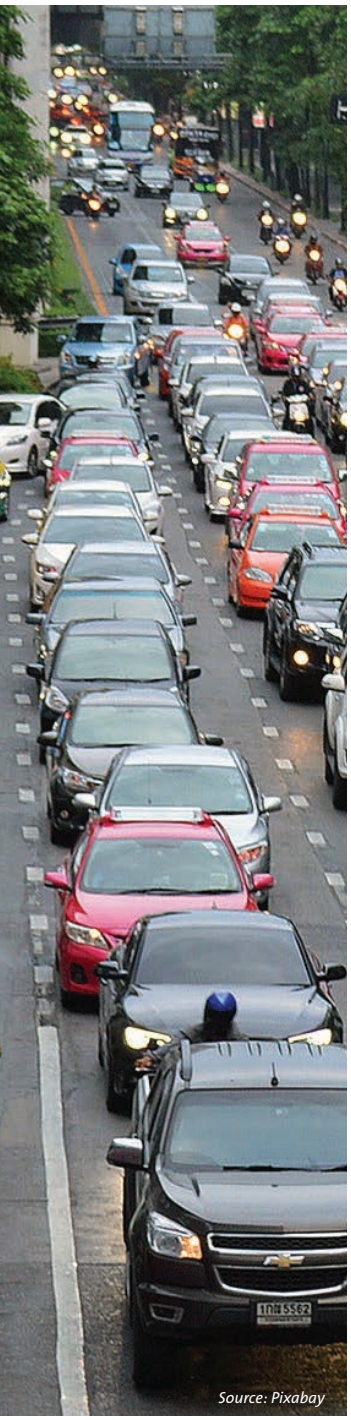
FUEL ADDITIVES

Added benefits

Global fuel additives consumption is set to reach 900,000 t/y by 2020 due to fuel consumption growth, regulatory developments and changing consumer choices, writes *Kunal Mahajan*, Project Manager, Chemical & Energy, Kline Group.



Source: Pixabay

Fuels are an important part of consumers' daily life across the globe. Today's economy depends on fuels as they are required to operate vehicles including cars and trucks, ships, aeroplanes, trains etc, to transport goods and people around the world. At the same time, it is important to use fuel with the right specification as it plays an important role in the effective working of various means of transportation.

The refining process determines the fuel specifications, but variations in process parameters, as well as the quality of crude oil, leads to some variations in specifications from the standards required by original equipment manufacturers (OEMs) or specified under regulations.

This is where fuel additives come into the picture as they are used to adjust these fuel specifications so that the fuel meets the standards required by regulations and OEMs. Fuel additives are also used to prepare fuel for logistics-related challenges such as the storing and shipping of fuel. Fuel marketers also use fuel additives to differentiate their fuel in the market.

Fuel market

Global fuel consumption was estimated to be about 66mn b/d in 2016. Diesel and gasoline together account for almost 80% of global fuel consumption and are the two most consumed fuels in the world. Diesel is consumed in myriad applications, including passenger cars, light trucks, heavy trucks, buses, off-highway equipment, stationary power generation sets and marine vessels, and is therefore the most consumed fuel in the world. Gasoline closely follows diesel and is used in most of the world's passenger cars, motorcycles, mopeds and other equipment like motor skis, snow blowers, etc. Other fuels, such as heavy fuel oil (HFO), jet fuel, kerosine and aviation gasoline account for a much smaller share of global fuel consumption. HFO is mainly used to fire power generation, factory boilers and steam generators and to run large vessels. Jet fuel is used to fly aeroplanes. Kerosine is mainly used as cooking fuel in developing regions of the world like India, while aviation gasoline is used in small quantities to operate private jets.

Asia and North America are the two largest fuel-consuming regions in the world, together accounting for about two-thirds of global fuel consumption. Asia, with its large population, is the world's largest fuel-consuming region, followed by North America, which has the highest per capita fuel consumption in the world. It is followed by Africa, the Middle East and Europe. South America and other regions account for only a small share of overall global fuel consumption.

Diesel is the most consumed fuel in all the regions except North America, where gasoline leads the field. This is because gasoline is the preferred fuel for passenger cars, with practically no use of diesel-powered passenger vehicles in the US. At the same time, diesel has a significantly higher share of total fuel consumption in Europe compared to other regions. The European Union (EU) has been a net importer of crude oil and prefers to use compression ignition engines over spark ignition engines as the former are more efficient. Compression engines operate on diesel, leading to much higher consumption of diesel in the region. It is important to understand the fuel composition in a region as it has a direct impact on fuel additive consumption.

