are light/sweet and both serve as an important global price benchmarks. By contrast, "heavy/sour" crudes are commonly found in Mexico, Canada, Russia, Venezuela, and parts of the Middle East. Heavy/sour crudes are more dense and higher in sulfur content. Common heavy sour crudes are Mexican Maya and Western Canadian Select. Because heavy/sour crudes are optimal in refineries that have made capital investments in complex refining equipment, these crudes typically trade at a discount to their light/sweet competitors.

Crude slate flexibility allows the U.S. refining system to produce IMO compliant fuels from a wider variety of feedstocks. It is widely expected that as IMO 2020 takes effect, less complex

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[7] Erwin Seba, *BP Starts New Whiting Coker to Swap Sweet Crude for Canadian*, REUTERS (Nov. 14, 2013, 5:52 p.m.) https://www.reuters.com/article/us-refinery-operations-bp-whtiing/bp-starts-new-whiting-coker-to-swap-sweet-crude-for-canadian-idUSBRE9AD1DN20131114.

[8] Erwin Seba, *Exxon Beaumont Refinery Overhauling Coker, Hydrotreater*, REUTERS (May 14, 2018, 10:14 a.m.) https://www.reuters.com/article/us-refinery-operations-exxon-beaumont/exxon-beaumont-refinery-overhauling-coker-hydrotreater-sources-idUSKCN1IF1WD; Ship and Bunker, *IMO 2020: ExxonMobil Announces Multi-Billion Dollar Upgrades to Singapore Refinery Complex*, WWW.SHIPANDBUNKER.COM (Apr. 2, 2019) https://shipandbunker.com/news/apac/469033-imo-2020-exxonmobil-announces-multi-billion-dollar-upgrades-to-singapore-refinery-complex; ExxonMobil, *Construction Begins on New Hydrocracker at Rotterdam Refinery*, Jun. 15, 2016, https://www.exxonmobil.com/en/basestocks/news-insights-and-resources/begin-construction-of-new-hydrocracker-at-rotterdam-refinery; ExxonMobil, *ExxonMobil to Expand Ultra-Low Sulfur Diesel Production at Fawley Refinery*, Apr. 24, 2019, https://corporate.exxonmobil.com/News/Newsroom/News-releases/2019/0424_ExxonMobil-to-expand-ultra-low-sulfur-diesel-production-at-Fawley-Refinery.

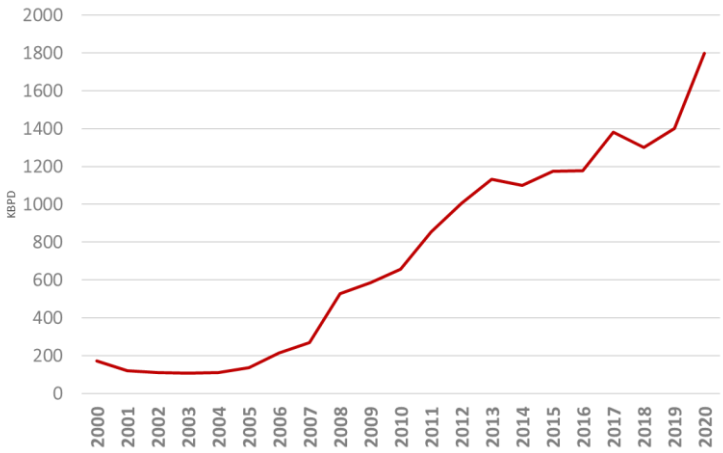
refineries will need to switch to lighter crude slates to minimize production of high sulfur fuel oil, increasing demand for light/sweet crude and widening the discount for heavy/sour crude. Complex U.S. refineries will be competitively advantaged because they will be able to increase their input of unrefined heavy crudes as well as high sulfur residual fuel oil produced by less-complex refineries, increasing utilization of refinery units, like cokers, designed to process heavy crude oil fractions.

