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SEPTEMBER

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HOWARD BRISKIN is publisher & president of Lubes'n'Greases. Contact him at **HBriskin@LubesnGreases.com**

The Outlook for Additives

Base oil is generally considered the lifeblood of any lubricant formulation. Just as important, though, are lubricant additives, which make up a significant portion of most finished lubricant formulations. Accounting for anywhere from 15%-25% by volume of a modern passenger car motor oil's total formulation, about 10% for greases and up to 40% for metalworking fluids, demand for additives will likely remain fairly strong in the coming years.

The problem, however, is that the available supply of lubricant additives has been greatly affected by the COVID-19 pandemic and other factors, such as the severe cold weather system that swept through the United States Gulf Coast in February last year as well as the major flooding in the Midwest that prompted Afton Chemical to declare force majeure in late July this year.

But what other factors have caused additive supply to tighten, and is it possible that any of those factors could be resolved in the coming months?

What's more, how might additives contribute to more efficient finished lubricant formulations in the future?

The answers to these questions and more can be found in *Lubes'n'Greases*' special report on additives in the October issue. Be sure to take a peek when it hits your inbox next month. And if you just can't wait to read about the latest in additives news, check out Page 24, which delves into the potential consequences of the Big Four additive suppliers pulling out of the Russian market.

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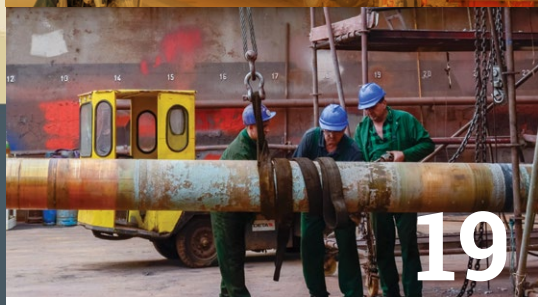

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ADDITIVES | EUROPE

Western Lubricant Additive Makers Exit Russia

The Big Four additive suppliers have reportedly exited the Russian market. How might this exodus affect finished lubricants in the region?

FEATURES

LUBES'N'GREASES

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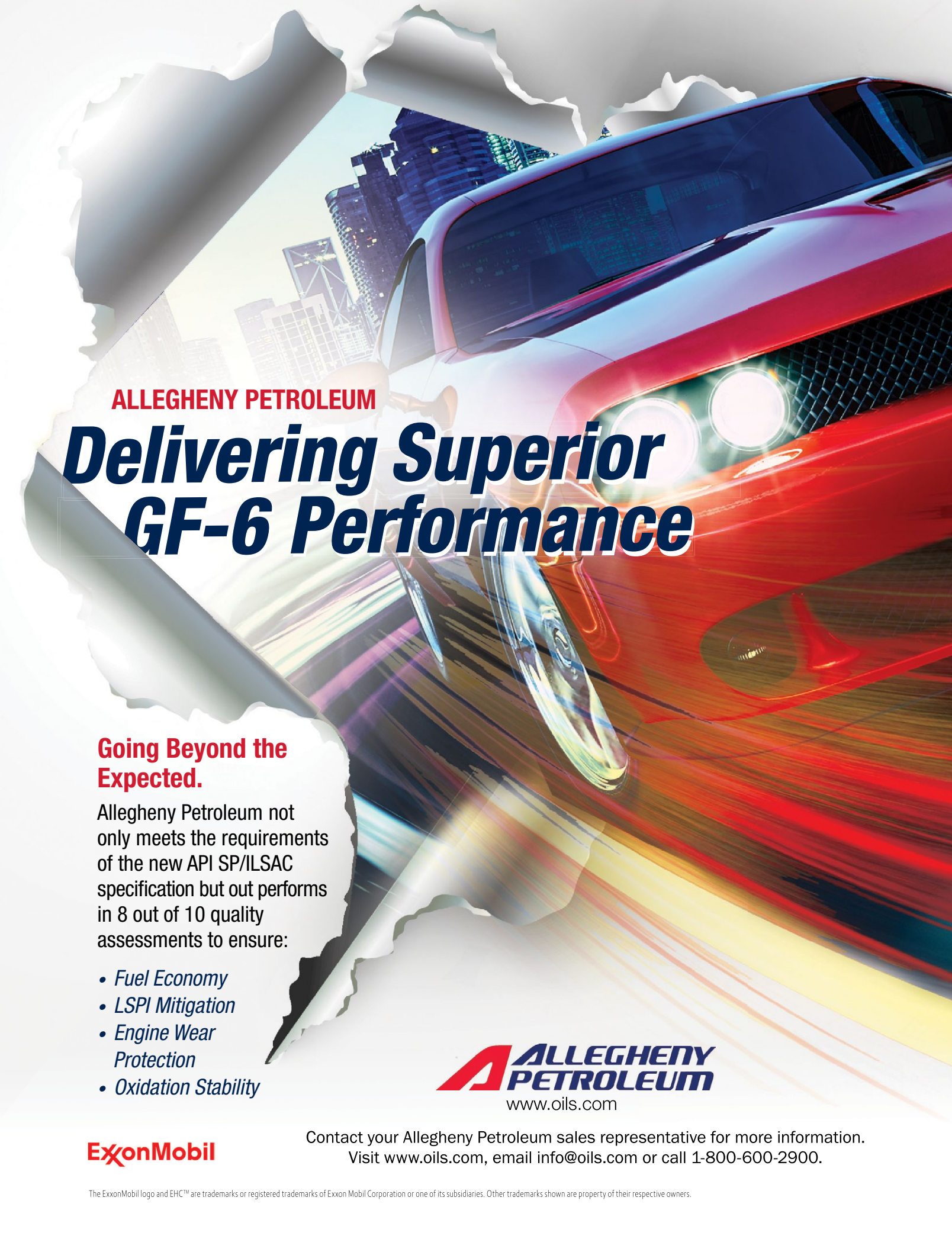

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BASE STOCKS | NORTH AMERICA

A Cool Summer Breeze

After a sweltering summer—not only because of the high temperatures that scorched large parts of the country but also because of unprecedented base oil fundamentals—a crisp summer breeze in the shape of lower crude oil and feedstock prices, along with easing supplies, led to a cool-down in base stock pricing in early August.

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This was a welcome turn of events for consumers, as base oil prices had seen heated conditions during the first half of the year, with six consecutive rounds of increases implemented since January. The upward adjustments had been driven by sky-high crude oil and feedstock prices, together with healthy base oil demand, tight global supply and reduced base oil output as refiners favored the production of distillates due to attractive margins.

The last increase was prompted by strong market fundamentals and the need to bolster margins, with paraffinic base oil producers communicating posted price increases between 20 cents per gallon and 40 cents per gallon between June 14 and June 27.

On the naphthenic base oil front, producers implemented 30 cents per gallon and 45 cents per gallon increases between June 15 and July 6.

In the first few days of July, however, crude oil futures became very volatile due to the prolonged Russian war on Ukraine, global energy supply concerns and fears of a potential worldwide recession. Crude oil prices generally softened compared to earlier in the year when they had reached record levels, and this relieved some of the pressure on base oil values. West Texas Intermediate futures were hovering near $95 per barrel in late July, down from highs of around $123 per barrel in early March.

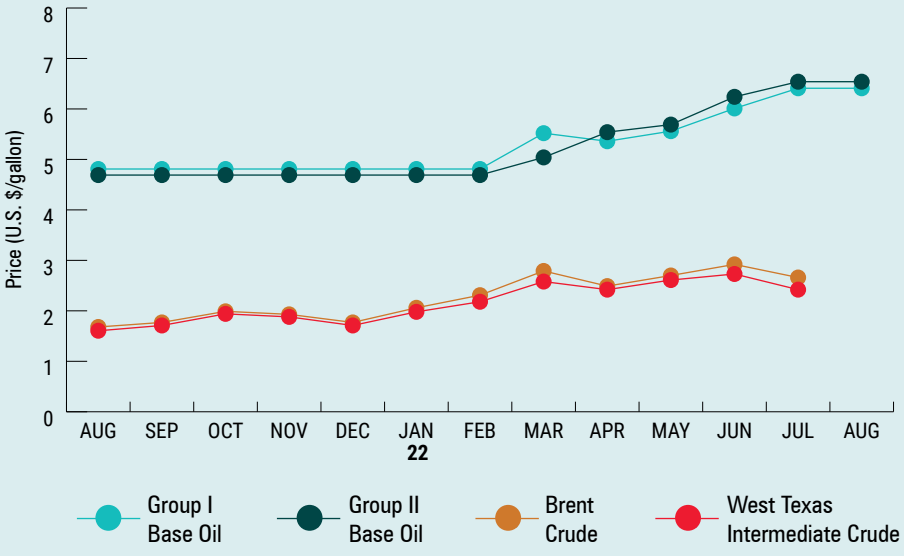
Despite the drop in feedstock prices, spot and posted base oil prices remained relatively stable throughout July. This stability was supported by healthy demand, balanced-to-tight inventories and the prospect of snug availability as a couple of base oil plants were set to begin turnarounds.

Additionally, base stock buyers and sellers alike kept healthy inventories during the hurricane season—which started on June 1 and will finish on

VIDEO | Watch Gabriela & Sydney discuss this month's Base Oil Report

Base Oil Report
September 2022

Base oil prices are lowest U.S. postings of the month for mid-vis grade before applicable discounts. Crude prices are monthly averages.



Historic and current base oil pricing data are available for purchase at **www.BaseOilPrices.com**

BOP BASE OIL PRICING DATA

Sources: Lubes'n'Greases research, U.S. Energy Information Administration

November 30—to cover potential weather-related supply disruptions along the United States Gulf Coast, where many base oil facilities are located.

By early August, however, reports of discounts and temporary voluntary or value adjustments (TVAs) and lower spot prices started to emerge on the paraffinic side. On the naphthenic side, official announcements by Ergon, Calumet and Cross Oil ushered in the first price decreases of the year.

Naphthenic base oil producer Ergon announced a decrease of 30 cents per gallon, effective August 5, while Calumet also stepped out with a 30-cent decrease, which went into effect on August 8. Cross Oil communicated a 30-cent decrease on packaged naphthenic oils, also effective August 8, and offered a discount on bulk base oils on a customer-by-customer basis.

