

Market Mosaic

December 2017

Bison, New Capacity and the P&K Outlook



Market Mosaic is a newsletter published for our customers, suppliers and stakeholders by the Market and Strategic Analysis group of The Mosaic Company. Some issues assess the near term outlook for agricultural and plant nutrient markets while others take an in-depth look at a topic of interest to our readers.

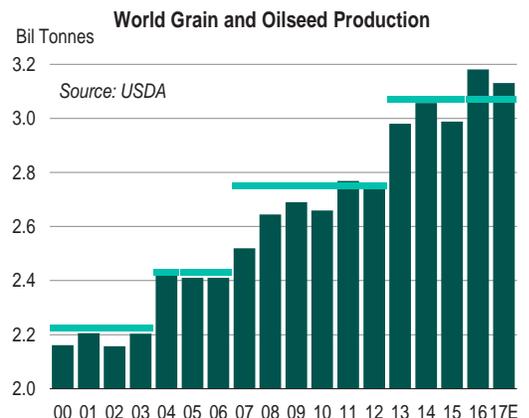
Scientists have long observed different responses of cattle and bison to a gathering storm. Cattle will instinctively move away from the storm. In most cases, the front catches up to and then moves right along with the herd, increasing the misery from the wind and snow. Bison, however, will wait for the storm to gather and then charge head on into it, minimizing exposure to the elements.

Well, we use the bison as a metaphor to assess the impact of new P&K capacity that is ramping up now or will start up shortly. We first evaluate the severity of the gathering storm that has caused other analysts and investors to move away from the sector. We then face straight into it and gauge how these developments likely will play out during the next several years.

The main take-away from our analysis is that, like many weather forecasts, the gathering storm of new capacity likely will be less severe than current watches and warnings. To be clear, we are not new capacity deniers, and we expect significant new supplies to come on line over the next several years. However, we do not expect that the ramp-up of a handful of projects will result in the gross supply and demand imbalances that some analysts are forecasting to persist for the next decade or longer. In fact, we do not project deep or prolonged downturns in these markets for three reasons. First, strong, broad-based and less volatile demand growth is expected to absorb much of the additional capacity as it ramps up. Second, ramp-ups of new facilities likely will be slower than expected and less than what most analysts have plopped into their spreadsheets. Finally, like the bison, some companies are charging directly into the storm and optimizing operations by idling higher-cost facilities and running lower-cost operations at high and steady rates in order to reduce unit costs and compete profitably in this new market environment.

Strong, Broad-Based and Less Volatile Demand Growth

Year-to-date statistics clearly show that global P&K shipments have clicked up a couple of notches this year. Despite the increase, we guesstimate that channel inventories will end the year at below-average levels in several key geographies. For example, India appears to have depleted inventories throughout its entire supply chain this year, so that bodes well for early and large imports in 2018. P&K inventories in Brazil and North America likely will end 2017 at below-average levels as a result of strong application seasons and cautious price expectations for next year.



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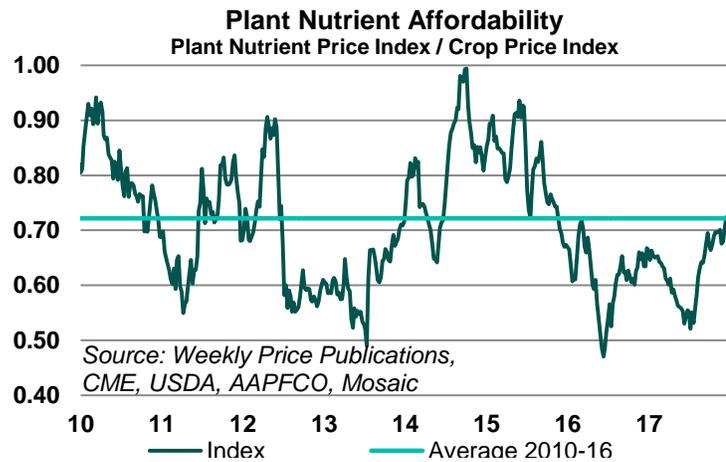
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Demand prospects look strong because both agronomic and economic drivers continue to point positive. Record-shattering harvests have removed record amounts of P&K from farm fields across the globe during the last five years. The chart on the front page shows that global production of the leading grain and oilseed crops has taken giant steps up following surges in agricultural commodity prices in 2004, 2008 and 2012. For example, farmers had never harvested more than 2.8 billion tonnes of these crops prior to 2013, but production has averaged nearly 3.1 billion tonnes per year since the devastating drought and price spike in 2012. The table shows that the most recent step-up in crop production (to 3.06 billion tonnes per year) removes about 11% more nutrients than output at the prior stoop (of 2.74 billion tonnes per year).