In fact, U.S. refinery inputs to coking units have declined in 2019 because of decreased availability of heavy sour crude oil due to sanctions and transportation bottlenecks. The availability of unrefined high sulfur fuel oil and the decrease in demand from less complex refineries for heavy sour crude oil will allow complex U.S. refineries to increase coker utilization. In its analysis of IMO 2020 earlier this year, the U.S. Energy Information Administration, U.S. refiners are expected to increase the processing of unfinished oil inputs from an average of "0.33 million b/d in 2018 to averages of 0.39 million b/d (an increase of 17.5%) in 2019 and to 0.56 million b/d (an increase of 44.6%) in 2020."[9]

For upstream U.S. oil producers, IMO 2020 is expected to increase international demand for light/sweet crude oil.

Product Optimization. The second flexibility available to refiners is the ability to shift production of petroleum products. For instance, U.S. refiners have some capability to increase yield of distillate fuels to meet demand. According to the U.S. Energy Information Administration, U.S refineries are expected to "increase distillate fuel refinery yields from an average of 29.5% in 2018 to 29.9% in 2019 to 31.5% in 2020, while motor gasoline yields will fall from an average of 46.9% in 2018 to averages of 46.5% in 2019 and 45.6% in 2020. Residual fuel yields will also decrease from an average of 2.4% in 2018 to an average of 2.2% in 2020."[10]

Figure 1 U.S. Distillate Exports Expected to Increase



In total, U.S. refinery production of distillate fuel is expected to "increase from an average of 5.18 million b/d in 2018 to 5.32 million b/d (2.7%) in 2019 and 5.92 million b/d (11.3%) in 2020."[11] This dynamic has already started. Valero Energy and Phillips 66 reported in October

[9] U.S. Energy Information Administration, *Upcoming changes in marine fuel sulfur limits will affect crude oil and petroleum product markets*, THIS WEEK IN PETROLEUM (Jan. 6, 2019), https://www.eia.gov/petroleum/weekly/archive/2019/190116/includes/analysis_print.php.
[10] *Id*.
[11] *Id*.

that they plan to continue running high-sulfur intermediates as part of their crude slate optimization.[12]

As U.S. refinery production of distillate increases, U.S. distillate net exports will increase from an average of 1.2 million barrels per day in 2018 to 1.8 million barrels per day in 2020.[13] U.S. domestic demand for distillate is not expected to be significantly affected by IMO 2020 as much marine fuel consumed in U.S. waters is already low in sulfur (0.1% ECA spec) and U.S. ports are not major bunkering centers for international marine traffic.

Refinery Utilization. The final flexibility available to refiners is the ability to increase refinery utilization to meet increased distillate demand. In fact, according to the U.S. Energy Information Administration, gross inputs to U.S. refineries are expected to increase from an average of 17.3 million barrels per day (b/d) in 2018 to a record level of 17.9 million b/d (up 3.6%) on average in 2020.[14] EIA projects "[t]his increase in gross inputs will result in refinery utilization increasing from an average of 92% in 2019 to an average of 96% in 2020."[15]

Refining utilization globally is expected to increase in the fourth quarter of 2019 and through 2020. In its *World Energy Outlook 2019*, the International Energy Agency ("IEA") notes that an expected increase in refining activity in 2020 suggests a smooth implementation in January of IMO 2020.[16]

III. DESPITE EARLY UNCERTAINTIES, MARKET INDICATIONS ARE THAT REFINERS AND SHIPPERS ARE READY

IMO 2020 has been a focus of analysts for many months given the potential implications for crude and product markets. However, as the transition has started, it is becoming increasingly clear that refining and shipping industries are prepared for IMO 2020.[17] Major bunker fuel refiners and suppliers have been testing fuels for much of the year, and very low sulfur fuel oil ("VLSFO") is already being supplied at major ports around the world. IEA reported that ports, ship owners and refiners have stepped up preparations and major bunkering hubs such as Fujairah, Rotterdam and Singapore are said to have large volumes of compliant fuel available.

