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King Abdullah Petroleum Studies and Research Center

Implications of IMO 2020: The Potential for High Sulfur Fuel Oil Penetration in Saudi Arabia

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Instant Insight

December 10, 2019

KS--2019-II21

About KAPSARC

The King Abdullah Petroleum Studies and Research Center (KAPSARC) is a non-profit global institution dedicated to independent research into energy economics, policy, technology and the environment across all types of energy. KAPSARC's mandate is to advance the understanding of energy challenges and opportunities facing the world today and tomorrow, through unbiased, independent, and high-caliber research for the benefit of society. KAPSARC is located in Riyadh, Saudi Arabia.

Legal Notice

January 1, 2020 marks the enforcement of the International Maritime Organization's (IMO) rule on limiting sulfur emissions from ships (IMO 2020). The rule mandates ships to reduce the sulfur content in their fuels to 0.5% from the current 3.5%. This suggests that ship owners and operators need to replace about 3 million barrels per day (MMb/d) of heavy fuel oil (HFO) with high sulfur content – known as high sulfur fuel oil (HSFO). This is also a challenge for refiners as they scramble to develop IMO-compliant fuels to meet the new sulfur regulation. Alternatively, ships could install sulfur removal technology, 'scrubbers,' and continue running on HSFO. The International Energy Agency (IEA) estimates that some 1 MMb/d of HSFO will continue to be used as marine fuel while about 2 MMb/d of HSFO will have to be replaced by low sulfur fuels, mainly marine gas oil (MGO) and very low sulfur fuel oil (VLSFO) (IEA 2019).

Most of the displaced HSFO is likely to find secondary markets in the power and industrial sectors. The expected discount on HSFO due to its surplus might attract some regions and end-users to increase their use of the fuel. Saudi Arabia is one of the largest markets for HFO, relying heavily on it for electricity generation and seawater desalination. In 2017, the share of HFO used in power generation surpassed that of crude oil for the first time on an annual basis. Significant amounts of crude oil are still being used to generate power in Saudi Arabia and could be substituted. The Kingdom could be one of the largest consumers of the excess HSFO resulting from the IMO 2020 regulation.