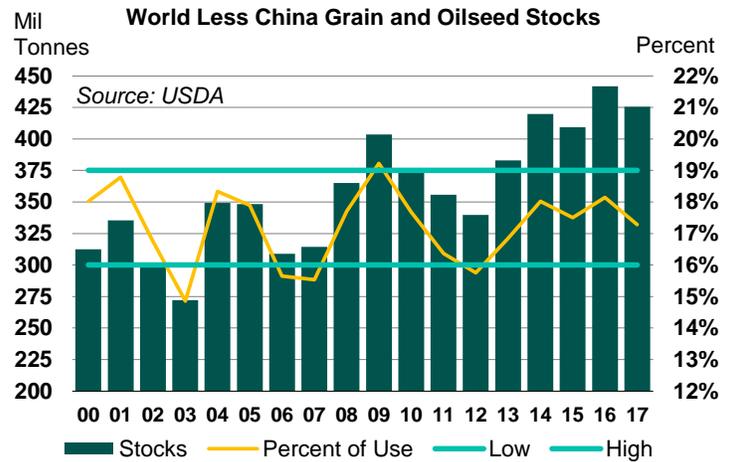
Estimated World Grain & Oilseed Nutrient Removal				
Mil Tonnes	2007-12	2013-17	Percent	
	Stoop (2.74 bmt)	Stoop (3,06 bmt)	Change	Change
N Removal	59.3	66.2	6.9	11.6%
P₂O₅ Removal	22.9	25.4	2.5	10.9%
K₂O Removal	19.2	21.5	2.2	11.7%

Source: USDA, IPNI, Mosaic

Plant nutrients also remain affordable. Our affordability metric, the ratio of a plant nutrient price index and a crop price index, registered 0.72 in mid-December, right at the average for 2010-16. Plant nutrients remain affordable because plant nutrient prices have declined along with crop prices. The crop price index in mid-December was 155, 32% less than the 2010-16 average of 227, but the plant nutrient index had fallen to 112, down 30% from the average of 161 for the same period.



Agricultural commodity prices have dropped from the lofty levels of a few years ago, but prices today still trade at values that underpin solid demand. For example, 2018 new crop corn, soybean and HRW wheat prices were trading at roughly \$3.80, \$9.85, and \$4.50 per bushel, respectively, in mid-December. The string of record-smashing harvests has resulted in a build-up of inventories, but steady demand growth is catching up with stepped-up production. In fact, the latest USDA estimates show that grain and oilseed stocks outside of China are projected to decline in 2017/18 and, more importantly, the stocks-to-use percentage is projected to drop into the lower half of the normal range by the end of the crop year. The food story is not in vogue today, but it still is solidly intact.



Other factors also point to strong, broad-based and less volatile growth. Significant demand is emerging from what looks like a take-off in Africa as well as an increasingly strong recovery in the former Soviet Union (FSU) and Eastern Europe. Our forecasts assume no impact from the proposed and potentially game-changing expansion of biofuels use in China. Demand also is projected to increase at a more consistent pace during the next five years. Both P&K and agricultural commodities prices are expected to trade at more moderate and less volatile levels during the next five years. In addition, no Richter-scale-type shocks such as the 2010/11 subsidy overhaul in India or the withdrawal of Uralkali from the Belarus Potash Company (BPC) in 2013 are anticipated during the forecast period.

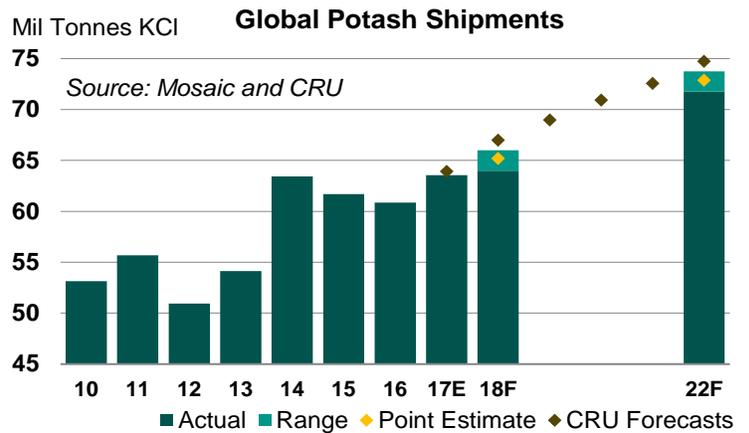
Potash Demand Outlook

Global potassium chloride (KCl) shipments increased 2.3% per year or 7.7 million tonnes from 2010 to 2016. The chart shows that growth was erratic to say the least. Shipments increased in three years and decreased in three years, and all of the gain resulted from the surge in 2014. India was a drag on global growth with shipments declining 2.2 million tonnes during this period due to subsidy cuts that resulted in nearly a tripling of retail potash prices in 2010/11.