Likewise, OPEC, in its *2019 World Oil Outlook* released on November 5th, projects the impact of IMO 2020 will be less severe than previously expected. OPEC attributes this to a lighter global crude slate that will allow refineries to more readily produce compliant fuel. Many

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[12] Janet McGurty, *US Refiners Increase HFSO Throughput as IMO 2020 Nears*, S&P GLOBAL PLATTS, (Oct. 30, 2019 20:51 UTC), https://www.spglobal.com/platts/en/market-insights/latest-news/shipping/103019-imo-2020-tracker-us-refiners-increase-hsfo-throughput-as-imo-2020-nears

[13] EIA, *supra* note 9.

[14] *Id*.

[15] *Id*.

[16] International Energy Agency, World Energy Outlook 2019, https://www.iea.org/topics/world-energy-outlook.

[17] John Kemp, *Fuel Market Calm Ahead of IMO Changeover*, REUTERS, (Dec. 1, 2019) https://www.reuters.com/article/oil-bunker-kemp-idAFL8N2894NJ ("The predicted marine fuel crisis has failed to materialise.").

refiners and ports/blenders that have either started to supply or announced plans to supply 0.5% sulfur fuel.

The U.S. Energy Information Administration reports that heating oil prices at the start of the 2019–2020 winter heating season (October 1 through March 31) were 10% lower than at the start of the previous winter.[18] Although October distillate production declined and distillate inventories fell because of fall refinery maintenance and the loss of supply from the Philadelphia Energy Solutions refinery, EIA nevertheless projects that U.S. average wholesale and retail prices of heating oil and ultra-low sulfur diesel in the fourth quarter of 2019 and into 2020 are expected to be below prices in the fourth quarter of 2018.[19] This is partially due to the fact that EIA expects distillate production to increase in 2020 by 8.1% as compared with 2019, while consumption is expected to increase by 1.2%.[20] In fact, in its November 2019 Short Term Energy Outlook, EIA reported that "[d]espite low distillate fuel inventories, EIA expects that average household expenditures for home heating oil will decrease this winter."[21]

Perhaps the most significant remaining challenges will be for ship owners, including planning to ensure a consistent quality of fuel across all ports of call and navigating port-state enforcement protocols that include standards for reporting the unavailability of IMO 2020 compliant fuels (Fuel Oil Non-Availability Reports or "FONARs") and remedies for non-compliant fuels in port states. AFPM has confidence that the market and cooperation through the MEPC process will effectively address these issues.

IV. Recommendations and Conclusion

The U.S. refining industry has invested nearly $100 billion over the last decade to increase processing capacity, improve operating efficiency, increase crude slate flexibility, and produce cleaner fuels. As a result of these investments, the U.S. is well-positioned to be a leader in producing and supplying lower sulfur marine fuels to a global shipping fleet and realizing the environmental and health benefits expected from IMO 2020.

AFPM supports maintaining an on-time and consistent adoption of IMO 2020. To continuing facilitating the transition to lower sulfur marine fuels worldwide, policy makers should consider enabling infrastructure to debottleneck light sweet crude oil production. Finally, as with any regulatory program, policymakers should adopt clear guidance for details of regulatory structure and integrate learnings from other fuel programs. AFPM is confident that the U.S. government and industry is ready to meet this challenge.