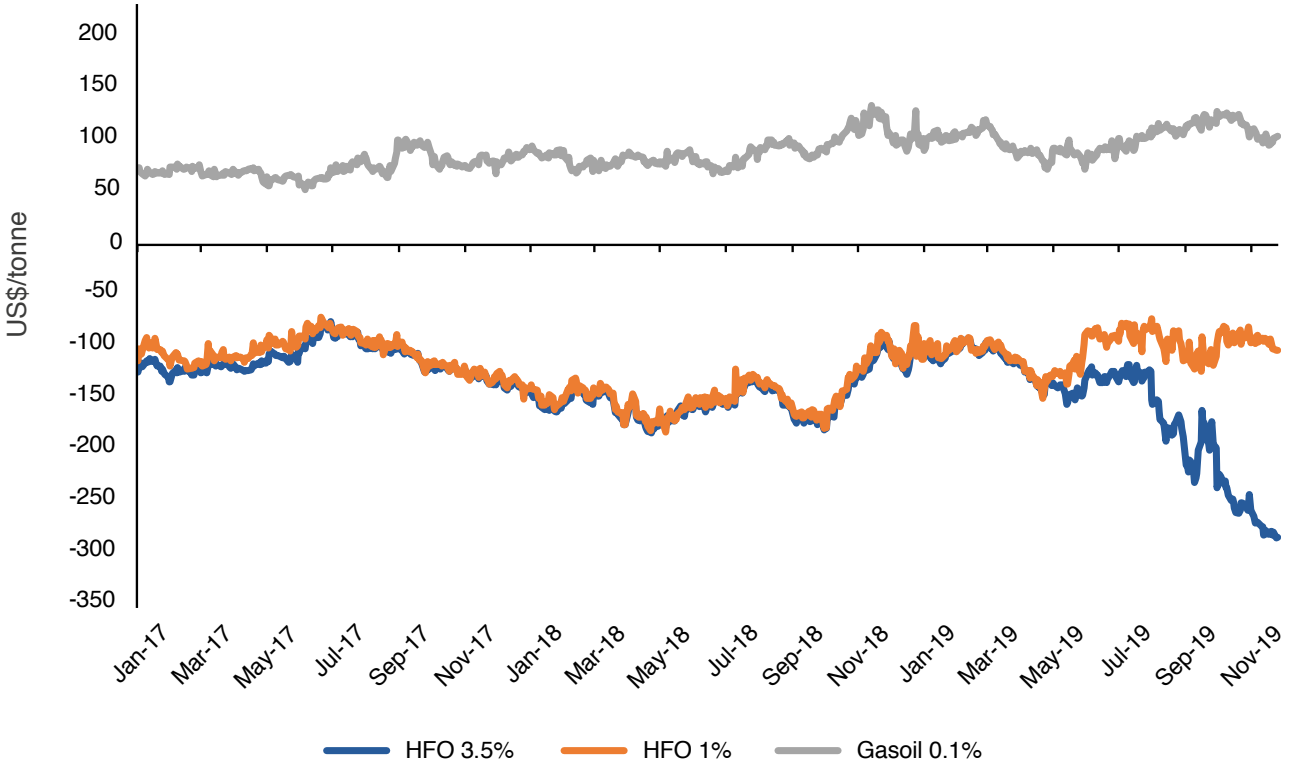
Context: The lead up to IMO 2020

The mandate to reduce sulfur in the maritime sector started in 1997, with the creation of the Sulfur Emission Control Area by the International Convention for the Prevention of Pollution from Ships (MARPOL) protocol. MARPOL's mandate was to address the problem of greenhouse gas (GHG) and non-GHG pollutants. It first introduced a sulfur cap in 2000, limiting sulfur content in fuels to 4.5%. The cap on sulfur was lowered to 3.5% in 2012 and, in October 2016, the IMO took the decision to revise the sulfur cap down to 0.5% from January 2020.

The prices of HSFO in some regions have started to fall, in anticipation of the enforcement of IMO 2020. In 2019, the price of HFO in Europe, with a 3.5% sulfur content, has seen a significant discount to Brent, while more desirable lower sulfur fuels, such as HFO 1% sulfur and gasoil 0.1% sulfur, have stayed relatively stable (Figure 1).

Some questions still remain surrounding how the shipping industry can transition to using lower sulfur fuels. From the supply side, there is great uncertainty as to the availability of VLSFO, given the capacity constraints of refineries to desulfurize HSFO or convert it to more valuable products such as diesel. IMO-compliant fuels would have to consist of blends from various refinery streams, raising issues of engine incompatibility and fuel contamination, which could be damaging (Argus 2019). Other choices include MGO, liquefied natural gas, or adding scrubbers — all of which bring limitations and risks.

Figure 1. Antwerp-Rotterdam-Amsterdam (ARA) prices of HFO and gasoil as a differential to Brent.