Fuel additive market

Global fuel additive consumption is estimated to be in the range of 800,000 to 850,000 t/y in 2016. North America is the largest fuel additive-consuming region as it has high fuel consumption for transportation and is the only market with mandated additive usage for gasoline. It is closely followed by Asia and Europe.

The market is divided into three segments (see **Figure 1**):

- Blending, shipping, and storage.
- Performance additives, including gasoline performance additives (GPA), diesel performance additives (DPA) and HFO.
- Aftermarket sector.

The blending, shipping, and storage segment represents the additives that are applied in the refinery to adjust specifications and prepare fuel for logistics-related challenges. Diesel, gasoline and jet fuel are mainly treated in refineries. It is the largest of the fuel additive segments, accounting for more than two-thirds of the total consumption of fuel additives in the world. As all of the fuel produced in the refinery is treated while in other segments, such as GPA, DPA and aftermarket, only a portion of the fuel is treated.

Performance additives are applied by fuel marketers to differentiate their fuel from the competition. It is divided into three segments based on the type of fuel that is treated by marketers. However, marketers mainly add additives to gasoline and diesel. HFO has a limited consumption of additives as it is a low value fuel. GPA has a much higher share than DPA in the overall consumption of fuel additives due to regulations and consumers' willingness to use treated fuel. For example, in the US, the Environmental Protection Agency (EPA) mandates the use of GPA in all gasoline sold in the country. As a result, North America accounts for more than 80% of the world's GPA consumption. Furthermore, gasoline is mainly used by passenger car owners, who are more willing to use a higher quality fuel (ie fuel treated with more additives), leading to higher consumption of GPA. On the other hand, diesel is mainly used by commercial fleets, buses, etc, for whom fuel cost is one of the largest cost items, which fleet operators want to minimise by using untreated fuel. Europe is an exception as diesel is used for passenger cars in the region. As a result, Europe accounts for more than 40% of DPA consumption globally, the highest in the world.

In Asia, the lines between the blending, shipping, and storage

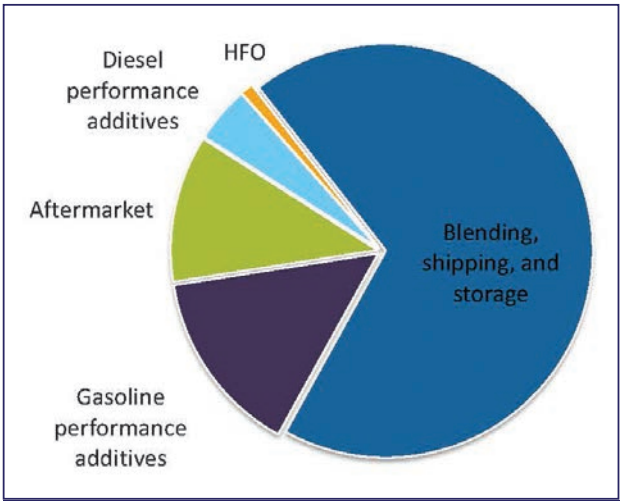


Figure 1: The current total fuel additives market stands at 800,000–850,000 tonnes *Source: Kline Group*

segment and the performance additives segment often blurs, and it is not clear if the additives are added by the marketers after procuring fuel from the refinery or at the refinery itself. In Asia, the companies in the downstream sector are mostly integrated and own the entire supply chain from refinery to retail networks. For example, in Japan, companies like JX Nippon Oil & Energy Corporation or Idemitsu Kosan, or, in China, companies like Sinopec or China National Petroleum Corporation, own refineries and fuel trading companies that supply fuel to retail stations, as well as their own retail networks. Such companies own most of the retail network and thus account for the major share of fuel sales in their respective domestic markets. It is not clear whether the additives are added by these companies at one point (refinery) in the supply chain or at two points (refinery and terminals). It is likely that such players might prefer to add additives at only one point (refinery) in the supply chain.

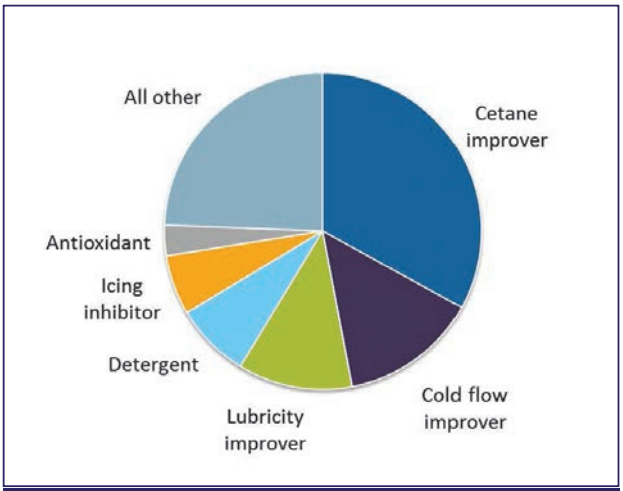


Figure 2: Global fuel additive consumption by components in 2016 *Source: Kline Group*