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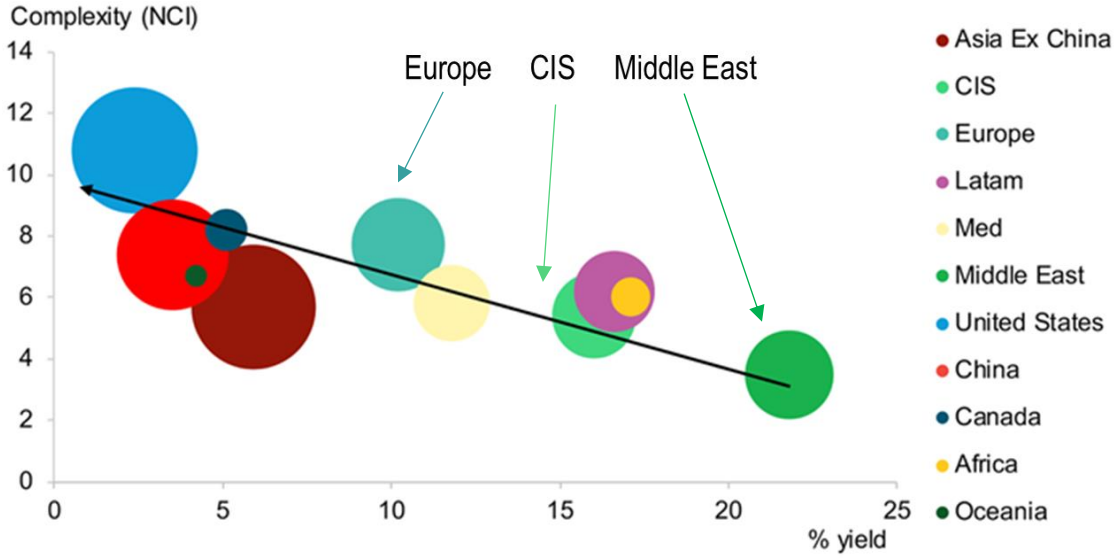
[18] U.S. Energy Information Administration, *Winter Fuels Outlook* (Oct. 2019), https://www.eia.gov/special/heatingfuels/resources/winterfuels2019.pdf.
[19] U.S. Energy Information Administration, *Short Term Energy Outlook* (Nov. 2019), https://www.eia.gov/outlooks/steo/pdf/steo_text.pdf.
[20] *Id.* at 10.
[21] *Id.* at 2.