“Like many weather forecasts, the gathering storm of new capacity likely will be less severe than current watches and warnings.”
- Dr. Michael R. Rahm

After two years of declines, a strong and broad-based rebound in shipments has occurred this year. We estimate that global shipments will climb 4.4% or 2.7 million tonnes to 63.5 million in 2017. Shipments are forecast to increase another 2.6% or 1.7 million tonnes to 65.2 million in 2018. The insert shows a breakdown by key country or region. Our robust forecasts are not just producer-speak. CRU estimates that shipments will increase to 63.9 million tonnes this year and then jump 4.8% or a whopping 3.1 million tonnes to 67.0 million next year.

Looking out a few more years, we forecast that global potassium chloride shipments will increase 3.0% per year or 12.0 million tonnes from 60.9 million in 2016 to 72.9 million in 2022. The big consuming countries - Brazil, China, India, Indonesia, and Malaysia - account for about two-thirds of the projected gain, but other regions such as the FSU, other Asian countries, and Africa are expected to post notable increases during this period. CRU's long term forecasts also are a bit higher than our projections. Based on its August 2017 outlook report, CRU projects that global shipments will grow 3.3% per year or 13.4 million tonnes KCl during this period.

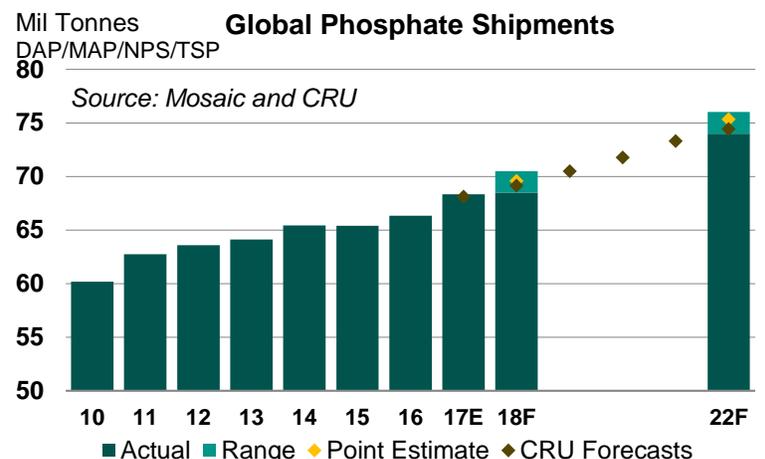
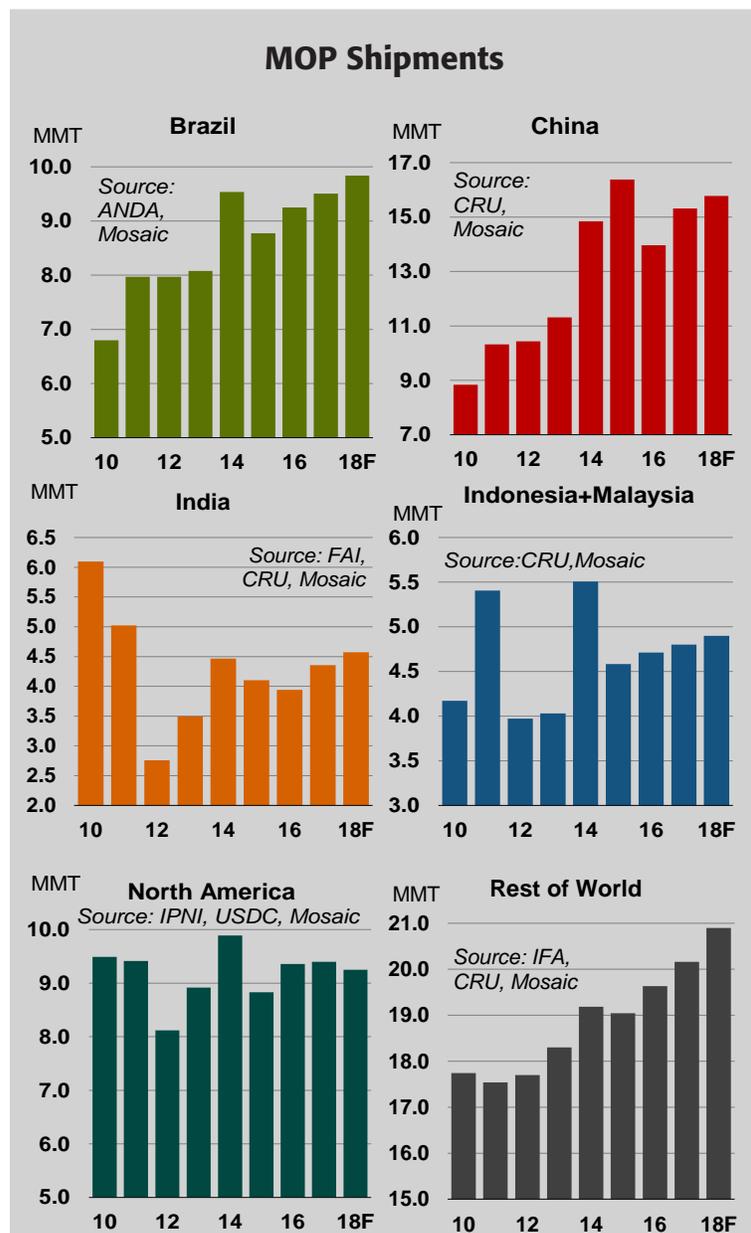


