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SiC PRICING REMAINS STRONG



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During the first days of January, when asked about the state of the global SiC industry, a trader told ***SiC & More***, "We are currently in a state of flux."

Global SiC prices continued to increase through the first couple weeks of December then plateaued for the balance of the month and into January. Nevertheless, the same concerns that faced the majority of the global SiC industry during late 2021 remain in play as we enter 2022. Issues #89 and #90 of *SiC & More* focused on six reasons that global supply was in duress and prices were increasing seemingly with each passing day.

As we enter the New Year, the Chinese environmental police continue to either curtail or shut down major industrial polluters. Although SiC inventory levels have improved along the entire supply chain, there remains significant concerns about the amount of SiC being furnaced and the lack of ships departing Chinese ports. A third reason, which seems to be haunting every global SiC furnace plant, is the cost of energy. A fourth concern is the ever-increasing cost of raw materials necessary to furnace SiC, with emphasis on pet coke and anthracite. Although improved, the global supply chain remains in disarray. Lastly, the cost of FeSi appears to have eroded just a bit settling in at $2.75-$3.00 pound contained but remains at historical highs.

The Beijing Winter Olympics are scheduled to open on February 4 and when they close on February 20, many believe the industry will exit the "state of flux". The looming Winter Olympics have had a profound effect on the environmental situation as the central government has stressed the importance of the "Olympic Blue Sky" policy thus closing hundreds of polluting industries as mentioned above. Unfortunately, for the world's SiC consumers, the "Blue Sky" policy means numerous SiC furnace plants have been closed across the Chinese landscape. Making a positive environmental impression on the rest of the world trumps the production of SiC and other commodities that result in unacceptable amounts of emissions.

Besides the Beijing Olympics, a 16-day Chinese Lunar New Year will also interfere with production activities across the country. Although the New Year runs simultaneous with the Olympic games, it will also represent a period of anemic productive capacity at the furnace plants that are still operational due to extended celebrations.

In short, although the industry is currently in a state of flux, the dynamics associated with the aforementioned six points lead most experts to believe that SiC supply could still be an issue as we close out Q2 and enter Q3 2022.

A trader's comments, however, seem to imply a change in industry structure could be on the horizon. He said, "The price of energy has increased significantly and many of us doubt we will return to the old structure. We heard during the first week of January the electricity rates in the Gansu province of China were $.07 per kWh and over $.08 in Ningxia. The plant in Vietnam is having issues getting enough electricity and it's believed that Sublime in South Africa is having issues striking a deal with ESKOM. It used to be a 3 ½ or 4 cent kWh price meant you had

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ELSID



Recent communications with Elsid confirmed that the SiC and graphite furnacing operations remain active and, according to one of the management team, "All monthly production is sold. The demand is higher than actual process possibilities based on a mix of energy levels possible for the actual period."

In other words, Romanian manufacturing is also faced with what many call a global energy crisis. That is interesting considering Romania traditionally has enjoyed the third lowest energy import dependency rate in the EU. Although that status has changed over the last few years, Romania's electricity mix is one of the most balanced in the EU. That mix includes hydropower, coal, nuclear energy, fossil gas, and wind power. In addition, despite varied opinions regarding how committed eastern European countries are when it comes to the carbon footprint, Romania puts that issue to rest with the final version of the National Recovery and Resilience Plan. The country committed to a coal phase out by 2032.

Where does that put ELSID and the production of both SiC and graphite? As reported in issue #86 of ***SiC & More***, ELSID produces SiC at its plants located in Titu and Slatina. Depending on market conditions, ELSID produces 28,000-40,000 metric tons per year of SiC and high-quality graphite with the option to increase production if energy is available.

Nevertheless, ELSID faces the same energy uncertainty as most of the world's high-energy consuming industries. Are kilowatts available and what is the price? In fact, ELSID management said, "Any prognosis should be done only on short period." In other words, on any given week, the price of kWh could eclipse an acceptable cost of goods matrix. Regardless of the daily kWh challenges, ELSID management remains committed to maintaining production levels and satisfying the needs of their customers.

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a world-class furnace plant. I doubt anyone is currently under 5 cents and I will be surprised if any SiC furnace plant anywhere in the world sees that type of electricity rate ever again. I'm concerned that we are on the cusp of a completely new global standard for the cost of energy, which will have a profound effect on the cost of SiC or any other commodity that requires large amounts of kilowatt hours."