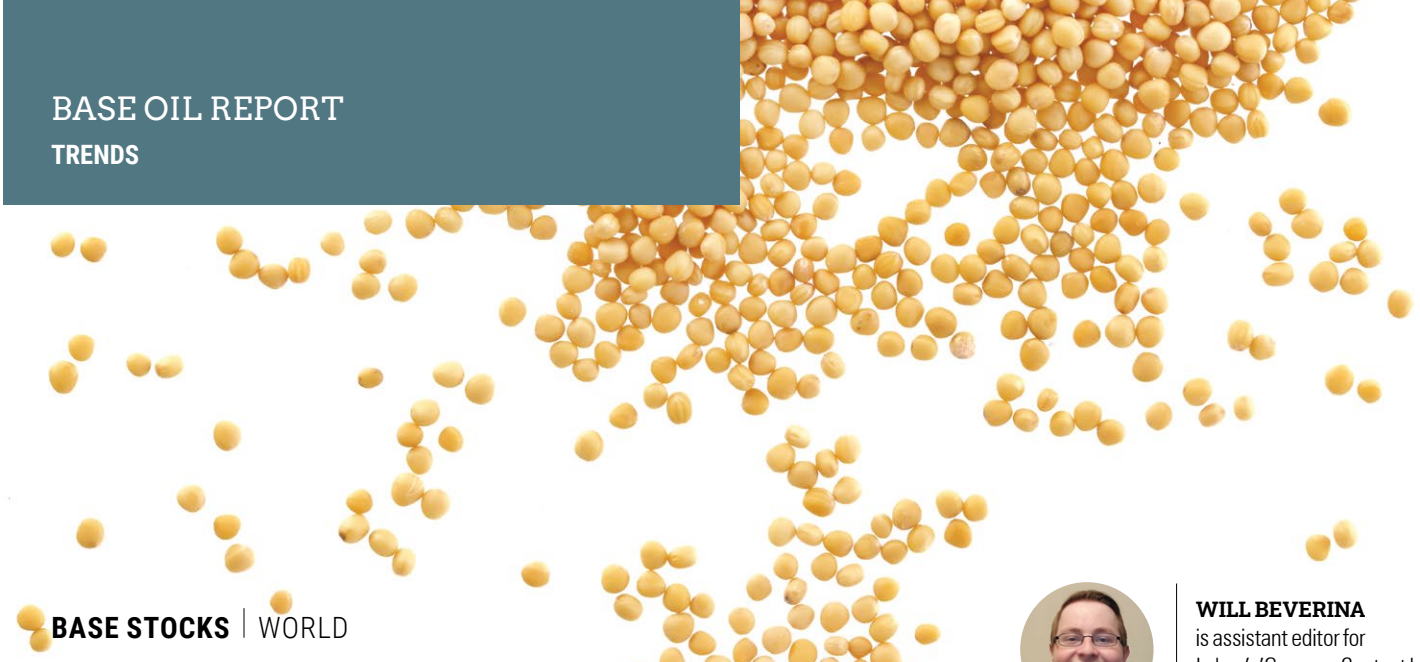
Meanwhile, pale oils supply and demand remained balanced, with suppliers reporting healthy demand for the light grades amid snug conditions.

An unplanned production outage and force majeure declaration at a U.S. additives plant in late July was expected to exacerbate the lingering tight additive supply situation and have repercussions on base oils consumption as well.

On July 26, Afton Chemical declared force majeure on additive production at its plant in Sauget, Illinois, which was flooded and forced to shut down following torrential rains in the St. Louis, Missouri, area. The company told customers that it would be limiting order quantities on engine oil additive packages and off-road products in North America.

Production outages and supply chain disruptions had caused ongoing supply headaches within the additives segment since late 2019, sometimes forcing lubricant blenders and finished product manufacturers to reduce operating rates and place customers on allocation. The unexpected shutdown of Afton's additives plant was likely to affect lubricant output rates and possibly result in reduced base oil demand, although the full impact of the additives production outage was difficult to ascertain.

While supply and demand fundamentals remained strained in some segments of the base oils market in early August, it was easy to see that the tide had begun to turn in terms of pricing, and that the heated conditions observed during the first part of the year had finally started to simmer down.



BASE STOCKS | WORLD

Very Veggie: Alternatives to Canola Oil

Vegetable oils have overcome numerous obstacles and are now viable replacements for standard crude-based base stocks. This isn't just because they're environmentally friendly. In fact, these products can outperform traditional offerings in certain areas. But global vegetable oil inventories have tightened, and suppliers are scrambling to offer alternatives.

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Rapeseed oil is one of the largest sources of vegetable oils in the world, with applications spanning from food-grade oils to biodiesel to lubricants. One derivative of this is canola oil, which is most often associated with food applications but can be used as a biobased oil in lubricants.

Supply of these vegetable oils has been on the downswing this year. Global events have led to dwindling supply, and with more common uses of these oils already eating up much of the demand, the smaller trickledown has had its effect on the lubricants industry.

Canada, the largest exporter of canola oil globally, is expecting a drop in production this year. The government agency Statistics Canada projects canola seed acreage to dip 7%.

Other sectors of the vegetable oil industry have experienced a domino effect. Indonesia is the biggest exporter of palm oil, which accounts for approximately one-third of all vegetable oil production. Earlier this year, the country put a halt on exports for three weeks to reduce domestic prices of cooking oil. Palm oil is also used for biofuels and personal care products.

Russia's war on Ukraine has lessened supply of sunflower oil; Ukraine supplies half of all sunflower oil exports. While sunflower oil isn't used to make lubricants, its use in cooking and cosmetic products means manufacturers must secure supply from elsewhere.

Mark Miller, CEO of Indianapolis-based estolides producer Biosynthetic Technologies, said canola oil and rapeseed, along with synthetic esters, are among the most commonly used feedstocks for biobased oils. Now, companies are having difficulties getting canola oil.

"Because people are utilizing vegetable oil products to make renewable diesel fuels, the market has gone upside down and topsy turvy; the prices have gone through the roof for all vegetable oils, making specialty products like estolides and polyols more affordable," he said. Miller noted those price increases happened in the past nine months but are starting to level out. "Still, we've yet to see the complete impact."

Canola oil is typically more expensive than soy oil but significantly cheaper than synthetic esters, he continued.

Miller said he believes companies that make canola-based products are struggling. "I think there are so many links in the supply chain that are difficult, so people are looking for alternatives."

One such alternative being offered is Sea-Land Chemical Co.'s Seaco-Chem ProHEAR Oil. This product uses high erucic acid mustard seed oil, which is from the same family as rapeseed and canola vegetable oils and contains similar lubricity properties as traditional high erucic rapeseed oil, according to the company. It also offers increased lubricity compared to many conventional vegetable and seed oils.

Erucic acid is a monosaturated omega-9 fatty acid found in certain plant

seeds and oils, denoted as 22:1. It can be used for a number of applications, such as adhesives, cosmetics, plastics and pharmaceuticals. It can also be used to make lubricants and surfactants.

High erucic acid rapeseed is a product of plant breeding. It can contain anywhere from 20%-54% erucic acid. On the other end of the spectrum, lower erucic acid levels in rapeseed make for canola oil, which can be limited to 2% for food-grade oils.

Sea-Land says its ProHEAR oil contains 22% erucic fatty acid content. The high erucic oils are used in industrial lubricants and metalworking fluids as well as textile lubricants, plasticizers, rubber processes and oleochemical intermediates.

The company touts the product as a canola oil and rapeseed replacement. Sea-Land said the mustard oil has better lubricity than canola oil, and that it is specifically offering the product because of global vegetable oil shortages.

Sea-Land said SeacoChem ProHEAR Oil has good oxidative stability, high viscosity index, low aquatic toxicity and is biodegradable. The oil is also compatible with mineral oils.

C22:1 is a reference to the carbon chain distribution and structure of vegetable oils. This chain is longer than conventional C14 to C18 fatty acid-based vegetable oils and seed oils, giving it increased lubricity.

"While I don't specifically know ProHEAR, I do like some mustard and seed oils, and I think there's some real opportunities for them," Miller said. "In the past they were very difficult to get ahold of. It's an interesting play because it doesn't compete with food. That's one of the issues with soy and canola because they do compete with the food, while mustard seeds don't do that."

One issue with high erucic acid rapeseed is availability. Miller said the market is limited. "It's sort of like the chicken and the egg. The farmers have to grow a very specialized crop, but they need to have the demand for the material. We in the industry can't start creating products with new materials until we know that the feedstock is available. I haven't seen enough farmers growing HEAR crops."

Miller noted that the drive toward sustainability is encouraging producers to be innovative with formulations using different feedstocks regardless of the current landscape.

"There's no doubt in my mind that more and more people will begin working not only with mustard seeds, algae and castor oils but will explore a wide range of feedstocks for sustainable base oils," Miller said.

FINISHED LUBRICANTS | NORTH AMERICA

Better But Not Out of the Woods

While supply of finished lubricants remains tight, a growing number of marketers say they're seeing some improvement. But we aren't out of the woods yet. There is still a good deal of pent-up demand due to low tank levels and end users catching up with deferred maintenance.

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Further, some blenders still find it challenging to get the volumes of PCMO and HDEO they need. While it's risky to assume there will be no more supply disruptions, most are cautiously optimistic that the industry is on the road to recovery.

As most industry players are aware, the deep cuts in lubricant supply during the past two years have primarily been due to disruptions in the supply of lubricant additives. Some additive manufacturers—Lubrizol in particular—struggled more than others to keep pace with demand. With that, there was increased demand placed on other additive suppliers to meet the needs of existing customers and those of new customers who couldn't get product from their usual suppliers. Consequently, shortages became contagious.

While there are many reasons for the additive supply crunch, most can be attributed to cascading events caused by the pandemic, which pulled the rug from under additive manufacturers in several ways. First, lockdowns at the start of the pandemic resulted in refineries slashing crude runs in response to the sharp drop in global demand for fuel. This resulted in constrained supply of many raw materials used as precursors to manufacture additives. Some refineries also took advantage of the downturn to conduct maintenance, which further cut into raw material supply.

In addition to a sharp reduction in crude runs, lockdowns created staffing issues and disrupted ocean and land freight. This further hobbled the ability of additive suppliers to move raw materials.

If this wasn't enough to fracture links in the supply chain, a staggering number of force majeures were declared at various refineries, chemical plants and other manufacturing facilities when a winter storm hit the Gulf Coast in Feb. 2021.

Other disruptions include a fire in June 2021 that destroyed Lubrizol's Chemtool grease manufacturing facility, one of the world's largest container vessels halting maritime traffic through the Suez Canal in March 2021, Union Pacific and BNSF reducing the number of railcars in their networks to ease congestion, a category 4 hurricane disrupting freight movements when it slammed the Gulf Coast in Aug. 2021, and the ongoing truck driver shortage.

It's little wonder why additive supply plummeted when demand for lubricants rapidly rebounded after the initial shock wave of COVID passed. But as challenging and disruptive as it's been, additive supply appears to be catching up now. Although there are still shortages of some additives

and finished lubricants, marketers say there are fewer. They are once again starting to fill their bulk tanks as well as their customers'.

While the bulk tanks at most accounts sat at about 40%-60% of capacity for nearly two years due to allocations, there is enough product now in the pipelines to start working back to what marketers say was the pre-pandemic average of about 85%. Unlike the supply and demand chaos during the past couple years, marketers say the good news is that the pathway to building back inventories is becoming more predictable, reliable and measured.

What has been learned from these tumultuous times and what can change as a result?

Many lubricant marketers say the most important lesson is having plans in place to address supply line interruptions, recognizing when they are in the making, and having the discipline and support necessary to execute them. Such plans must afford flexibility and creativity as conditions change or plans don't pan out as expected. To be successful, plans require a high level of collaboration between channel partners, transparent and timely communications with suppliers and customers, and technology platforms that provide accurate, real-time data, analytics and intelligence.

Many marketers and blenders say they also learned a hard lesson about the risks of single sourcing supply. If you rely on one supplier for product, it's critical to understand and consider the supplier's resilience. To the extent possible, it's important to broaden the supply base to best manage risks. Many found this to be a tough road to hoe since alternative suppliers may also be facing challenges and working hard to meet the needs of their existing customers before welcoming new business.

Although lubricant marketers say it's tempting to take on new business when it comes knocking, it's important to take care of existing customers before taking a risk with new business. Such business might not be sustainable and could compromise a marketer's ability to service loyal customers. While this may seem obvious, marketers say it's easier said than done. It requires a defined customer management strategy and the discipline to avoid being overwhelmed by conflicting priorities and ephemeral sales opportunities.

Other lessons learned include the value of safety buffers in an environment where lean inventories and just-in-time delivery practices are commonplace, adhering to allocations and listening to suppliers' guidance, and frequent and candid internal and external communications. The industry is still learning what it costs to get customers back when they switch suppliers due to supply line interruptions.