The aftermarket segment comprises additives that are bought by vehicle owners and applied to their vehicles (ie it is the consumer part of the market while the other two segments are business-to-business). These additives are sold through different channels such as the consumer retail channel that includes auto part stores and service stations, OEMs/car dealers and independent garages/workshops, as well as direct sales including e-commerce websites. Out of these channels, consumer retail (service stations and auto part stores) is the largest, accounting for more than 50% of the aftermarket segment in most regions. Europe and North America are the two largest markets for the aftermarket segment as consumers in developing regions, such as Asia and South America, are price sensitive and reluctant to buy additives that will increase overall fuel costs.

The aftermarket segment also faces two main challenges – consumer awareness and trust issues. Firstly, consumers awareness levels about the benefits of adding additives to fuel is low. Secondly, consumers have a trust issue about the product they are buying, whether it is a genuine product or not, and whether it will cause more harm than good to the vehicle. This problem is further compounded since aftermarket fuel additive suppliers do not have the third-party oversight that lubricant suppliers have to verify claims of product quality. This could adversely impact the development of this segment in the future.

In terms of diesel components, cetane improver, cold flow improver and lubricity improver are the three largest fuel additives used in the industry. Detergents, icing inhibitors and antioxidants are also important additives. Other fuel additives include biocides, anti-foam, dyes and markers, corrosion inhibitors, octane enhancers, solvents and carriers etc (see **Figure 2**).

Moreover, adding additives to fuel is an additional cost. As a result, refiners and marketers try to minimise their addition. This is an important factor that determines the overall consumption of different additives. For example, cetane improvers account for almost one-third of total fuel additive consumption while cold flow improvers account for about 14%. Almost all diesel contains cetane improvers, whereas cold flow improvers are only added to diesel used during the winter months. Furthermore, consumption of additives such as dyes and markers, biocides, etc, is low as they are only used in specific cases. Biocides are only used if fuel testing reveals a problem, and their usage is stopped once the problem is fixed. Similarly, dyes and markers are used to differentiate tax-exempted gasoline and diesel from non-exempted gasoline and diesel, limiting their use in the industry.

Global suppliers dominate the fuel additive industry. However, no single supplier dominates as the market shares of various suppliers are almost similar. BASF, Afton and Infineum are the three largest suppliers for fuel additives in the world. The supplier landscape can be categorised in two ways. One criteria is based on the geographical presence of different suppliers. For example, BASF has a strong presence in the fuel additive business globally and is among the top three fuel additive suppliers in various regions. Meanwhile, Afton has a presence in all the major regions in the world; however, most of its sales are concentrated in North America. There are some local suppliers like Wande, who are only present in their local markets – in this case, China. The second criteria is based on the components marketed by fuel additive suppliers. For example, Eurenco is strong in cetane improvers, while Innospec is strong in the cold flow improvers sector.

Pluses and minuses

There are various factors such as growth in fuel consumption, fuel standards, different grades of fuels, treat rates and regulations that impact the consumption of fuel additives positively, as well as negatively.

Growth in fuel consumption – Globally, fuel consumption is expected to grow at a compound annual growth rate (CAGR) of 1.9% until 2020, driving the demand for fuel additives. However, tightening fuel economy norms around the world are expected to have an adverse impact on growth in the consumption of fuel additives. For example, in the US, the 2017 fuel economy standard for passenger cars is 40 miles per gallon (mpg). This is expected to rise to 46.6 mpg in 2021. Light trucks fuel economy requirements are 29.4 mpg in 2017 and 33.3 mpg in 2021 in the US. Similarly, in China, new vehicles sold in 2015 should have a mileage of 6.9 litres per 100 km that should

improve to 5 litres per 100 km by 2020. This tightening of fuel economy norms is expected to slow down the global growth in demand for fuel, leading to lower growth in the consumption of fuel additives.

Fuel standards – Developing fuel standards are expected to impact the blending, shipping, and storage segment of the market as refiners are required to supply fuel that meets the fuel standards specified by regulations in a market. As fuel standards change, consumption of certain fuel additives is expected to be affected, especially in developing countries as the governments focus on improving the quality of fuel sold in the country. For example, there is a movement towards reducing the sulphur concentration of different fuels, especially in developing countries. In India, in April 2017 compliance with Bharat Stage (BS) IV standards for both fuel and emissions will be made mandatory. Under BS IV, the sulphur content for both gasoline and diesel will be brought down to 50 ppm, further reducing to 10 ppm under BS VI in 2020. Similarly, in China, the government announced a new national standard for gasoline in 2013 (Gasoline national standard V: GB17930-2013) under which the sulphur content in both gasoline and diesel will have to be below 10 ppm, starting in 2017. This is expected to lead to a growth in the demand for lubricity improvers in the future as lubricity of diesel reduces as its sulphur content reduces.