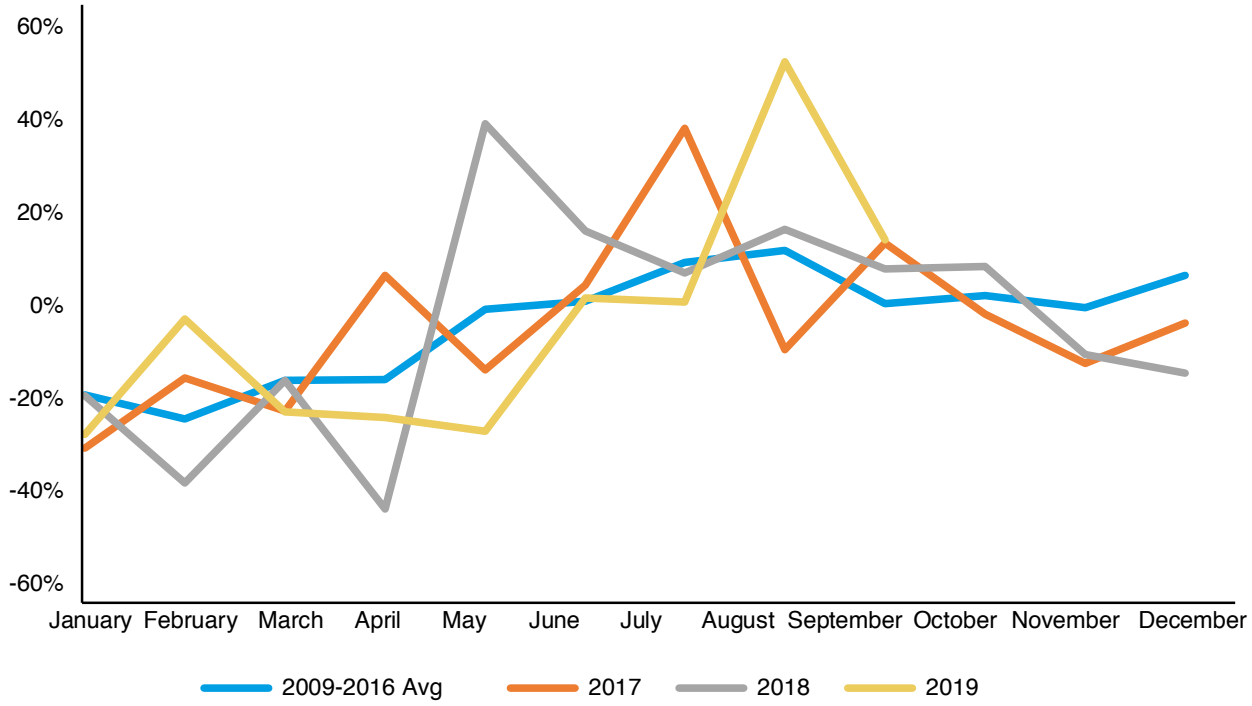


Source: Bloomberg.

HFO demand in Saudi Arabia is on the rise

In contrast to global marine transport, HFO demand in Saudi Arabia has increased significantly since 2016. This can be partly explained by the country's addition of 3 gigawatts (GW) of HFO power plant capacity between 2014 and 2018. In August 2019, Saudi Arabia consumed 880 thousand barrels per day (Kb/d) of HFO, its highest ever monthly volume of HFO consumption. Despite total oil demand growth declining in the Kingdom since 2016, fuel oil consumption has been strong. Given the large seasonal variability in its power load, Saudi Arabia's power plant fuel intake typically peaks in the summer to meet the demand for electricity from air conditioning. During peak summer seasons, fuel oil consumption usually rises 20% above its yearly average. However, since 2017, it has risen 40% above it, reaching 56% in 2019 (Figure 2). Demand for HFO is expected to increase, with 7 GW of HFO-fired power plants expected to come online in 2020 (APICORP 2019). KAPSARC's Oil Market Outlook (KOMO) estimates that year-on-year demand for fuel oil will increase by around 80 Kb/d in 2019 and by more than 90 Kb/d in 2020.

Figure 2. Monthly changes in Saudi Arabia's HFO consumption compared to its annual average.

