TANK STORAGE
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GETTING THE MIX RIGHT FOR BETTER PROFITABILITY

In the year of oil storage, blending and mixing capabilities can boost profitability more than ever

ACCORDING to the EIA's most recent forecasts, global oil consumption will average 92.6 million BPD in 2020, down 8.1 million BPD from 2019. This decline comes from reduced travel and diminished industrial activities due to the COVID-19 pandemic.

While the decline in consumption has been immediate, the production and distribution chains (extraction, separation, transportation, storage, blending and refining) unwind at a much slower pace. Decisions to cap wells are not taken lightly, because shuttering productive sites can result in a complete loss of unrecovered reserves once a well is capped.

Today, almost 100 different countries produce oil, and for many, exports are central to their economies. Within the last two years, the US has become the globe's top producer, contributing 13-15 million BPD to global markets. Historic production growth in the Permian Basin, combined with 'unconventional' growth in other parts of the world has produced more oil than is needed. This past quarter, producers supplied 90 million BPD, while global demand required just 75 million BPD.

In a world of supply and demand, global shocks to the system take time to run their course. No one wants to reduce production first, and as the world has seen repeatedly, declining prices do not immediately curtail production. Earlier this year, Saudi Arabia and Russia proved that collapsing prices can be intentionally used to bankrupt competitors in an attempt to increase market share.

While current and futures prices have a limited impact on production, one constraint remains absolute-storage capacity.

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There is a finite capacity to store oil, in tank farms, pipelines, and via leased tankers idling at sea. This year, the world reached that limit. As prices dropped, traders kept buying futures contracts, regardless of their ability to take physical delivery. For the first time in history, oil (futures) dropped below zero, because speculators facing imminent delivery without storage contracts had to pay the few remaining third parties with storage capacity to take contracts off their hands. A contango (also known as forwardation) became a super contango. Everyone in the industry realised that future prices would exceed current prices (which were less than zero), and this sent storage costs skyrocketing.

THE CRITICAL ROLES OF STORAGE PROVIDERS AND THEIR AGITATORS

Oil storage providers play a critical role in the industry. Agitators play a critical role for storage providers, for two reasons: -

1. Continuous mixing prevents bottom sediment and water (BS&W) from settling in a tank, which wastes available space to store oil. When every inch of storage is billed at a premium, tank farms cannot waste finite resources.
2. Crude oil must be blended before it can be refined. The ability to minimise blending times enables operators to prep feedstocks more effectively and deliver to refineries faster – freeing up storage space, which is in high demand.

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KEEPING BS&W IN SUSPENSION

When crude comes out of the ground, it is accompanied by sand, salt and debris. Water is added to facilitate easier pumping into pipelines. These impurities are removed during the refining process, but until crude is refined, the impurities, known as BS&W, pose an expensive and wasteful risk to tank operators. Over time, if enough BS&W settles on the bottom, a

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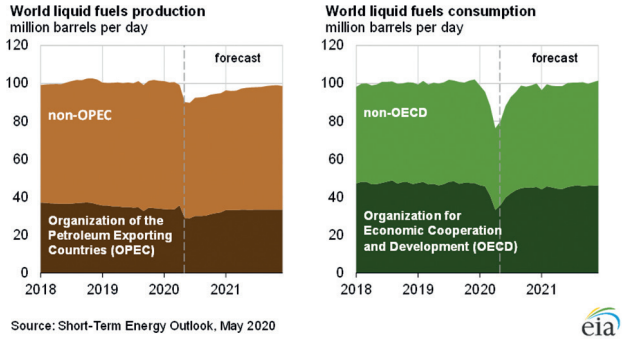