Phosphate Demand Outlook

In the case of phosphate, we estimate that global shipments of the leading solid high-analysis products (DAP/MAP/NPS/TSP) increased just 1.6% per year or 6.1 million tonnes from 2010 to 2016. Phosphate shipments were less volatile than potash shipments, but India and China were drags on global growth during this period. In India, shipments dropped 2.4 million tonnes due to subsidy cuts that resulted in roughly a doubling of retail phosphate prices. By Chinese standards, domestic shipments barely budged in the world's largest consuming country during this period. Chinese shipments increased during the first half of this period as a result of strong on-farm demand as well as a build-up of channel inventories and strategic reserves. Shipments then dropped during the second half as demand gains slowed and inventories were pulled down. Led by Brazil, shipments in the rest of the world, however, increased at the robust rate of 4.0% per year or 8.1 million tonnes from 2010 to 2016.

The pace of demand growth clearly picked up this year. We now estimate that global shipments will increase 3.0% or 2.0 million tonnes to 68.3 million in 2017 and then climb another 1.8% or 1.2 million tonnes to 69.6 million in 2018. The insert provides a breakdown by key country or region. CRU forecasts again are a bit higher at 69.1 million tonnes this year and 70.1 million in 2018.

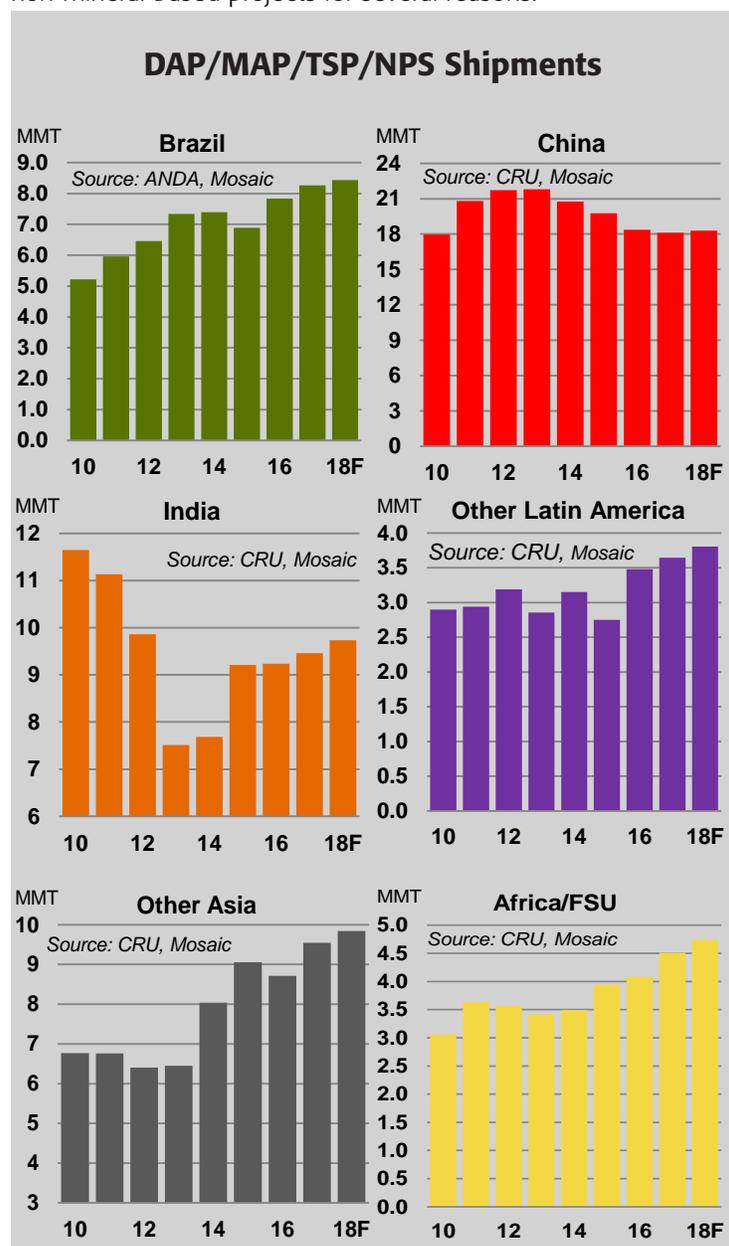
Looking further out, shipments are forecast to increase at a faster clip than in the recent past. We project that global shipments of these products will increase 2.1% per year or 9.0 million tonnes from 2016 to 2022. The projected pick-up is due to an expected worst-to-first turnaround in India, stable Chinese shipments, and