The pandemic and other events laid bare vulnerabilities in lubricant supply chain and the damage that can be done when the chain buckles. Suppliers and buyers along every link will be asking some tough questions and looking for solutions to increase their resilience and assure business continuity when the next storm rolls in.

Editor's Note: At the time of writing, supply issues for lubricant additives appeared to be improving. However, Afton Chemical's plant in Illinois was affected by flooding, and the company declared force majeure in late July, causing another disruption to the supply chain. Look to future issues of Lubes'n'Greases and Lube Report for more information about how this will affect the industry.

Our columnists are temporarily writing every other month. Look for the next Need to Know column in the November issue.

Is India a Land of OPPORTUNITY?

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By Sydney Moore

With a population of more than 1.4 billion people, India was hit particularly hard by the COVID-19 pandemic. In fact, consultancy Kline & Co. announced in an August 3 webinar that the country showed its worst economic performance on record in 2020 as a result of the virus. According to data from the World Economic Outlook Database, India's gross domestic product dropped by more than 24% from April to June in 2020. For the entire year, the country's GDP saw a 7.3% decrease.

With India's economic contraction came a subsequent squeeze on the country's lubricants market. How well has the Indian lubricants market recovered from the pandemic, and what challenges is it still working through? What opportunities for growth exist in the country now and in the coming years?

These questions and more are answered in Kline's study, "Opportunities in Lubricants: An Overview of the Indian Market." The study explores lubricant demand in the commercial and consumer automotive and industrial segments by product type, application and end use. It also reveals drivers of growth in the market and offers profiles of prominent installed and retail channels as well as the country's leading lubricant marketers. The study's base year is 2021 with forecasts reaching out to 2026.

The study broke the Indian lubricants market into three main segments: consumer automotive, commercial automotive and industrial.

7.3%

Decrease in India's GDP in 2020

2.8 million tons

Total lubricant demand in India in 2021

These three categories were further divided. The consumer automotive segment encompassed lubricant demand from factory fill, dealerships, fuel stations and garages. Lubricants in this segment include motorcycle oils, transmission fluids, gear oils, greases and passenger car motor oils. Demand in the commercial automotive segment came from factory fill, on-highway applications (fleets and dealerships as well as owner-operators) and off-highway applications (agricultural, construction and mining). This segment is represented by various products, including heavy-duty engine oils, transmission fluids, gear oils and greases. Demand in the industrial segment was comprised of all other industrial lubricants, such

as metalworking fluids, industrial engine oils, turbine oils, greases, hydraulic fluids and more.

What's the Deal with Demand?

"The most important thing that each of us want to understand—and this was also a prime objective of the study—was how good the market was in 2021," Hareesh Nalam, product manager, energy, for Kline, said in the August 3 webinar. "We saw the lubricant demand—and not only the lubricant demand but demand across the segments for all the products and commodities—decline in 2020 due to the COVID-19 pandemic."

However, total lubricant demand in India rebounded in 2021 to narrowly surpass pre-pandemic levels by just 1%, reaching 2.8 million tons, Nalam said. Demand in the country in 2020 was just 2.5 million tons.

Of the three segments examined in Kline's study, "the lubricant demand in industrial is still the largest," Nalam said. Partially responsible for the high ranking of industry lubricant demand in the country was process oil, which accounted for nearly 800,000 metric tons of the country's total lubricant demand.

Consumer Automotive Lubricant Demand

According to Kline, demand for lubricants in the consumer automotive segment rang in just below 500,000 tons in 2021.

"The strongest growth in 2021 was in the consumer automotive segment," Nalam said. "The consumer automotive segment's growth was primarily driven by the two-wheeler segment; motorcycle oil demand has grown significantly, and that is what is driving the lubricant demand in the consumer automotive segment."

Why such an increase in MCO demand, though?

Lubricant Demand in India, 2021

Consumer Automotive	500,000 tons
Commercial Automotive	800,000 tons
Industrial	1,600,000 tons

Source: Kline & Co.

"In 2021, the demand for MCO was strong, mainly because of people using personal mobility to commute and avoiding public transport," Nalam explained. "Yes, definitely the vehicle parc has increased for two-wheelers and four-wheelers both, but in four-wheelers the lubricant demand has not yet recovered." In fact, demand for passenger car motor oil still lagged behind pre-pandemic levels through 2021. However, trends in 2022 show that PCMO demand is currently growing significantly in the country.

The rest of demand in the consumer automotive segment was comprised of gear oils, greases and automatic transmission fluids.

How did demand in the segment differ by installation point?

"There has been an ongoing shift away from garages toward more organized channels of vehicle servicing," Nalam said. However, garages still accounted for more than half of the consumer automotive lubricant consumption in India in 2021. The next highest consumption in the segment came from vehicle dealerships.

As is the case in countless other countries around the globe, demand for lower-viscosity oils increased in India last year, with 0W and 5W grades accounting for about 40% of the total PCMO demand. Similarly, 10W grades made up around 40% of MCO demand in 2021.

Demand also varied considerably based on API service category. "When it comes to the two-wheeler segment, API SL is still the predominate category for MCO demand," Nalam said. As for the passenger car segment, over 30% of demand in the country was for oils meeting API SM and SN standards.

Commercial Automotive Lubricant Demand

Demand for lubricants encompassed by the commercial automotive segment was just over 800,000 tons in 2021, but demand in the commercial automotive segment in India was still trailing behind 2019 levels last year.

However, not every subcategory in the segment experienced the same lag. "Interestingly, there are two components to this commercial automotive segment," Nalam said. "One is on-highway and one is off-highway. The off-highway segment has recovered to 2019 levels, but the on-highway segment has yet to recover." The on-highway segment includes three-wheelers, buses and trucks.

Lubricants used in off-highway applications accounted for the bulk of the segment's demand at about 450,000 tons.

Why has the off-highway segment shown improvement while the on-highway segment hasn't? "A part of the reason the on-highway segment hasn't recovered is the low mileage traveled by trucks and also the fact that oil drain intervals are gradually widening," Nalam said. The slight shift away from public transportation could also be a contributing factor in the decline of on-highway demand.

According to Kline, heavy-duty engine oils made up the largest portion of demand in the commercial automotive segment last year, followed by hydraulic and transmission fluids, gear oils and greases.

The most sought-after viscosity grade for HDEO was 15W-40, which accounted for more than half the demand for HDEO in 2021.

"The demand share for monogrades has been declining significantly," Nalam said. "But having said that, we are unlikely to see that monogrades demand would vanish completely over the next few years in the HDEO market."

Conversely, demand for 10W oils "has started gaining pace in the HDEO segment, but some of the Indian OEMs in the truck and bus segment haven't recommended 10W grades" yet, Nalam said.

Industrial Lubricant Demand

The industrial segment is nearly even with pre-pandemic levels, with a slight growth in demand in 2021. This is quite the achievement because demand in the segment had contracted by almost 10% in 2020.

Demand for industrial lubricants in India last year rang in at about 1.6 million tons. More than half of that volume was made up of process oils, followed by hydraulic fluids, metalworking fluids, industrial engine oils, greases and other general industrial oils.

However, industrial lubricant demand in the manufacturing sector still has not recovered to pre-pandemic levels, and demand for industrial engine oils is actually declining.

For instance, metalworking fluid demand did not recover to pre-pandemic levels in 2021. "A large share of metalworking fluid is used in the [automotive manufacturing] sector, which has not completely recovered" from the pandemic, Nalam said.

Meanwhile, demand for industrial engine oils is gradually decreasing. However, unlike railway lubricants, "not all the segments in industrial engine oils are contracting," Nalam said. "Industrial oils would include marine oils, which are definitely going up. It also includes aviation lubricants, which are also growing slightly."

Which industries have the greatest demand for industrial lubricants? According to Kline, the power generation industry, the chemicals manufacturing industry, and the automotive manufacturing and general engineering industry comprised 75% of demand in the segment in 2021.

Which Suppliers Are on the Top of the Heap?

It is reasonable to believe that some lubricant suppliers active in the Indian market would have fared the pandemic better than others. To a certain extent that may be true, but Kline's study indicated that the top dogs of the Indian lubricants market more or less stayed the same from 2019 through 2021.

"We didn't see any major lubricant suppliers gaining or losing market share tremendously," Nalam said. "However, lubricant suppliers lost some of their market volume in 2020. In fact, all the lubricant suppliers lost market volumes in 2020, but some saw larger losses while others saw minimal losses. While some lubricant suppliers' shares have grown in 2021, we did not see that major lubricant suppliers' rankings have grossly changed."

Which lubricant suppliers had the most market share in India in 2021?

According to Kline, nationalized oil companies possessed the biggest piece of the pie last year. Leading the pack was Hindustan Petroleum Corp., followed by Indian Oil Corp., Apar, Bharat Petroleum Corp., BP, Raj Petro, Shell, Savita Oil, Columbia, Gulf Oil and Valvoline.

Future Growth

While the pandemic and other factors significantly stunted India's economy, the current recovery observed in the country bids well for the lubricants industry. In fact, Kline projects that India will continue to be one of the world's fastest growing economies in the coming years and that lubricant demand in the country will grow at a compound annual growth rate of 2% through 2026.

"The strongest growth in demand would be from the consumer automotive segment, followed by the commercial automotive segment and the industrial segment," Nalam said. "The industrial segment still has a high potential for growth, but with greater maintenance practices and with oil analysis and filtration, the growth would be somewhat subdued. To some extent, this applies to the commercial automotive segment, but the growth is still projected between 2%-3%."

SYDNEY MOORE
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CRACKING CORROSION'S CODE

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By Trevor Gauntlett

The annual cost of corrosion worldwide is about $2.2 trillion, or more than 3% of the world's GDP, according to the World Corrosion Organization, a nongovernmental organization of the United Nations. This is double the percentage impact due to friction reported by Peter Jost, commonly referred to as the founder of tribology, in his seminal 1960s report on the costs to the British economy of poor lubrication and maintenance.

Lubricants prevent greater losses, although their impact goes un-noticed by many end users. In many lubricant applications, corrosion control is a "table stake" activity where a simple specification can be easily passed with a small amount of generic chemistry. Sometimes corrosion control is a consequential effect of formulating with surface-active ingredients that have a different primary purpose. However, there are other applications where corrosion prevention is the differentiating factor between fluids, and many lubricant companies have specialized corrosion preventive fluids in their portfolios.

Keeping It Simple

While the term corrosion can be applied to the oxidative degradation of ceramics or polymers, this article is about corrosion of the alloys of iron or aluminium that are manufactured and shaped into parts used in lubricated equipment. There's also a detour into the corrosion of copper and the so-called "yellow metals."

Corrosion requires water and oxygen to be present at a metal surface. It can be chemical or electrochemical and can take place under either acidic or basic conditions. To prevent corrosion, either the oxygen or the water must be kept away from the surface. Acids can both catalyze oxidation and prevent it.

At the simplest level—during storage or transport, for example—corrosion control can be achieved by use of an oil film to slow the migration of water and oxygen to the metal surfaces. However, water and oxygen are sufficiently soluble in hydrocarbons that garden tools dipped in oil for the winter need to be sharpened in the spring. Their dullness is the result of some limited corrosion over the intervening months.

Crankcase Lubricants

Corrosion due to ambient conditions has almost never been an issue in automotive crankcase lubricants for passenger cars, buses and trucks. This is mainly due to the high treat rates of detergents, said Phil Reeve of Wantage, United Kingdom-based ADLU Consultancy. These calcium- or magnesium-based soaps bear a chemical resemblance to many of the metal-containing corrosion inhibitors added to many industrial lubricants.