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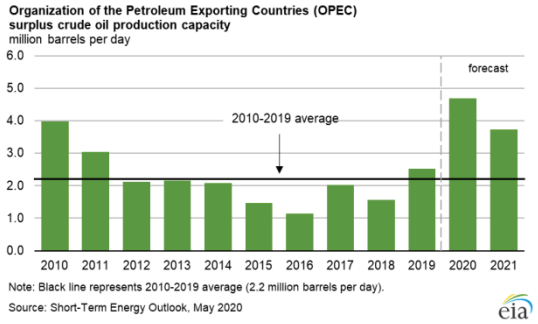
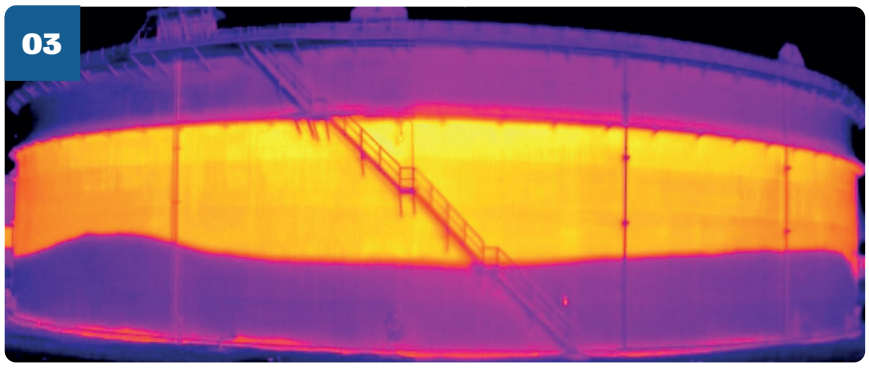
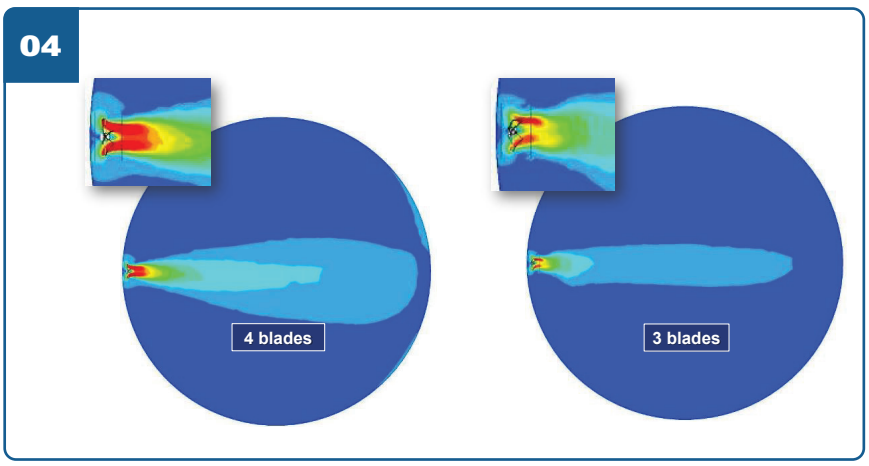






process called 'sanding-in' takes place, which can reduce the capacity of a storage tank by up to 30%.

Figure 3 is a thermal image of a tank that was not mixed for more than a year. The purple colour highlights more than 3 m of sediment in the bottom of the tank.

A tank in this condition is surrendering almost a third of its revenue generating capacity, and it also poses an environmental hazard by degrading the tank's integrity. The API-653 standard provides guidance for maintaining the foundation and bottom shell for above-ground tanks. It also stipulates inspection and cleaning schedules. A tank with this much BS&W accumulation would need to be taken out of storage immediately for remediation. Clean-ups can cost more than $100,000 (€89,000), requiring specialised crews and equipment. They are also time-consuming, which prevents a tank from generating any revenue during its restoration.

The way to manage BS&W is to keep it in suspension until the crude is ready for refining. This is accomplished by attaching side entry mixers to storage tanks, which keep the crude moving in the tank and prevent BS&W from settling at the bottom. Mounted on the lateral flange of the tank, side-entry mixers provide consistent fluid motion, and they ensure a greater level of product homogeneity, which plays an important role in maximising recoverable hydrocarbon content.

OPTIMISING BLENDING PERFORMANCE

In recent years, the growth of shale production has delivered enormous volumes of crude with different (and higher volumes of) impurities than that which comes out of the Middle East.

Extra light crude from the US, or extra heavy crude from Canada requires mixing and blending with imported stocks from the Middle East to create the right recipe – or the preferred feedstock that US refineries (which were built decades ago) are designed to handle. The blending of these diverse feedstocks takes place upstream in storage tanks, and it is the job of mixers/agitators to prepare the feedstocks.

To provide good flow patterns and proper agitation, a series of computational fluid dynamics tests should be conducted, based on the volume of crude stored in the tank as well as the crude's gravity and viscosity. This data determines the optimal configurations for the mixers.

Numerous tests have demonstrated that marine-style, legacy three blade mixers require twice as much horsepower and take several hours longer to deliver the required mixing intensity and fluid velocity of today's modern 4-blade SABRE® impellers.