continued solid gains elsewhere. Indian demand is expected to get back on a growth trajectory as a result of high minimum support prices for key crops, more moderate and less volatile phosphate prices, a workable subsidy, and a stable to stronger rupee. Shipments outside China and India are forecast to grow 2.5% per year or 6.2 million tonnes during this period. Prospects for lower and less volatile raw materials costs are expected to help keep phosphate prices at moderate levels and fuel steady gains across the globe. CRU forecasts that demand will grow at a more modest rate of 1.7% per year with shipments climbing to 74.4 million tonnes by 2022. The main difference is that CRU projects a material decline in Chinese shipments during this period.

Slower-Than-Expected Ramp Ups

We expect that most of the P&K projects will start up a bit later and ramp up more slowly than what analysts have plopped into their spreadsheets. Mineral-based P&K projects typically are more complicated to develop and require more time to ramp up than non-mineral-based projects for several reasons.



First, the development of a world-scale greenfield mine is a big and costly undertaking that often takes longer than planned due to geological and other surprises encountered along the way. This is especially the case for the development of deep underground potash mines using shaft or solution mining technologies.

Second, refining mineral ores, particularly phosphate rock, involves nearly as much art as science in order to get the process and recipe just right. For example, the chemical reactions when sulphuric acid and phosphate rock are combined are impacted by the amounts of trace minerals as well as other characteristics of the ore, and ore quality can vary significantly even within the same deposit. By contrast, while nitrogen production is energy intensive and requires high-pressure vessels and other sophisticated equipment, the chemistry is relatively simple and precise once you flip the switch.

Finally, P&K projects require the handling of large amounts of bulk materials including raw ore, refined ore, co-products, other raw materials, water and finished products. Calibrating all of these flows, especially for a world-scale greenfield project, often takes more time than planned.

So far, it looks like recent start-ups are following this pattern. In the case of phosphate, the market is closely watching two start-ups -- the Ma'aden Wa'ad al Shamal Phosphate Company (MWSPC) joint venture in Saudi Arabia and Jorf Phosphate Hubs 3 & 4 (JPH 3 & JPH 4) in Morocco. Most analysts had projected that these facilities would be flooding the market by now, causing prices to plummet. That has not happened so far due to a combination of developments. A slower-than-planned start-up of each of these facilities is one of them.

The MWSPC joint venture began production in July and is expected to produce about 450,000 tonnes of DAP in 2017. That is less than half of its initial plan and market expectation of about 1.0 million tonnes. We expect production will ramp up to 1.5-2.0 million tonnes in 2018 before the complex reaches a capacity of 3.0 million tonnes in 2019.

In Morocco, the JPH 3 granulation plant reportedly started up last spring utilizing phosphoric acid from other plants at the sprawling Jorf complex. The JPH 3 phosphoric acid plant started up late last summer, officially marking the increase in phosphate output, about six months later than expected. JPH 4 was scheduled to start up late this year, but industry publications have reported that commissioning is not expected until late second quarter of next year. The granulation plant likely will begin production ahead of the phosphoric acid plant by a few months, initially providing the company with more product-mix flexibility before additional phosphate comes on the market.