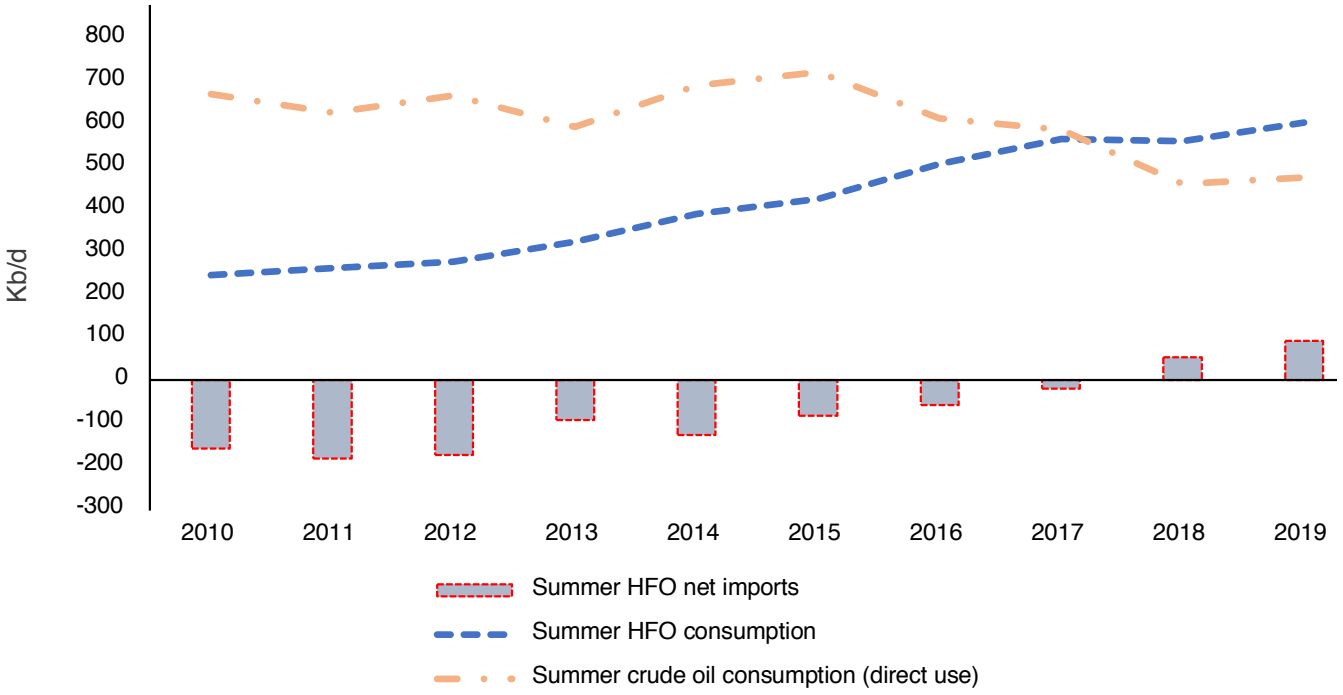


Sources: JODI; KAPSARC.

In the summer of 2017 (April to October), Saudi Arabia's HFO demand peaked, averaging 564 Kb/d, before dropping slightly during the same period the following year to 558 Kb/d. The slight drop in HFO demand in 2018 was mostly due to the increase in the country's electricity tariffs and newly enforced energy efficiency measures, which curbed peak load demand. But despite the drop in HFO demand, Saudi Arabia became a net importer of HFO in the summer of 2018, averaging 53 Kb/d. HFO use has surpassed crude oil burn for the first time in the country (Figure 3). This trend continued in the summer of 2019, with summer net imports increasing to 75 Kb/d due to increased demand.