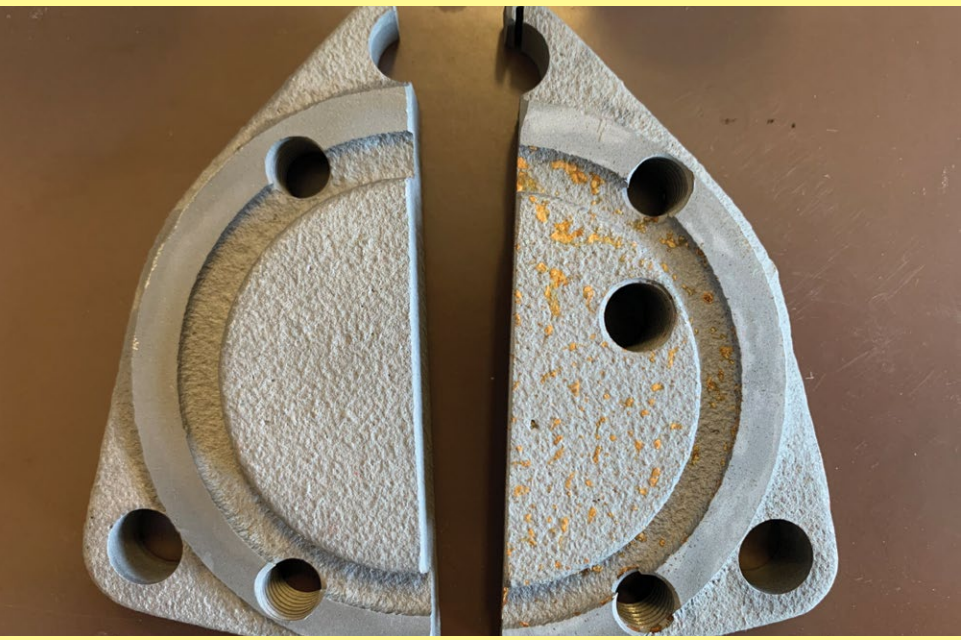
"The Sequence IID and IIE were early rust tests, which were passed with sufficient reserve total base number from the detergent," Reeve told *Lubes'n'Greases*. "The Sequence II rust tests were replaced by the Ball Rust Test, or BRT, a bench test that many thought to be less severe." Possibly as a result "some OEMs added a rusting test (usually a bench test) to their specifications for crankcase factory fill oils." As it may be several months between manufacture and first use, the engine must be protected when the vehicle is stored in the open air or transported long distances by rail, road or sea.

Cylinder Lubricants

Sometimes changed operating conditions can induce corrosion. This became apparent in large low-speed two-stroke marine engines, following the financial crisis of 2008, when cold corrosion appeared on the cylinder liners after ship operators adopted "slow steaming."

Cold corrosion is caused by condensation of sulfuric acid on the cylinder liners—a consequence of operating vessel engines at lower than optimal loads, leading to cooler cylinder liners than the design operating conditions. Sulfuric acid, formed from combustion, can be related to the sulfur content of the fuel. Traditional 70BN cylinder lubricants were not always capable of neutralizing the acid.

Ian Bown, technical manager - marine engine oils at Lubrizol, told *Lubes'n'Greases*: "Left unattended, corrosive wear occurs. The rate of material loss can be very high, much higher than the sum of the individual contribution of wear and corrosion. This is because loose corrosion



Corrosion of grey iron castings after 3.5 hours. The casting on the left was treated with an alkaline cleaner boosted with 3% MC Aurocor 11001, while the one on the right was treated with a base alkaline cleaner.

© Image courtesy of Metal/Chemie

products are easily removed by wear to continually reveal fresh metal beneath, which in turn can corrode quickly. It is likely that high wear rates will be observed with piston rings and cylinder liners requiring more frequent replacement."

Additive and lubricant companies responded by producing 100BN and 140BN cylinder oils containing additional detergent chemistry to neutralize the acids. Those detergents are usually overbased calcium phenates, sulfonates, salicylates or carboxylates. "Although the global marine fuel sulfur cap has reduced to 0.5% (very low-sulfur fuel oil), cold corrosion still needs to be considered when developing new cylinder oils," Bown said.

Unprotected metal panel (left) and panel protected with a 72% biobased content removable coating (right) after 300 hours in salt spray testing.

Salt Water

Salt water and its vapors are an issue for any seagoing vessel, as they can induce corrosion. This is a common issue for the greases and lubricants used in on-deck equipment or to lubricate bearings and hinges below the waterline.

Resistance to water washout is the primary concern for greases below the waterline, so aluminum- or calcium-based thickeners are often preferred over lithium analogs due to their generally superior resistance to water. This relationship is also generally true of the corresponding metal complex thickeners. The demands of many grease applications mean that some corrosion-inhibiting additives are almost unique to greases. These include barium sulfonates (natural and synthetic) and bismuth, lead or zinc naphthenates. Others, like sodium sulfonates, fatty amines and amides, imidazolines, benzotriazoles, phosphates or amine phosphates, might also be found in industrial or crankcase lubricants or metalworking fluids.

Industrial Lubricants

Formulators of industrial lubricants usually must pay more attention to corrosion than their crankcase colleagues, as additives treat rates are much lower and the types of surfactants that are used in crankcase lubricants as detergents are usually not present.

Rafe Britton of Lubrication Expert in Sydney, Australia, explained some of the issues: "Water is such a pervasive oil contaminant … and the nature of ingress differs by industry and application. The construction and food industries often suffer from overaggressive washdowns, the chemical and process industries may produce water, while power generation typically deals with environmental contamination—think steam in steam turbines, sea spray in offshore wind, and hygroscopic polyol esters removing moisture from the air in land-based aeroderivative turbines."

Several strategies are used to combat corrosion. "In the formulation, the protection of ferrous surfaces is typically performed by mildly acidic additives which sit on metal surfaces like seaweed on an ocean floor, excluding water molecules from interacting," Britton said. "The other means of defense is water separability—this is why most of the wind turbine gear oils are fully PAO-based lubricants and why demulsibility is such an important performance parameter in steam turbine oils. But there is also an increasing focus on excluding water by means of installing desiccant breathers and dry air/nitrogen blanketing systems on reservoirs."

In the cases above, the metals are mainly steel alloys. Specific corrosion inhibitors may be added to lubricants where corrosion of yellow metals or copper must be prevented. Screw compressors, for example, contain brass, which is often protected by use of a triazole additive.

Working with Water-based Fluids

When steel or aluminum are cast, forged or rolled, corrosion of the formed part, the die or the roller can be a significant issue. Every stage of the value chain—from furnace to finished piece—exposes the surfaces to different temperatures and pressures. The chemistry of the steel or aluminum is modified at each stage, depending on the final application. Often a piece is stored or transported between each stage of manufacture, so the surfaces must be protected

> "During machining operations like drilling, milling, etc., the protective layer of metals is constantly removed, and a highly reactive fresh metal surface is exposed. Corrosion inhibitors in the MWF passivate these surfaces. They attach temporarily to the metal surfaces and shield it against the corrosive environment."
>
> — DANIEL GRIEBE
> **METALL-CHEMIE**

from corrosion while awaiting the next stage. This leads to a proliferation of fluids, as each one must be tailored to the metallurgy, form and application.

Graham Twiddle of LUBRO-LOGIC, based in Wolverhampton, U.K., outlined some of the issues faced by fluid formulators for machining applications. "Corrosion in steel is usually initiated by acids, whereas corrosion of aluminium is usually initiated by highly alkaline (basic) solutions. So, if you are machining an aluminium piece using steel tools, your fluid must remain in a very tight window of pH to avoid corroding the tool steel or staining the aluminium workpiece."

Many different machining operations can be applied to individual workpieces, whether consecutively on one piece of equipment or via several machines connected to a central supply system. The system for aluminium machining usually contains oil, water and entrained air—excellent sources of food for bacteria, which can produce corrosive metabolites. It also introduces the possibility of galvanic corrosion, where electrochemical reduction on the surface of swarf or fines of one metal are coupled with oxidation of the workpiece or tool.

Regulations, like REACH and the Biocidal Product Regulations, have effectively removed many bactericides from the formulator's palette in Europe and North America. This also impinges on amine borate corrosion inhibitors. On the positive side, they also inhibit bacterial growth, opening the possibility of wider use. However, for about 20 years there has been much uncertainty on how the EU would classify boric acid and its compounds.

(Boric acid is a Substance of Very High Concern under REACH. The issue for many years was whether boric acid in amine borates and related materials could be quantified and whether the amine borates were themselves reprotoxic. The classification of boric acid changes in December 2022, and the Union of the European Lubricants Industry will soon publish a paper explaining the new classification as "CMR 1B"—CMR substances are those that are carcinogenic, mutagenic or toxic to reproduction—and the impact on MWFs.)

Secondary amines, like diethanolamine, provide excellent corrosion control, are basic and have good pH stability. However, they have been replaced due to concerns that they could react with nitrates or nitrites and other nitrogen-based compounds to form nitrosamines that could be carcinogenic.

Acidic corrosion preventives include mono-, di- and tricarboxylic acids, which are well-established corrosion inhibitors for MWF used in ferrous metal machining processes. "The number and orientation of the carboxylic acid groups and the nature of the rest of the molecule determine the corrosion inhibitor performance, foaming behavior, hardwater compatibility and their solubility," said Daniel Griebe, head of R&D at Hamburg, Germany-based Metall-Chemie. "During machining operations like drilling, milling, etc., the protective layer of metals is constantly removed, and a highly reactive fresh metal surface is exposed. Corrosion inhibitors in the MWF passivate these surfaces. They attach temporarily to the metal surfaces and shield it against the corrosive environment."

One benefit seized by many marketers recently is the high sustainability credentials of their remaining corrosion inhibitors, as many have been derived from natural products for years.

Cleaning Up

Since MWFs and cleaners for steels are usually alkaline, the corrosion inhibitors can be used in both applications. However, Griebe advised: "The requirements can differ, since cleaners are used prior to final process steps like finishing paint. Therefore, they need to be easily rinseable and almost residue free for proper paint adhesion."

Lubricants play many roles in protecting against corrosion of the equipment or parts they are used to protect. This can be by binding to surfaces to prevent reactions, neutralizing reactive species or providing the correct chemical conditions for the effective removal of water. Although legislation has reduced formulators' options, many corrosion inhibitors derived from natural products have received a new level of attractiveness due to interest in sustainability. Steel and aluminum use will continue in all "net zero" scenarios beyond 2050, so there is still a lot of that $2.2 trillion market to aim for. Watch out for many new developments.