In the case of potash, two greenfield projects started up this year -- the 1.4 million tonne project in Turkmenistan and the 2.0 million tonne project of K+S in Saskatchewan. Two world-scale projects are scheduled to start-up in Russian next year. Potash prices have moved steadily upward since mid-2016. New supplies have not yet broken that trend. Again, one reason is the slower-than-planned start-up of new capacity.

In Turkmenistan, the small Garlyk facility reportedly was commissioned at the end of March, but only small quantities from this facility have shown up in the global market this year, indicating that either most of the output is staying in the local area or production is ramping up more slowly than expected.

In Saskatchewan, the K+S Bethune facility produced its first tonne of potash on June 12, but the company did not export its first vessel of standard grade product until October 24. Management recently indicated that the facility is expected to produce 500,000 tonnes KCl this year, down from its prior estimate of 600,000 to 700,000 tonnes. Management also said it expects output to climb to 1.7 million tonnes in 2018. Management also noted that Phase II of the project, taking capacity from 2.0 to 2.9 million tonnes per year, will not come online until the second half of the next decade.

In Russia, EuroChem is developing two world-scale projects – the Usolskiy facility in the Perm region (home to Uralkali operations) and the Volgakaliy project in the Volgograd region. Management laid out the expected ramp up of these facilities in a recent investor presentation. Capacity is expected to total 1.1 million tonnes KCl in 2018, but management emphasized that production likely will be less than capacity at around 500,000 tonnes next year. The Usolskiy mine is expected to start up either very late this year or early next year and produce 500,000 tonnes in 2018. The Volgakaliy project in the southern Volgograd region is not expected to begin commercial production until early 2019. Combined capacity is projected to ramp steadily over time reaching 2.3 million tonnes in 2019 and 3.5 million in 2020, but the facilities are not expected to reach design capacity of 8.3 million tonnes until 2024 or 2025.

There are two greenfield projects at early stages of development in Belarus that are not expected to begin commercial operation until after 2022. The first is the Belaruskali Petrikovsky project in the southern Gomel region. The second is the Slavkaliy project at Nezhinsky.

Optimizing Operations

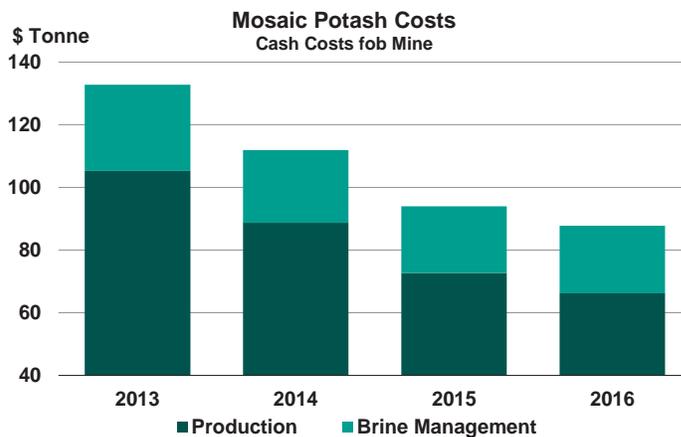
Like the bison, some companies are charging directly into this storm. They are optimizing operations by idling higher-cost facilities and running lower-cost operations at high and steady rates in order to reduce unit costs and compete profitably in this new market environment. North American potash producers, having riled up the atmosphere with their own expansions, have led the charge. Phosphate producers typically have fewer options to flex operations, but significant structural changes also are beginning to take place from China to the United States.

Potash Supply and Demand

Let's start by looking at the changes in the North American potash industry. Like producers elsewhere, Canadian producers invested large amounts of capital to expand operations following the 2007-08 price fly-up. The combination of excess capacity, declines in global shipments in 2015 and 2016, and the collapse of currencies and costs in the FSU resulted in a sharp drop in potash prices in 2015/16. Facing lower prices and the eventual start-up of these greenfield projects, North American producers made changes - optimization became the name of the game. North American producers have indefinitely idled or permanently closed 3.6 million tonnes of capacity since 2014.