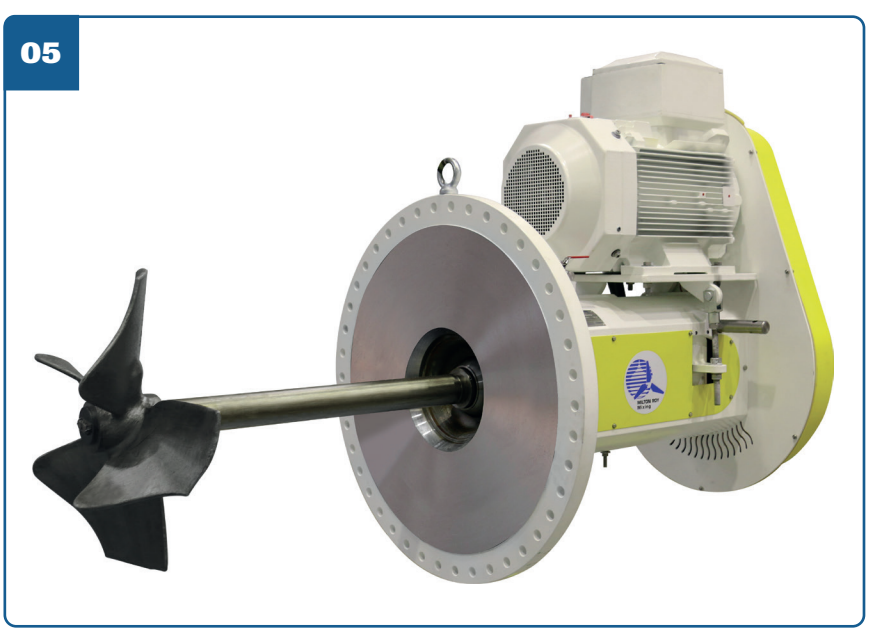
By grouping together side entry mixers into the optimal orientation, numerous tank farm operators have been able to increase fluid velocity distribution and minimise blending time without requiring more horsepower. The performance helps to reduce stock dilution and increase the throughput of storage providers, which helps them increase revenue.

THE BENEFITS OF MIXERS

Mixers should provide tank operators with two important benefits.

Energy savings

The need to store more crude brings with it the need for more mixers, and that increases energy costs, which already



represent the single largest expense for many tank farm operators. As more operators begin to adopt ISO 50001 standards, they seek ways to enhance energy efficiency. Side entry mixers minimise energy costs in two areas: -

- The bladed SABRE impeller provides up to 25% energy savings over legacy 3 bladed marine style impellers with the same flow.
- Beyond efficiency, the increase in blending power provides additional energy savings, because the equipment does not need to operate as long to complete the required blend.

Streamlined maintenance

Side mounted mixers from manufacturers like Milton Roy require less maintenance and fewer re-alignments than other mixers. The ease of maintenance comes from the design and the small diameter of the SABRE impeller. The mixer's mechanical seal can be replaced quickly – even if the tank is full – whereas older, marine-style mixing pumps cannot be maintained without emptying the tank or lowering the tank's level.

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Milton Roy mixers are designed to minimise vibration. Inboard spherical roller bearings can withstand greater radial loads, and they do not wear out as quickly as conical roller bearings or deep groove ball bearings. Vibration is also reduced by articulated motor support, which enables a fast belt and motor de-assembly and re-assembly. This simple design features a single-set screw for tensioning the belt, which does not require a senior skilled technician to maintain.

The design of the 4-blade mixer minimises the risk of the impeller hitting the inside wall of the tank while it is running. This reduces the probability that the impeller could get loose and fall to the bottom of the tank, which would require draining the tank for repairs, or it could require a person to enter the hazardous environment. Fast and efficient shutoff actuation capabilities help to ensure limited environmental impact, by lessening the potential for oil spills or leaks.

The side entry mixer is also simple to install, due to a small diameter for the SABRE impeller. It is easily inserted into the tank, and just as easily removed, because the impeller diameter is smaller than the flange's inside diameter, further simplifying maintenance requirements.

STORAGE BEYOND 2020

Storage will continue to be a big story in 2020 and beyond. Thankfully, economies around the world are starting to ramp up, and with that comes increased travel, and increased oil consumption. But the lag times between production and consumption will always require a buffer, and that buffer is provided by storage operators.

Mixers will continue to play a vital role in storage operations. Whatever criteria operators evaluate – be it enhanced blending performance, greater energy efficiency, simplified maintenance, better reliability/safety, or a more effective means of keeping BS&W suspended in the tank – the benefits of replacing older, inefficient mixers with newer Milton Roy side entry mixers is easy to qualify.

For more information

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To learn more about Milton Roy Mixers, please visit: www.miltonroymixing.com.

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