TREVOR GAUNTLETT has more than 25 years' experience in blue chip chemicals and oil companies, including 18 years as the technical expert on Shell's Lubricants Additives procurement team. He can be contacted at **trevor@gauntlettconsulting.co.uk**

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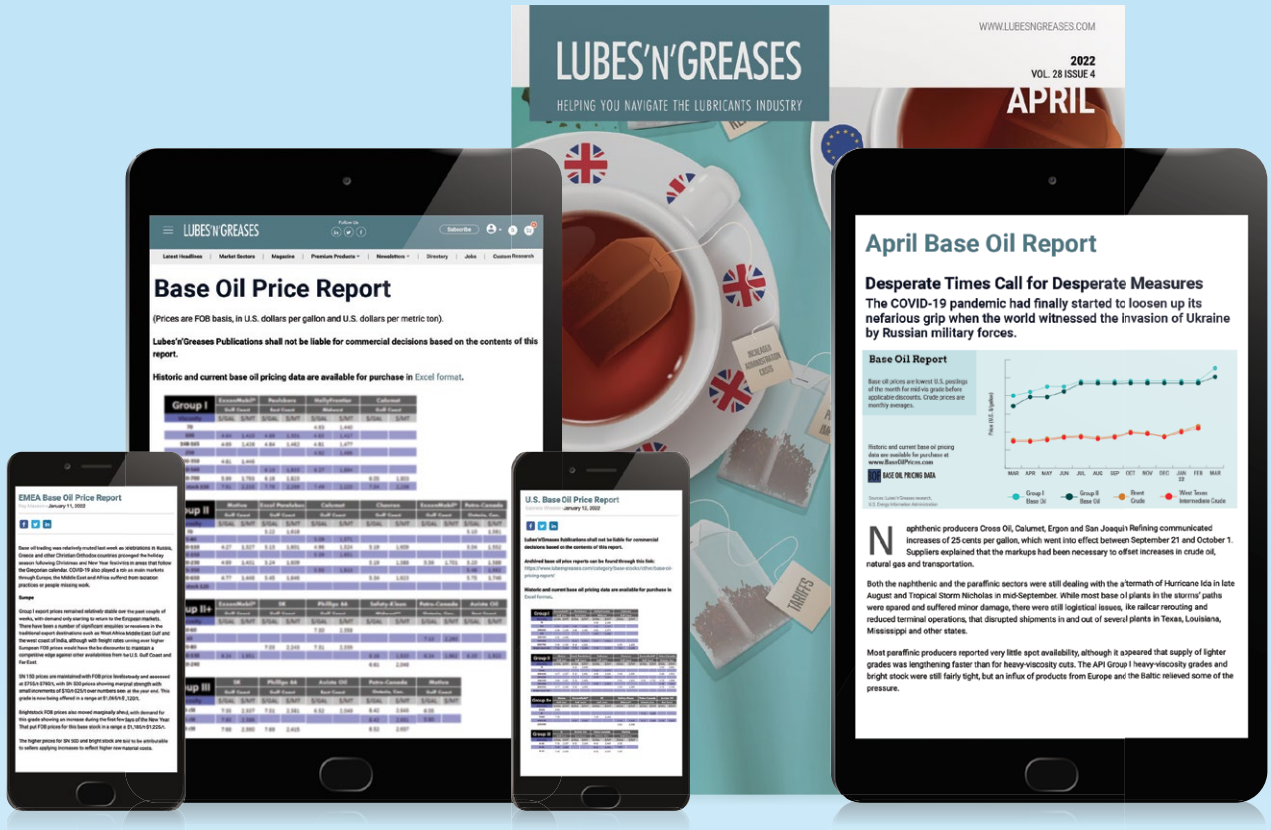

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WESTERN LUBRICANT ADDITIVE MAKERS EXIT RUSSIA

Shortly after news of Russia's invasion of Ukraine broke in February, some of the world's largest lubricant companies—including Shell, ExxonMobil, Total and Fuchs—seemed quite eager to announce publicly their departure from the Russian market. By comparison, the world's top lubricant additive suppliers were much quieter about halting their business in the country.

Two independent consultants operating in the Russian lubricant industry told *Lubes'n'Greases* that the big four additive makers—Infineum, Lubrizol Corp., Chevron Oronite and Afton Chemical—have stopped supplying to the country. One of the sources was Tamara Kandelaki, general director of Info-Tek, a Moscow-based consultancy. The other spoke on the condition of anonymity, saying he feared reprisals from within Russia.

Lubrizol, Afton and Infineum declined to comment for this article. German chemicals company Evonik Industries and Chevron Oronite confirmed that their activities in the country have ceased.

How is the major additive suppliers' exit from Russia likely to affect the country's lubricant market?

While the answer is multidimensional, perhaps the most obvious effect is that the absence of these companies' presence in the country will likely result in a general lack of lubricant blending capabilities. That is, Russian lubricant producers may find themselves unable to manufacture engine oils that are suitable for use in newer model European cars, Kandelaki and the anonymous consultant predicted.

By Boris Kamchev

How might this force the Russian market to adapt?

Simply stated, Russian blenders may be required to downgrade to such older technology as the now obsolete Gost standard. There is also the option to pivot toward Chinese technology, which would allow Russian lubricant makers to produce oil formulations that are suitable for use in Chinese models as well as some of those manufactured by companies in Korea, Japan and the United States.

Good and Sanctioned

Western entities, such as the European Union and the United States, imposed economic sanctions against Russia after its invasion of Ukraine. Among other things, the sanctions forbid transactions with Russian state-owned banks and oil companies. Business with privately-owned Russian companies is still permitted, but many companies have chosen to shun the already isolated market altogether. These decisions have been made as a form of protest as well as because of problems with payments and logistics.

"We fully support the sanctions against Russia imposed by the United States and the European Union…due to the political situation in Ukraine," an Evonik spokesperson told *Lubes'n'Greases*.

She added that the Essen, Germany-based company "completely complies with the EU Council Regulation (EU) 2022/576 concerning restrictive measures in view of Russia's actions destabilizing the situation in Ukraine." She also confirmed that Evonik stopped its supply of lubricant additives to the country.

A Chevron Oronite spokesperson said that the company continues to monitor developments around Russia and Ukraine and that it halted any transactions with the country.

"As always, we comply with all current applicable laws and regulations. Our commercial exposure for sales of lubricants and chemicals destined for Russia and with Russian entities has historically been limited. Due to the current situation, Chevron has stopped all transactions," the spokesperson said.

Short on Additive Packages

Lubrizol, Oronite and Afton are headquartered in the United States. Infineum—which is a joint venture between ExxonMobil and Shell—is based in the United Kingdom. Together the companies supply a vast majority of additive packages around the world—especially packages for automotive engine oils.

Germany-based Evonik produces certain lubricant additive components but not additive packages.

Additive packages consist of all the individual chemical additives or components that go into a lubricant, combined with enough base oil diluent for them to dissolve in. Additive package suppliers usually conduct extensive research to develop formulations that meet finished lubricant performance specifications. Additive companies also pay for testing at independent laboratories to document performance. Consequently, they supply not only the ingredients that are blended with base oils to make finished lubricants but formulary knowledge for the finished lubricants. They also provide the documentation that lubricant companies need to prove that their products meet performance standards.

The consultant who spoke on condition of anonymity said Russian lubricant manufacturers are turning to additive package suppliers in other countries—such as India, the United Arab Emirates and China—to replace the products that they were previously buying from Lubrizol, Infineum, Afton and Chevron Oronite. There are a number of such suppliers around the world, but most lack the technology to meet the latest engine oil specifications.

For instance, Richful Lube Additive Co., sells additive components and some packages—including packages that meet API SP, API SN and API SM, the three latest passenger car engine oil specs adopted by the American Petroleum Institute for the North American car market. But Richful—which is headquartered in Xinxiang, China—does not offer packages meeting recent specifications developed by many European original equipment manufacturers or the European Automobile Manufacturers Association.

Among the other potential replacement suppliers mentioned by the anonymous consultant is the United Arab Emirates-based Kemipex. The company's website does not specify that it offers products meeting recent ACEA or API specifications.

Kemipex and Richuful did not respond by deadline to inquiries by *Lubes'n'Greases*.

As a result, the anonymous consultant said, engine oils formulated with Chinese additives would likely

> Simply stated, Russian blenders may be required to downgrade to such older technology as the now obsolete Gost standard.

not qualify to claim compliance with recent specifications issued by such European OEMs as Mercedes-Benz, Renault or Volkswagen.

However, "Russian oils formulated with Chinese additives can be used only for servicing the Korean, Japanese and Chinese makes that recommend API-specified lubricants," he said.

Russian motorists are well aware that German, Italian or French cars up to several years old risk engine damage if operated without oils meeting the latest ACEA or OEM specifications. These specifications stipulate certain properties, such as viscosity and chemical composition. They must also pass engine tests for parameters including wear protection, resistance to oxidation and contribution to emissions control.

Challenges Beget Opportunities?

Despite these challenges, the Russian market is adapting to these extraordinary conditions.

Smaller foreign lubricant companies have opted to continue shipments to Russia. Furthermore, Russian motorists are eager to use these products because they purportedly have approvals from some European OEMs.

Additionally, domestic car makers are planning to revive long-forgotten makes, such as Moskvich. There also may be plans to modernize Volga luxury sedans, which contain motors that can run on oils formulated to meet the obsolete Gost specification.

Gost is an abbreviation of the Russian words for state union standard. It is a collection of 20,000 technical specifications first developed during the Soviet era that lay out the parameters for almost any product manufactured in the ex-communist state, including lubricants.

After the end of the USSR, Gost persisted as a regional standard system in some countries, including Belarus, Kazakhstan, Armenia or Azerbaijan—part of the Commonwealth of Independent States, known as CIS.

Some of these smaller foreign lube blenders that have chosen to continue shipping products to Russia are Berlin, Germany-based Bizol and Turkey-based Belgin Oil. According to a Russian automotive news outlet, these companies' products have some approvals for "technically complex BMW motors." Because of this, their synthetic products can also be

used in other German equipment, like VW, Audi, Mercedes or Porsche.

Neither Bizol nor Belgin responded by deadline to inquiries by *Lubes'n'Greases*.

"Despite the exit of the big oil majors, some sale points still offer western engine oils," news outlet Avtozglyad reported. "We should be aware that many of these are fake. This could be a very lucrative business because the price of Russian oils packed in canisters emblazoned with American or European brands is increasing by six- to seven-fold. That's why there is a greater chance for swindlers to fake Shell or Mobil products than Bizol's or Belgin's" products.

Kandelaki said the situation certainly challenges Russian lubricant manufacturers and the country's auto industry. However, she also believes that they have the ability to rise to the occasion.

The Russian lubricant market is "in short, not comfortable but not critical," she said. "We have the components; we have the capacities. And this is a chance for the domestic additive makers. A window of opportunity" is opening.

Which companies can step in to fill Russia's lubricant additive needs?

There are actually a few lubricant additive suppliers in Russia and Belarus that Russian lubricant marketers could tap. The most prominent of these is NPP Qualitet, which does offer engine oil packages as well as additive components. According to the Moscow-based company's website, however, its current packages meet only older API specifications and fall short of ACEA standards completely.

Another important lubricant additive supplier in the region is LLK-Naftan, a joint venture between LLK International—the largest lubricant marketer in Russia—and the Belarus' Naftan. Before the war in Ukraine began, LLK-Naftan was described as the main lubricant additive producer in Russia. However, now the company's website is not operational, and it remains unclear if the joint venture has maintained its pre-war status.

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By Sydney Moore

A NEW INTERNATIONAL VEGAN CERTIFICATION

Veganism is defined as a lifestyle that endeavors to exclude all forms of exploitation of and cruelty to animals for clothing, food or any other purpose. With respect to diet, the term refers to the practice of abstaining from eating all animal produce. This includes meat, fish, poultry, eggs, animal milks, honey and all their derivatives.

Based in Palm Beach Gardens, Florida, BeVeg has developed and implemented an international vegan certification program. Encompassing everything from food ingredients to the products used to clean food processing equipment and the food-grade lubricants that keep that equipment in working order, the certification program aims to bring "legal credibility to vegan claims, which inherently raises the standard

© SeventyFour

> "I started to realize that while the consumer protection laws are in place for other label claims to prevent misleading and fraudulent claims, they somehow fell short when it came to vegan."
>
> — CARISSA KRANZ
> **BEVEG**

of consumer transparency, bringing integrity to a process that was once legally deficient," the company's website said.