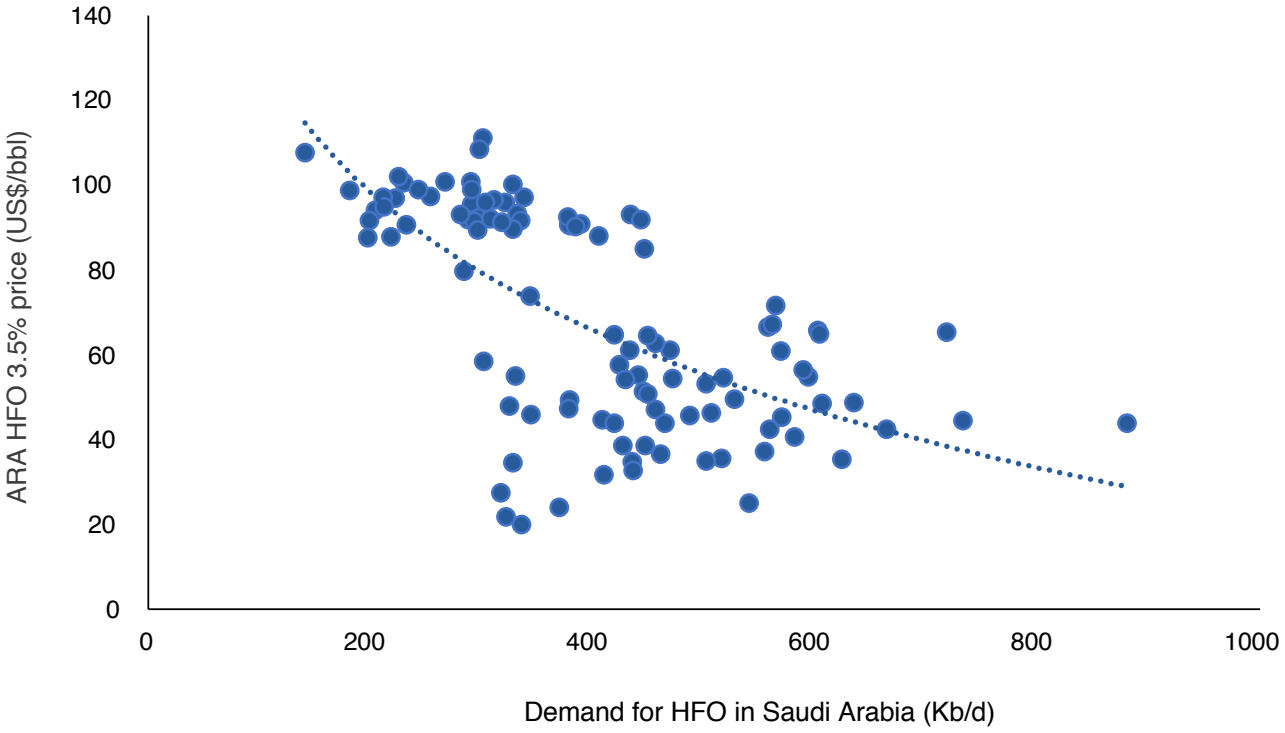
The rise in HFO imports and demand for HFO in Saudi Arabia could signal that the Kingdom is taking advantage of the discounted price of HSFO to optimize its fuel mix. Figure 4 shows a simple correlation between the Saudi domestic demand for HFO and the ARA price of HSFO from 2011-2019. It is clear that demand increases as the global prices of HFO fall, in line with economic theory. As HSFO prices trade at a favorable discount to crude oil and diesel, this provides the Kingdom with an opportunity to displace more volumes of crude oil and diesel (estimated to be 380 Kb/d in 2018) from the power sector and make them available for exports, increasing the government's revenues.

Figure 3. Summer demand and imports of HFO against summer consumption of crude oil in Saudi Arabia (April to October).



Sources: JODI; KAPSARC.

Figure 4. Relationship between monthly prices of HFO and quantity demanded, 2011-2019.



Sources: JODI; Bloomberg; KAPSARC.

However, the Kingdom has been clear that its long-term plan is to eliminate liquid fuels from the power sector. Data up to 2018 has shown that liquid fuels used for power generation have been declining. Between 2015 and 2018, the Kingdom's total liquid fuel burn decreased from 940 Kb/d to 760 Kb/d (ECRA 2019). The country's energy price reforms and energy efficiency measures have been key to reducing its overall liquid fuel use. The increased supplies of domestic natural gas have also assisted in displacing crude oil and diesel from the power sector, especially in the eastern and central regions. The Kingdom has a target to produce 70% of its power from natural gas, with the remaining 30% from renewable energy (Platts 2019). The western and southern regions remain dependent on liquid fuels and, until natural gas supplies, infrastructure and the use of renewables are boosted, the western region is expected to optimize its fuel using cheap HSFO.

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