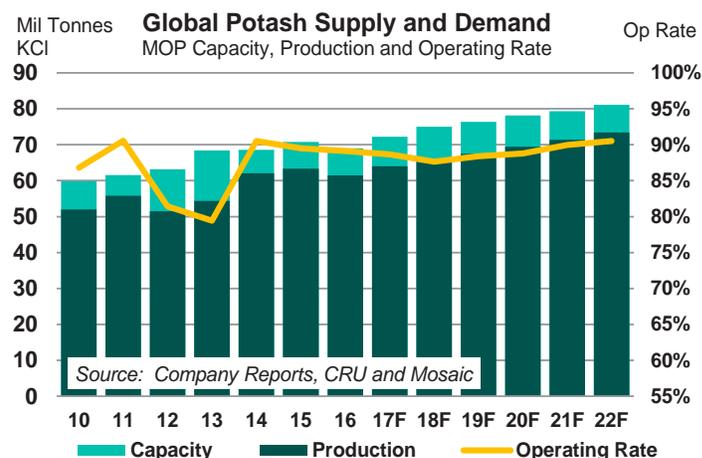
In fact, nearly all of the North American facilities that were at the right end of the industry cost curve are closed today.

In the case of Mosaic, cash costs fob mine declined 34% from \$133 tonne KCl in 2013 to \$88 tonne in 2016. Mosaic closed two smaller and higher cost operations at Hersey, MI and Carlsbad, NM in 2014 and temporarily idled its Colonsay operation in Saskatchewan for part of 2016.



Outside North America, other companies also are beginning to optimize operations by idling or closing high-cost operations or transitioning to the production of specialty products. For example, K+S recently announced that it will close the Sigmundshall mine in Germany by the end of next year just as the Bethune operation is ramping up, and ICL is rapidly transitioning its UK Boulby mine from MOP to polyhalite production.

The bottom line is that the combination of 3% demand growth, realistic ramp-ups of greenfield projects, and recent optimization of existing operations results in a reasonably balanced outlook for the next five years – not the Potash Armageddon forecast by many analysts. Our most recent estimates show that the global operating rate is forecast to dip from 89% in 2016 to around 87% in 2018 before trending back up to 90% by the end of the forecast period.

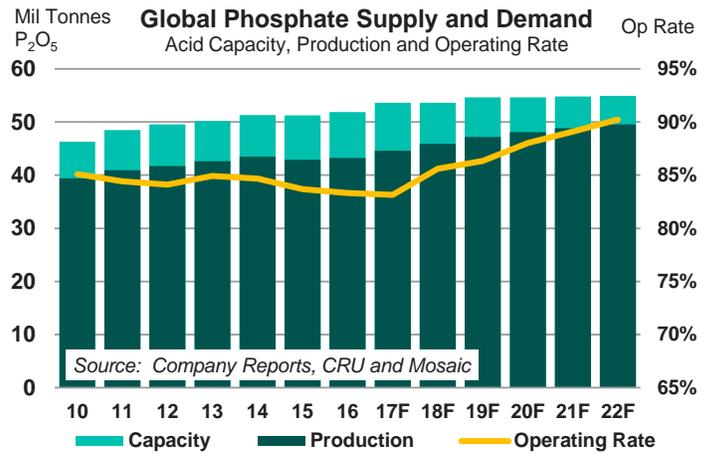


Phosphate Supply and Demand

In the case of phosphate, similar changes are beginning to take place. For example, Mosaic announced the temporary idling of its Plant City facility on October 31. The loss of 1.5 million

tonnes of DAP/MAP production eventually will be more than made up by its 25% of MWSPC output (750,000 tonnes when fully ramped up) and the solid high-analysis capacity obtained from the pending acquisition of the Vale Fertilizantes S.A. business (about 1.8 million tonnes of MAP/TSP at Uberaba). So Mosaic will continue to serve its customers from North America to Brazil to India from a more diversified and cost-competitive portfolio of phosphate facilities.

Some changes are taking place and more are expected to take place in China next year. While we were too early in making this call, we still expect that a significant restructuring of the large and diverse Chinese industry will occur – driven mainly by new environmental taxes and tighter regulations. However, Chinese DAP/MAP/TSP exports were up 20% through October and likely will end the year at or even a bit greater than the 9.5 million tonnes exported last year. Larger-than-expected exports this year are a testament to strong demand growth and relatively high export prices. Nevertheless, interests of the domestic industry that seeks to boost profitability and interests of the central government that wants to improve air and water quality are closely aligned. At the end of the day, we expect China will produce slightly less phosphate but from a smaller, more profitable and environmentally compliant industry in the near future.