The company was founded in 2017 and is currently working to gain its third year of accreditation under ISO 17065 and ISO 17067. It is the creator and standard owner of the only accredited, audit-based standard in the world to date.

The technical administrator of BeVeg's vegan certification is NSF, which is a global, independent organization dedicated to protecting and improving human health. According to the organization's website, the NSF certification mark "assures consumers, retailers and regulators that certified products have been rigorously tested to comply with all standard requirements." Among the many products that NSF certifies are food-grade lubricants.

"We have a very robust auditor training program," said Carissa Kranz, founder and CEO of BeVeg. "We have a serious checklist that was built with GSFI standards and GMP practices in mind. The BeVeg standard has GFSI and GRMA and GMP as prerequisites to the vegan standard. So it requires a serious third party technical administrator to be able to administer the standard with integrity. BeVeg is only interested in partnering with certification bodies that have the ability and the expertise to carry out a vegan claim with integrity that would warrant against our standard. NSF has the infrastructure, the training, the auditors and the ability to do all of that."

Sara Risley, director of product certification for NSF, agreed. "NSF, from a food safety perspective, is a leading global provider, so it really made a lot of sense for us to partner with BeVeg, given our client base and our expertise in the realm of auditing and food safety. For lubricants, it's really relevant. Not only can we do the registration and that type of work, but we can also really lend our expertise for the customers that [BeVeg is] trying to attract. If they're looking for vegan lubricants to use in their food manufacturing facility, this is a great way to pair those two worlds together."

Why Is a Vegan Standard Necessary?

"I'm a vegan from birth," Kranz said. "I'm also a lawyer, and thought I was always vegan. It wasn't until much later in life that I was having a tofu burrito with a friend of mine and I ordered a glass of wine. She told me that my wine may have been filtered through a fish bladder. I was pretty disgusted, and I didn't believe her. Then I turned to Google, and sure enough I started learning about things that can go on in the manufacturing process of making wine."

Kranz explained that this realization then opened her eyes to other products that claimed to be vegan but may have fallen short of the mark in reality. "That opened the door to other food products and cosmetics," she explained. "As a lawyer, my antennas went off, and I started realizing that there's a big problem here. There's a lack of definition; it's the Wild West. People are using vegan claims freely. There's no consistent standard, there's no audit checklist, there are no manufacturing facility controls in place, and everyone is self-claiming vegan. I started to realize that while the consumer protection laws are in place for other label claims to prevent misleading and fraudulent claims, they somehow fell short when it came to vegan."

So why has a vegan standard been lagging behind other similar standards?

It is only in recent years that veganism has become a widely adopted

lifestyle. "I don't think that consumer protection laws mean to fall short, but I do think the time is now for us to define it," Kranz said. "It was very taboo to be vegan when I was young, but now it's mainstream. Now plant-based products are very popular, and the consumer—whether they're the super consumer or not—doesn't deserve to be lied to. They deserve transparency. BeVeg offers that."

That said, the main advantage of a clearly defined vegan standard "is that it really fills the gray areas where the laws fall short right now globally," Kranz said.

The Basics of the BeVeg Standard

At its core, "the BeVeg standard is a process-based standard," Kranz said. "So it's a quality assurance standard that basically requires facility audits and facility standard operating procedures to be in place to ensure no cross-contamination of the final product that would be BeVeg certified."

She continued: "The BeVeg program is a facility audit standard. We certify facilities, and facilities must cooperate for products to then gain access to the trademark after. It's not required that the facility be a dedicated vegan facility because most facilities are shared and have shared lines. But what is required is that there is a senior-level commitment in the standard operating procedures to show that there is going to be no animal cross-contamination and that integrity and quality assurance are going to be maintained in the manufacturing process."

150%

Increase in vegan food sales between 2020 and 2021

How do food-grade lubricants play into the standard and its associated facility audit?

Simply stated, the standard takes into account every product that does or could possibly come into contact with the final certified product. "We look into every ingredient, we look into every supplier ingredient, and

© Image courtesy of BeVeg

we want to make sure that there's no animal exploitation in any part of the process," Kranz said. "That includes animal testing as well. So if a lubricant is used in a final certified product or if the lubricant is the final certified product, it's going to be looked at in terms of whether there is any deliberate or intentional additive of any animal DNA or not. Is there any chance of cross-contamination that would be incidental and accidental in the process? That would be considered before granting certification."

Additionally, once a product is certified by BeVeg, the trademarked certification mark can be displayed on the label of the product.

Advantages for Lubricant Marketers

Knowledge of the expanding demand for vegan food as well as what it takes to obtain BeVeg's vegan certification can help lubricant marketers to assist their customers in meeting the standard.

"People really look at vegan food in a couple of different ways," NSF's Risley said. "Obviously, there are those people who are very committed to veganism from a moral standpoint but also those who might have food allergies. They're allergic to dairy or they're allergic to eggs, so they're looking at those vegan products not just from a moral perspective. I really feel like it's a great thing for a lubricant manufacturer to understand that the category of people who are buying vegan food is growing, and the way consumers are looking at how they want to buy food will help [lubricant producers] to support the businesses—the food manufacturers—that they are trying to sell to."

Furthermore, "The work that we do at NSF touches all industries," Risley said. "My team specifically really looks at claims that people are making that bring value. What we see with those—for example, if you're a lubricant manufacturer that is selling a product to a food manufacturer, or you're selling an end product that's going to end up on a shelf at a grocery story—it's really important from the very beginning of the supply chain to the very end of the supply chain to ensure consistency. There's a huge demand from the companies downstream in that supply chain—the people that maybe a lubricant manufacturer is going to target. They're able to really differentiate

$29 billion

Sales of plant-based dairy and meat in 2020

$162 billion

Projected sales of plant-based dairy and meat by 2030

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An ad for plant-based hamburger meat at an MOS BURGER store in Tokyo, Japan.

their products because they have these additional claims that make it easier for the food manufacturer to check that the food-grade lubricant is also vegan" and can be used to make truly vegan products that meet BeVeg's standard.

Kranz added that the BeVeg standard can help to keep the supply chain accountable. "There are a lot of products that may use an ingredient supplier, and if that ingredient supplier is certified by BeVeg, then it's easier to sell to manufacturers of these other end products that might want to use your products," she said.

Other Benefits

BeVeg's standard provides not only economic benefits to those brands that have obtained certification, but it also provides a certain degree of legal protection.

"BeVeg is a program that has to do with risk assessment," Kranz said. "So when, as a lawyer, I started connecting the dots, I realized how a vegan program is needed to protect not only the consumer to get what they think they are buying, which is plant-based products, but it also protects the retailer to ensure the manufacturing facilities did their due diligence. Then it protects the manufacturing facilities and the brand owners because they did their due diligence, too. Product recalls may or may not still happen, but when they do happen, you're a lot less negligent when you've gone through an audit and had certain protocols and standard operating procedures in place to ensure no contamination. Plus, it's just a way to avoid an expensive product recall."

Furthermore, adhering to the standard also decreases the likelihood that animal-derived allergens are present in the final product. "A lot of people will choose a vegan product because they expect it to mean that it's free from animal material" Kranz said. "More than half of the world's most potent allergens are from animal origin, so it's very important to have a vegan standard that is not confused with allergen alibi disclosure warnings. It should be vegan—even if it's made in a shared facility with eggs and dairy—and it should not contain animal material if it went through audit protocols and had standard operating procedures in place" during production.

Constant Evolution

BeVeg's vegan certification standard has been crafted in such a way that will allow it to evolve as necessary. "BeVeg has built a standard that is very robust," Kranz said. "It's more than 130 pages and goes into clear technical definitions and audit processes and protocols. It is a living, breathing document that allows us to constantly update and republish based on things we learn in the auditing process. This allows us to be consistent in our application globally of a vegan trademark that actually means something."

SYDNEY MOORE is managing editor of *Lubes'n'Greases* magazine. Contact her at **Sydney@LubesnGreases.com**

Product News

New Packaging Technology

Utilizing its co-injection multi-layer technology, Mold-Masters has proven its ability to combine two separate resins into a single 3-layer melt flow. This enables the company to inject high PCR content as the core layer up to 50% of the total part weight without sacrificing part quality or cycle time. In its most recent production application, Mold-Masters implemented a 2-cavity co-injection system for producing 5-gallon (20-liter) pails. Each of these 700-gram pails incorporated 50% PCR as the core layer. This sustainable solution has the potential to generate significant savings for the molder by reducing the use of virgin material and TiO_2 compared to traditional mono-layer pails, the company says. **www.moldmasters.com**

Message on a Bottle

Petro-Canada Lubricants unveiled new product packaging for its 1-liter bottles across Petro-Canada Lubricants product lines, including DURON, DuraDrive and TRAXON. The new packaging will be extended to the company's 4-liter bottles and pails later this year. The new user-friendly packaging design incorporates several upgrades, including a wider bottle mouth opening for easier pouring and a smoother flow. The new contemporary bottles are made from a thicker resin to produce sturdier material to support the integrity of packaging while in transit. The new bottles also feature a new label design that conveys the product tiering, allowing customers to easily differentiate between products. **www.lubricants.petro-canada.com**