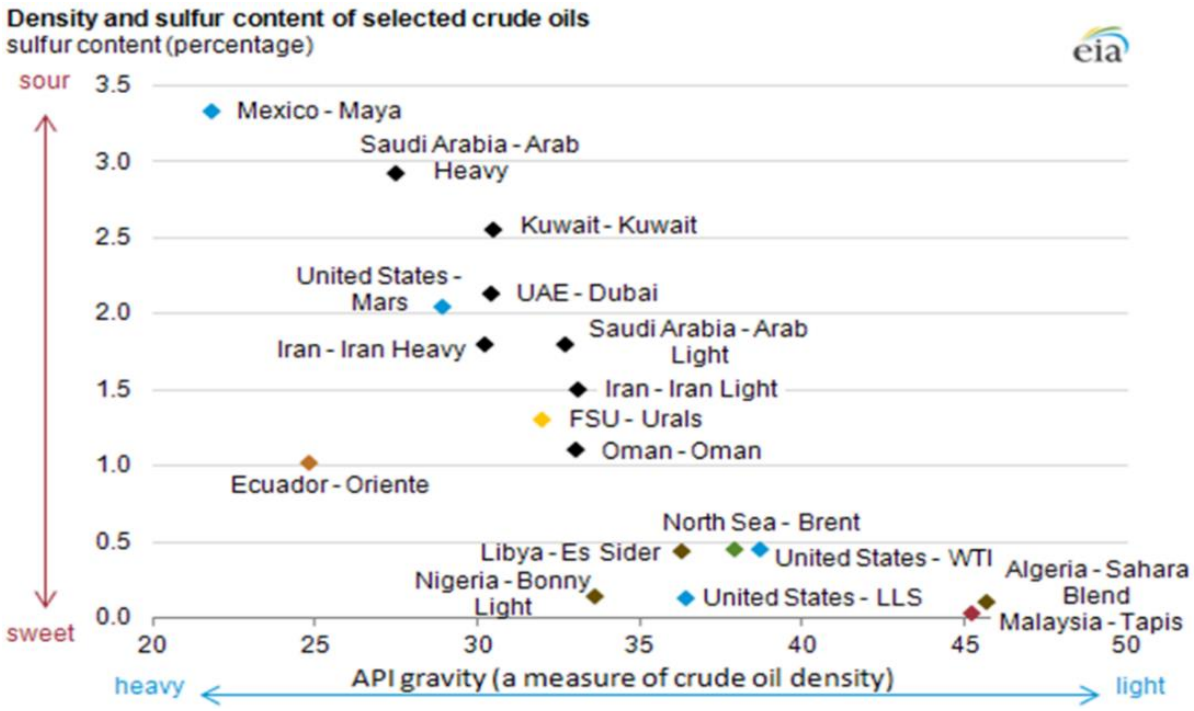
Appendix

Figure 1: This graphic illustrates the relative complexity of refining capacity around the world. Complexity, in this case based on the Nelson Complexity Index, is a measure of the extent to which a refinery can convert crude oil into high value products, like gasoline and diesel fuel. The higher the complexity score, the higher the value of products that are produced. The industry complexity scores are based on individual complexity scores for each refinery in a region. The U.S. refining industry as a whole, the blue circle in the upper left part of the chart, is the most complex refining system in the world and as a result produces very little low value heavy fuel oil – which is what is measured on the horizontal axis.



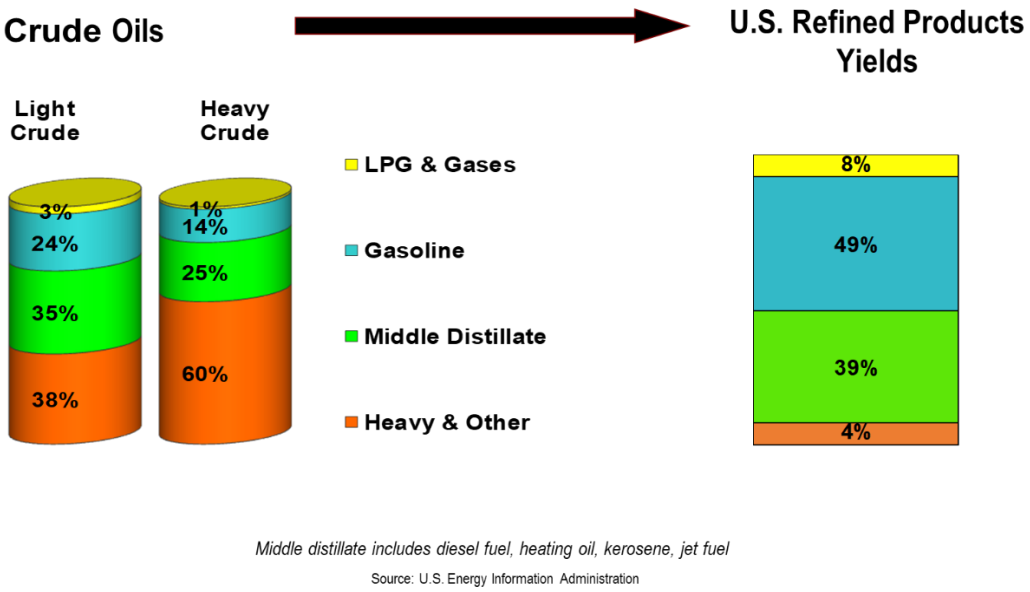
Source: BloombergNEF, Oil & Gas Journal, JODI (JODI<GO> on Bloomberg Terminal)
Note: NCI = Nelson Complexity Index. Bubble size indicates total CDU capacity

Figure 2: This chart compares the sulfur percentage and relative density of various crude oils.



Source: Energy Information Administration

Figure 3: EIA estimate of product yield from heavy and light crude oils. The estimates on the left-hand side of the graphic are illustrative of a simple refinery. The U.S. yields are illustrative of U.S. capacity to produce higher-value products from various crude slates.



Source: Energy Information Administration

Figure 4: A complex refinery schematic. The blue shaded oval highlights distillation, the red, cracking or breaking apart molecules, and the green chemically changing.