The bottom line for phosphate looks even more constructive than for potash. There are no world-scale projects in the pipeline behind JPH 3 and JPH 4 in Morocco and MWSPC in Saudi Arabia. If demand grows at the moderate pace of just more than 2% per year, we project that the global phosphoric acid operating rate will trend upward from 83% in 2016 to 90% by 2022. The idling of Mosaic’s Plant City facility is expected to help boost this rate from 83% in 2017 to 86% in 2018 and pull forward the projected recovery about one year.



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This document contains forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995. Such statements include, but are not limited to, statements about our proposed acquisition of the global phosphate and potash operations of Vale S.A. (“Vale”) conducted through Vale Fertilizantes S.A. (the “Transaction”) and the anticipated benefits and synergies of the proposed Transaction, other proposed or pending future transactions or strategic plans and other statements about future financial and operating results. Such statements are based upon the current beliefs and expectations of The Mosaic Company’s management and are subject to significant risks and uncertainties. These risks and uncertainties include but are not limited to risks and uncertainties arising from the possibility that the closing of the proposed Transaction may be delayed or may not occur, including delays or risks arising from any inability to satisfy closing conditions; difficulties with realization of the benefits of the proposed Transaction, including the risks that the acquired business may not be integrated successfully or that the anticipated synergies or cost or capital expenditure savings from the Transaction may not be fully realized or may take longer to realize than expected, including because of political and economic instability in Brazil or changes in government policy in Brazil; the predictability and volatility of, and customer expectations about, agriculture, fertilizer, raw material, energy and transportation markets that are subject to competitive and other pressures and economic and credit market conditions; the level of inventories in the distribution channels for crop nutrients; the effect of future product innovations or development of new technologies on demand for our products; changes in foreign currency and exchange rates; international trade risks and other risks associated with Mosaic’s international operations and those of joint ventures in which Mosaic participates, including the performance of the Wa’ad Al Shamal Phosphate Company (also known as MWSPC) and the entity operating the Miski Mayo mine, the risk that protests against natural resource companies in Peru extend to or impact the Miski Mayo mine, the ability of MWSPC to obtain additional planned funding in acceptable amounts and upon acceptable terms, the timely development and commencement of operations of production facilities in the Kingdom of Saudi Arabia, the future success of current plans for MWSPC and any future changes in those plans; difficulties with realization of the benefits of our long term natural gas based pricing ammonia supply agreement with CF Industries, Inc., including the risk that the cost savings initially anticipated from the agreement may not be fully realized over its term or that the price of natural gas or ammonia during the term are at levels at which the pricing is disadvantageous to Mosaic; customer defaults; the effects of Mosaic’s decisions to exit business operations or locations; changes in government policy; changes in environmental and other governmental regulation, including expansion of the types and extent of water resources regulated under federal law, carbon taxes or other greenhouse gas regulation, implementation of numeric water quality standards for the discharge of nutrients into Florida waterways or efforts to reduce the flow of excess nutrients into the Mississippi River basin, the Gulf of Mexico or elsewhere; further developments in judicial or administrative proceedings, or complaints that Mosaic’s operations are adversely impacting nearby farms, business operations or properties; difficulties or delays in receiving, increased costs of or challenges to necessary governmental permits or approvals or increased financial assurance requirements; resolution of global tax audit activity; the effectiveness of Mosaic’s processes for managing its strategic priorities; adverse weather conditions affecting operations in Central Florida, the Mississippi River basin, the Gulf Coast of the United States or Canada, and including potential hurricanes, excess heat, cold, snow, rainfall or drought; actual costs of various items differing from management’s current estimates, including, among others, asset retirement, environmental remediation, reclamation or other environmental regulation, Canadian resources taxes and royalties, or the costs of the MWSPC, its existing or future funding and Mosaic’s commitments in support of such funding; reduction of Mosaic’s available cash and liquidity, and increased leverage, due to its use of cash and/or available debt capacity to fund financial assurance requirements and strategic investments; brine inflows at Mosaic’s Esterhazy, Saskatchewan, potash mine or other potash shaft mines; other accidents and disruptions involving Mosaic’s operations, including potential mine fires, floods, explosions, seismic events, sinkholes or releases of hazardous or volatile chemicals; and risks associated with cyber security, including reputational loss, as well as other risks and uncertainties reported from time to time in The Mosaic Company’s reports filed with the Securities and Exchange Commission. Actual results may differ from those set forth in the forward-looking statements

4R Principles of Nutrient Stewardship



RIGHT SOURCE
Matches fertilizer type to crop needs.



RIGHT RATE
Matches amount of fertilizer to crop needs.



RIGHT TIME
Makes nutrients available when crops need them.



RIGHT PLACE
Keeps nutrients where crops can use them.