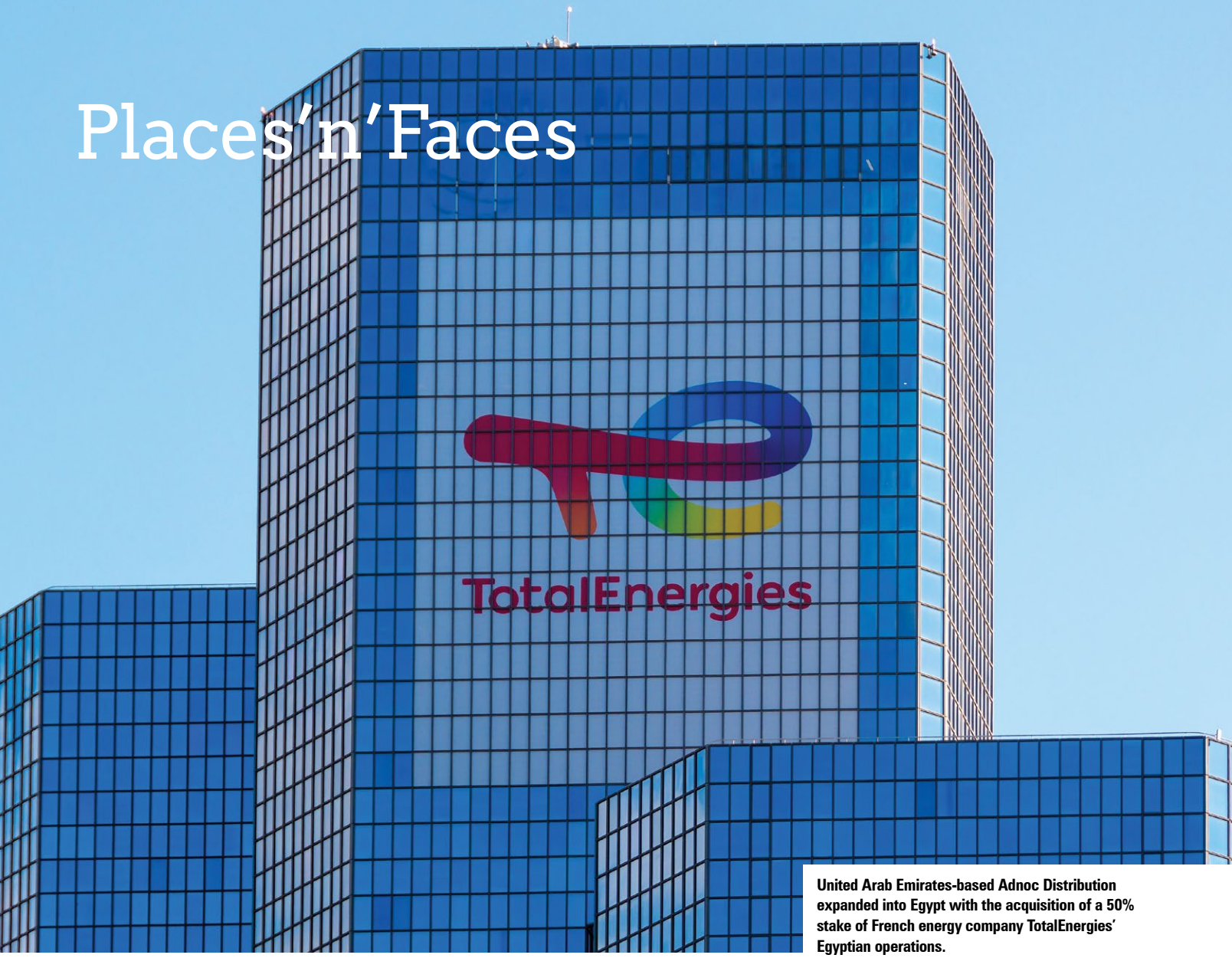
The Latest in Mining Lubes

Chevron Lubricants introduced its Delo TorqForce Syn FD-1 high performance, fully synthetic lubricant. Designed for use in final drives and axles of large mining haul trucks and other support equipment, the new lubricant offers an expanded temperature range, maximized equipment life in severe operating conditions and extended drain intervals. Delo TorqForce Syn FD-1 was designed to increase performance over conventional SAE 60 TO-4 and FD-1 products and formulated to deliver maximum system protection. It also provides excellent gear wear protection as well as very strong oxidation control and minimal varnish to extend service intervals from the standard 4,000 hours to 6,000 hours, Chevron says. **www.chevron.com**

Firearm Grease

Fluoramics now offers Tufoil Gun Grease, a moly-PTFE-Lithium complex NLGI 1 firearm grease for use on handguns, rifles and shotguns. Engineered to meet the demanding conditions found in hunting, law enforcement and military environments, Tufoil Gun Grease works well in extreme low and high temperatures. Tufoil Gun Grease is recommended for all types of firearms and provides excellent moisture and corrosion protection. It also provides lubrication for shotguns, pistols and revolvers, as well as full auto carbines, rifles and belt-fed machine guns. It is suitable for rifle bolts, triggers and semi-automatic pistol rails because it does not thin or melt as it heats up. The grease is solvent-free and lowers barrel temperatures and reduces jams and wear. The grease is sold in 15-gram jars. **www.fluoramics.com**

Places'n'Faces



United Arab Emirates-based Adnoc Distribution expanded into Egypt with the acquisition of a 50% stake of French energy company TotalEnergies' Egyptian operations.

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Adnoc Buys Stake in TotalEnergies Egypt

United Arab Emirates-based Adnoc Distribution expanded into Egypt with the acquisition of a 50% stake of French energy company TotalEnergies' Egyptian operations, including part ownership in its lubricants sales and lube service stations.

Announced July 28, the deal—in which Adnoc Distribution acquired half of TotalEnergies Marketing Egypt LLC from TotalEnergies Marketing Afrique SAS—will see the company gain part ownership in a number of assets, including lubricants sales and more than 250 lube service stations. It will also acquire fuel retail stations, fuel distribution, aviation fuel business operations and convenience stores.

Adnoc Distribution bought the stake for U.S. $186 million, with potential for up to an additional $17.3 million if certain conditions are met. The acquisition will be completed in the first quarter of next year.

TotalEnergies Egypt operates about 7% of the service stations in Egypt and is a top-four fuel retail operator in the country, according to both companies.

Abu Dhabi National Oil Co., the United Arab Emirates state-owned oil company, says Adnoc Distribution is the U.A.E.'s largest fuel and retail distributor. Adnoc Distribution sells automotive, industrial, and marine lubricants, along with greases, coolants and brake fluids.

Cepsa Ups Stake in Brazil's Deten

Cepsa Quimica closed on its acquisition of 27.88% of Deten Quimica

from Brazil's Petrobras, after obtaining authorization from a government agency. In addition to making raw materials for detergents, Deten produces heavy alkylates used in production of lubricants, greases and lubricant additives.

According to the July 6 press release, Deten produces 10,000 metric tons per year of heavy alkylates, known as ALP, which is mainly intended for the production of thermal fluid, greases, lubricant additives and textile oils.

The company claims to be the only national producer of linear alkylbenzene, known as LAB, a precursor of linear alkylbenzene sulfonate acid, or LABSA. Located in the northeastern state of Bahia, the company produces 230,000 ty of LAB and 120,000 t/y of LABSA, and these raw materials are primarily for manufacture of surfactants for biodegradable detergents intended for home care.

With the signing of the agreement, Cepsa Quimica increased its stake in Deten to 97.82%. The remainder remains divided among small shareholders. Cepsa Quimica became part of Deten's shareholders in 1999.

The Administrative Council for Economic Defense approved the agreement, which was initially announced in early May. In May, Cepsa Quimica said its goal was to convert the Deten production unit into the Cepsa group's large production center for all three raw materials for the whole of South America.

Spanish energy company Cepsa said it is studying a plan to modernize and improve Deten's factory in Brazil, with the intention to make new investments and enable a safer, more efficient and sustainable production process. The plan's goals include reducing the factory's emissions, reducing its water consumption and optimizing the efficient use of raw materials and electricity.

Petrobras Chile Up for Sale

Southern Cross Group, which owns the Petrobras lubricants and fuels business in Chile, has put it on the sales block, according to local news reports.

The business, Esmax, also distributes Chevron lubricants in Chile and is the nation's third-largest fuels and lubes retailer. Diario Financiero reported that Southern Cross is seeking a price tag of U.S. $900 million. Southern Cross did not respond to questions.

The investment firm, which is based in Buenos Aires, Argentina, acquired the Petrobras chain in Chile in 2017 from Petrobras, which is Brazil's national energy company. The chain now includes 294 fuel stations and convenience stores that sells fuels, along with lubricants marketed under the Lubrax brand.

The stations are still branded as Petrobras, but the Lubrax brand now belongs to Vibra, which was formerly BR Distribuidora S.A., the fuels and distribution arm of Petrobras before Petrobras spun it off between 2019 and 2021. Southern Cross's acquisition of Petrobras Chile gave it rights to continue using the Petrobras and Lubrax brands until 2025.

Petrobras Chile ranks behind Empresas Copec—a Chilean energy and forestry company—and Shell in terms of fuels and lubricant sales in Chile. Because of their market leading positions, competition rules would not permit Copec or Shell to purchase Petrobras Chile.

Without citing sources, Diario Financiero reported that Southern Cross contacted potential buyers in the United States, Europe and Asia. It also said that Peruvian conglomerate Romero Group, which has existing operations in Chile, is one of the potential buyers "repeated most."

SK Signs on to Rerefining Effort

SK Lubricants and South Korea's Ministry of Trade, Industry and Energy signed a memorandum of understanding to recycle waste lubricants into base oils. The program, which would also involve other companies, aims to reduce carbon dioxide emis-

> Modern rerefineries process used lubricants by removing chemical additives, water and other impurities and hydrotreating saturate molecules to make the fluid more chemically uniform.

sions by turning used oils back into a raw material for lubricants rather than burning them as a source of energy.

South Korea does not currently have any rerefineries that produce base oils, Kline Group consultants said recently.

SK's role will at least include facilitating sales of rerefined base oils, according to a July 6 news release posted by the ministry. The ministry said other companies will also participate in the program – such as start-up Clean Korea, which is receiving a government subsidy, and Sebang Refining – fulfilling tasks such as collection of used lubricants.

Modern rerefineries process used lubricants by removing chemical additives, water and other impurities and hydrotreating saturate molecules to make the fluid more chemically uniform. Rerefineries can make base

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oils, and it is also common for a portion of the output to be used as fuel.

Using rerefined oils as base stocks is generally viewed as more environmentally beneficial because it does not generate emissions as burning does, and it reduces the need for virgin base oils produced at fuels refineries.

Metalworking Lubricants Co. Pays Fine

The U.S. Environmental Protection Agency and an Indiana state government agency have reached a settlement with Metalworking Lubricants Co. for alleged violations of the Clean Air Act at a facility in Indianapolis, according to an EPA press release. The settlement will see the company pay a total of $310,000 in fines.

The EPA and the Indiana Department of Environmental Management alleged that Metalworking Lubricants emitted more than 25 tons of hazardous air pollutants per year from its used-oil processing facility in violation of its permit, EPA said. These pollutants include naphthalene, ethylbenzene, xylene, phenol and toluene.

In addition, the company allegedly did not operate its scrubber at certain times when oil processing tanks were operating, did not respond when the scrubber failed, did not keep required records and underestimated the amount of hazardous air pollutants in the oil it sourced, which the EPA says affected its emissions, the EPA said. And Metalworking Lubricants allegedly did not apply for a major source operating permit.

The company will pay $155,000 to both agencies for a total of $310,000, the EPA said. It will also be required to install a carbon adsorption system to control emissions and connect all oil and wastewater processing tanks to the system and scrubber. This system must recover more than 95% of the total organic compound emissions and emit no more than eight pounds of sulfur dioxide per hour.

Metalworking Lubricants will have to meet testing, monitoring and recordkeeping requirements and stay in line with a revised federally enforceable state operating permit to keep its emissions to less than 25 tons per year.

Repsol Boosts Startup Nuspec

Nuspec Oil, a United Kingdom-based company developing biobased base oils and advancing commercialization of novel rapeseed oils, was among five startups selected by the Repsol Foundation in the latest call of its Entrepreneurs Fund. Benefits will include a year of financial support, along with advice from and testing opportunities at Repsol.

The Spanish refiner's foundation, considered a business accelerator, chose the startups after an evolution and selection process from a total of 420 proposals received from 69 countries, mainly from Spain, the United States, the United Kingdom, Canada, Nigeria, and Portugal.

According to a foundation press release, each project will receive financial support of up to €100,000 (U.S. $101,000) for one year, as well as the advice of export technologists from Repsol and a team of professional mentors with experience and knowledge of both the energy sector and business management. In addition, each company will have the opportunity to validate their initiatives in a real environment, through pilot tests at Repsol's own facilities and industrial plants or by carrying out concept tests at the Repsol Technology Lab, a technology and innovation center.

Founded in 2019, Nuspec Oil focuses on development of biobased base oils. According to its website, the company's products include base oils and vegetable oils. Its two high viscosity base oils are marketed as suitable for formulating marine and industrial lubricants requiring high levels of biodegradability.

With its vegetable oil product, the company aims to advance commercialization of novel rapeseed oils that are considered suitable in neat form

Continued on Page 40

ILMA
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If you're feeling like your business has taken a few punches recently–from the pandemic to supply chain to regulatory issues–you're not alone. It's been a tough few years.

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Trucks at a Valvoline Canada facility in Mississauga, Ontario. Saudi Aramco is acquiring Valvoline's Global Products business, which is its lubricant and maintenance product sales segment.