Different grades of fuels – Different grades of fuel mainly impact the performance additive segment of the market as the decision to supply different grades of fuels is dictated by marketers. Marketers will usually supply gasoline/diesel with a higher octane/cetane number than required by regulations to differentiate themselves in the market. This trend is particularly notable in developed regions where consumers are relatively less price sensitive and look to use better quality fuel. For example, top tier grade fuel, which has a higher octane number than regular gasoline, accounts for 65% to 75% of gasoline consumption in the US and Canada, but less than 10% in Mexico, leading to higher consumption of GPA in the US and Canada. Similarly, in India, as the majority of consumers are price sensitive and prefer to purchase regular gasoline, only 10% of gasoline is treated with GPA. However, this situation is changing as the fuel retail segment opens up in countries, such as Mexico, and fuel marketers offer higher quality fuel to differentiate themselves, or disposable income grows in Asian countries and customers begin to shift to premium products. This may lead to growth in the consumption of performance additives in developing countries.

Treat rates – Additives represent an additional cost. As a result, fuel marketers are always looking to reduce treat rates while also meeting fuel specifications. This can be seen in the low additive content gasoline in the US, where treat rates have fallen from 35 pound per thousand barrels (ptb) in 2011 to 25 ptb in 2015. This is expected to adversely impact fuel additive demand growth across all the market segments.

Regulations – Regulations can have both a positive and negative impact on the consumption of fuel additives, affecting all segments of the market. Regulations such as the 'Total Addivation Program' in Brazil which mandates minimum treat rates are expected to boost the demand for fuel additives. However, regulations mandating minimum ethanol blending with gasoline and biodiesel blending with diesel could have a positive impact on additives such as corrosion inhibitors and anti-oxidants, but a negative impact on additives like lubricity improvers. Biodiesel has lubricity properties, and if biodiesel is blended at more than 1% with ULSD (ultra low sulphur diesel) then a lubricity additive is not needed and, in most cases, is not added to the biodiesel-blended diesel. At the same time, biodiesel has poor oxidative stability that will favour the addition of anti-oxidants. Ethanol absorbs moisture, which can cause corrosion; as a result, the demand for corrosion inhibitors will increase. However, the impact of biofuels regulations also depends on the implementation of the requirements. For example, in 2003, India launched its 'Ethanol Blending Program' to ensure that 5% of ethanol-blended gasoline was available in the country. However, as of May 2014, blended gasoline was only available in 13 states in India, and only 2% blending of ethanol in gasoline has been achieved in the country to date.

Market outlook

The above factors are expected to influence growth in global fuel additive consumption, with overall fuel additive demand projected to grow by 1.9% to reach almost 900,000 tonnes by 2020.

Growth in fuel demand will be driven by markets in Asia, as economies in the region grow, which in turn will drive fuel additive consumption in the region. Furthermore, as consumers' disposable incomes grow in Asia, an increasing number are expected to shift towards higher quality fuels, leading to increased use of fuel additives. The market in South America is also expected to grow, largely driven by Brazil. As noted, in Brazil the ANP (National Petroleum Agency), which regulates the country's petroleum derivatives market, is working to implement a 'Total Additivation Program' that mandates a minimum treat rate for gasoline in refineries or while distributing fuel to marketers. This initiative has been postponed by ANP since 2014 and is now expected to be implemented from July 2017. The markets in North America and Europe will also show growth as fuel consumption rises in these regions.

Jet fuel is expected to be the fastest growing fuel in the world, leading to growing demand for jet fuel additives, especially from expanding economies in regions with urban concentrations separated by long distances.

Dispersant, detergent and diesel blending, shipping and handling additives like cetane improvers, stabilisers, lubricity improvers, cold flow improvers and de-icers will experience increased demand in the future. High sales numbers for diesel-powered automobiles bring greater sales of premium diesel. Diesel differentiated by winter operability additives is the enduring success story for diesel fuel additives within the growing commercial segment. The rapid growth of diesel-powered private automobiles has also created a new market where premium fuels sell well.

Meanwhile, clean fuels create substantial opportunities. There is a nearly universal application of lubricity improvers in ultra low sulphur diesel. As governments around the world enforce tighter norms for sulphur content in fuels, the demand for lubricity improvers is expected to rise, especially in Asia, where the government is finding it difficult to implement a biofuels mandate. ●