Continued from Page 38

as a base for lubricating oil or as feedstock in production of biobased chemicals. Nuspec claims its specialty rapeseed oils contain less than 5% of polyunsaturated fatty acids, which increase their stability at high temperatures. Elevated levels of monounsaturated or very long chain fatty acids in the oils make them also more suitable for demanding applications, according to Nuspec. The company said it is working with industrial partners towards development of a flexible processing platform to manufacture base oils from various biobased raw materials.

Valvoline to Sell Lubes Unit to Aramco

Saudi Aramco announced a $2.7 billion deal to acquire Valvoline's Global Products business, which is its lubricant and maintenance product sales segment. The acquisition marks not just a massive expansion for the state-owned oil company but a complete shift for Valvoline to a service-driven business model.

This comes just two months after Saudi Aramco initially expressed interest in buying the segment, according to reports. In one move the company has set itself up as a much larger player in the lubricants sector.

Having not been in the finished lubricants business since 2007 after selling its stake in the Petromin joint venture, it re-entered the market with the launch of its Orizon brand of lubricants in Saudi Arabia.

"Valvoline's global products business fits perfectly with Aramco's growth strategy for lubricants as it will leverage our global base oils production, contribute to our R&D capabilities and strengthen our existing relationships with OEMs," Mohammed Y. Qahtani, Aramco's senior vice president of downstream, said in a press release.

With the acquisition, Aramco joins the ranks of other large merchant suppliers of base oil that are also large suppliers of finished lubricants.

Blending Plant Opening in Northern China

A company in Northeastern China has finished constructing a blending plant designed to make fluid lubricants formulated with graphene. Sanrun Technology Co. is now commissioning equipment and plans soon to begin operating the plant, which has capacity to make 30,000 metric tons per year of lubricants, according to recent reports by the local government and Chinese news organizations.

The facility, dubbed Sanrun Graphene Lubricating Oil Project, was built in two years for ¥270 million (U.S. $40 million), according to a report posted by Jilin City, which has jurisdiction over the nearby city of Huadian, where the plant is located. Both are located in Jilin province, which borders North Korea.

The project received seed funding and other support from the Chongqing Institute of Graphene, which is located in the southwestern city of the same name, and the Chinese Academy of Sciences, which supported it because of the desire to commercialize graphene technology and to support economic development in Jilin province.

A subsidiary of Sanrun has been

manufacturing lubricants containing graphene for a number of years in southern China, and the parent company wanted to establish a production base in the north. Sanrun officials said the project will employ 200 people and that they expect it to achieve annual sales revenue of ¥200 million.

OQ Gives Final Approval for Expansion

OQ Chemicals said it reached a final investment decision to build additional propionic aldehyde capacity as well as infrastructure to support Röhm in constructing a world-scale methyl methacrylate plant at OQ Chemicals' production site in Bay City, Texas. The compounds can be used to make viscosity modifiers for lubricants, among other applications.

In June 2021, Germany-based Röhm announced approval of a final budget for construction of the new methyl methacrylate production plant in Bay City. The new plant will have capacity to make 250,000 metric tons per year and create 70 direct jobs.

In the announcement, OQ Chemicals said that under terms of a February 2021 agreement with Röhm, OQ will integrate the plant into its production site at Bay City and provide raw materials, utilities and site services to Röhm. Based on the engineering progress of both parties, all other arrangements for construction are now complete, and the new plant is slated to be mechanically complete by the first quarter of 2024.

The plant will be the first of its kind to implement newly developed LiMA – Leading in Methacrylates – technology on a large industrial scale. According to Röhm, the technology enables a high yield with low energy consumption and reduced wastewater volumes. Benefits cited by company officials included supply security and strengthening Röhm's position in the methyl methacrylate market.

Briefly Noted

Petronas Lubricants (India) became a strategic lubricants partner for Indian automotive manufacturer **Tata Motors**' commercial vehicles, under a recently announced agreement.

Afton Chemical Corp. announced that it completed a $70 million expansion at its lubricant additive factory in Sauget, Illinois—a project that enables the plant to make additives for new types of fluids for electric vehicles, along with increased amounts of products for transmission fluids.

Krahn Hellas S.A., the Greek subsidiary of Germany-based **Krahn Chemie GmbH**, expanded its distribution portfolio with the additive range of **BYK-Chemie GmbH** for a variety of applications, including lubricants.

Indian lubricants blender **Maximus International Ltd.** plans to triple its production capacity in East Africa, the company announced, setting a high growth target with eyes on extending its reach across the continent. The company operates in the region through its wholly owned subsidiary, **Nairobi, Kenya-based MX Africa Ltd**.

Algerian motor fuels retailer **Naftal** inaugurated a factory in July that manufactures metal drums used to package lubricants. Located in the city of Mascara, the factory has capacity to produce 400,000 barrels per year and was built at a price of 1.2 billion dinar.

Sweden-based **SKF** entered into a collaboration that will combine **Quaker Houghton**'s industrial oils and application expertise with **SKF RecondOil**'s double separation technology to offer industrial customers a fully circular use of industrial oil. The tailored solutions will be offered under fee- or performance-based contracts, helping provide the companies' customers with future-oriented offers and facilitate their transition into a circular economy.

Faces in the News

Peter Kim has been appointed president of SK Lubricants Americas, Inc., replacing **Chris Song**, who returned to a role at SK's headquarters in Seoul, South Korea, in June.

Peter Kim

Sanjay Singh was named CEO of Trinity Lubes & Greases FZC, UAE, and **Krishna Prasad Jaladanki** was appointed chief operations officer.

BUSINESS | WORLD

Leadership Is Critical Right Now

As we emerge from the pandemic, unsettling events that most current executives have never experienced are putting the business world in an state of flux.

JACK GOODHUE,
management coach,
can be reached at
goodhue@aol.com

The importance of effective business leadership is more critical now than ever before because decisions made during the next year or two may very well set the pattern for the future.

Managers will have to be especially resilient. The best ones will share many of the characteristics of the Navy Seals, who have proven themselves able to perform efficiently and flexibly under stress.

The Seals typically have a positive and optimistic outlook, as well as calmness, self-control and tenacity. Most importantly, they are not dogmatic; they are able to come up with innovative solutions and act decisively when circumstances are changing rapidly.

In his recent book "Leadership: Six Studies in World Strategy," former U.S. Secretary of State Henry Kissinger points out, "Leadership is most essential during periods of transition, when values and institutions are losing their relevance, and the outlines of a worthy future are in controversy."

Admiral James Stavridis, who reviewed Kissinger's book for The Wall Street Journal, observes that "Mr. Kissinger is an astute observer of the personal element in strategy—the art and science of leadership, or how, on the executive level, decisions are made, trust earned, promises kept, a way forward proposed."

As Kissinger says, "The task of the leader is to get his people from where they are to where they have not been."

In his analysis of six effective leaders, Kissinger writes that all were known for their "personal discipline, self-improvement, charity, patriotism and self-belief, and that they shared a strength of inner character and knowledge of history."

Stavridis' review also highlights an additional leadership trait: "The ability to tell hard truth to their followers."

Good leaders have personal integrity and strong moral principles; they are honest and truthful. They do the honorable thing, even if it might temporarily put them in a bad light. They lead by example and accept responsibility for their actions.

They are respectful, have empathy toward others and are worthy of trust. They listen to the ideas of experts and non-experts alike, but in the end their decisions are grounded in reality. They realize that there may be occasions when they have to reinvent themselves to cope with changing conditions.

Kissinger feels that boldness is a part of effective leadership. Outstanding leaders are willing to take risks, and their experience and character improve the odds of success.

There are other desirable leadership characteristics. As U.S. President John Quincy Adams once said, "If your actions inspire others to dream more, learn more, do more, and become more, you are a leader."

In the end, of course, effective leaders cannot be characterized by a simple list of traits. Exceptional leaders are not necessarily born that way—most of us have to work at it.

There are different ways to get there. Each individual has to find his or her best path, but the qualities outlined in this column may serve as useful goals.

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Our columnists are temporarily writing every other month. Look for the next Your Business column in the November issue.

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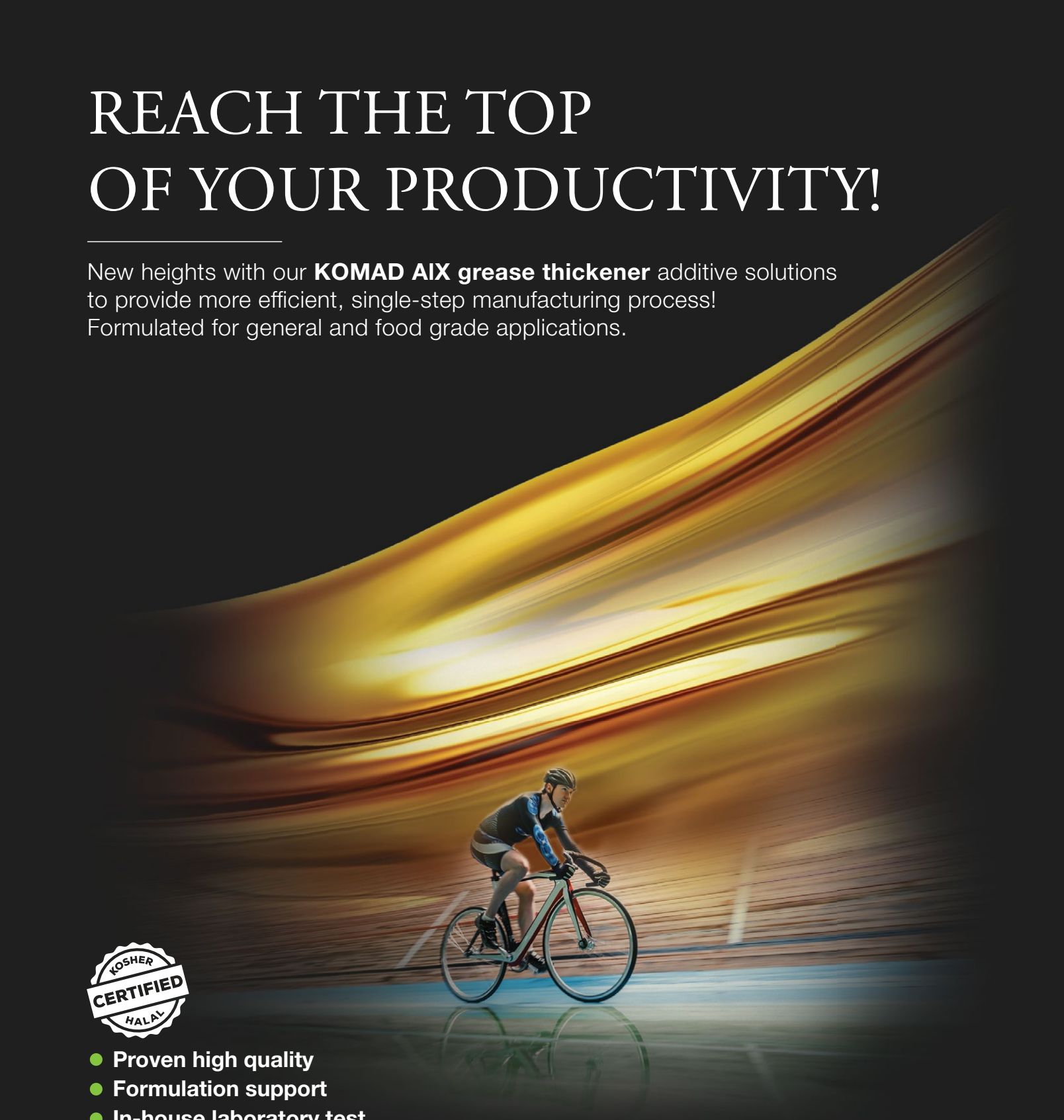

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