After consulting with SiC producers from around the world, as well as long-term observers, the consensus is that a respectable percentage of the run-up in price over the last 6-12 months is likely to remain in place. The demand for energy and the more stringent regulations regarding coal-fired generating stations is creating a shortage across the globe. Dedicating valuable kWh to high energy consuming manufacturing facilities that also pollute the environment is growing in unpopularity.

With kWh costs representing the largest portion of SiC cost of goods, in the next few issues, *SiC & More* intends to focus additional attention on the effects of kWh pricing on SiC and end-use market pricing.

In summary, readers should be aware that there is still a global shortage of SiC and after we exit this January/February "state of flux" the shortage is likely to remain and additional end-use market price increases should be expected.

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SiC Update from South Africa

Since the Sublime SiC furnace plant was first commissioned, ***SiC & More*** has made it a priority to remain in contact with ownership and management. However, only on a few occasions over the past 20 years has that linkage been more important than it is today. With global SiC supply struggling to keep pace with demand, and the supply situation in China seemingly tentative, tonnage from a furnace plant that has been generally underutilized virtually since day-one is vitally important.

In issue #90, ***SiC & More*** reported that conversations with Leonardo Curimbaba of the Curimbaba Group were ongoing and when it came to the restart of Sublime's #1 transformer, Leonardo commented, "We are discussing this matter with the local electricity supplier, once we need their allowance to purchase more energy."

Sublime is currently operating only transformer group #3, which yields about 18,000 metric tons per year. The aforementioned tonnage, however, is sold-out making a restart of unit #1 all that much more intriguing.

SiC & More had heard rumors from industry sources that the Curimbaba Group was entertaining bringing on board a financial partner to restart the #1 unit. ***SiC & More*** asked Leonardo about that rumor and he graciously responded, "Due to the high volatility of the silicon carbide market, the Curimbaba Group is considering all economically viable possibilities to restart furnace 1. One of these possibilities is to finance the restart of the furnace by partnering with a major client that the current crisis could put in difficulty in the long term."

Leonardo continued, "Nothing has yet been decided, neither the restart of the furnace nor the internal or external financing of this potential restart once we need also a green light from the electricity supplier (ESKOM)."

Therein lies much of the rub when it comes to the production of SiC, namely a "green light from an electricity supplier". ESKOM has been somewhat unpopular in South Africa due to price increases and a proposed tariff hike of 20.5%. According to research by Power Optimal, the price of electricity increased by 753% between 2007 and 2021 compared to inflation of 134%. ESKOM counters the opposition by citing the increase in energy supplied by independent producers, a carbon tax, and the increased price of coal.

The issues surrounding reliable supply and pricing of kWh is not going away. This is a global issue and manufacturing will bear their share of the brunt by paying higher than historical rates for kWh. The end-use markets are unlikely to see 2019 or 2020-level pricing ever again for commodities that require extraordinary amounts of energy.

The SiC industry will wait and see what transpires in South Africa, however, ESKOM will play a big role in the Curimbaba Group's decision to restart Sublime's #1.

Syrah Resources

Binding Active Anode Material Offtake Agreement with Tesla:

Syrah Resources Limited (ASX:SYR) ("Syrah") announces that it has executed an offtake agreement ("Agreement") with Tesla, Inc. ("Tesla") to supply natural graphite Active Anode Material ("AAM") from its vertically integrated AAM production facility in Vidalia, USA ("Vidalia").

Tesla will offtake the majority of the proposed initial expansion of AAM production capacity at Vidalia at a fixe price for an initial term of four years commencing from the achievement of a commercial production rate, subject to final qualification. Tesla also has an option to offtake additional volume from Vidalia subject to Syrah expanding its capacity beyond 10kt per annum AAM.

The Agreement provides a compelling foundation to proceed with the initial expansion of Vidalia's production capacity and Syrah plans to make a final investment decision for construction of this expanded facility in January 2022, subject to financing commitments.

Syrah is advancing commercial and technical engagement with other target customers to develop Vidalia for mass production and secure additional long-term purchase commitments for Vidalia.

Greenhill & Co acted as financial adviser to Syrah. White & Case acted as legal adviser to Syrah.

This release was authorized on behalf of the Syrah Board by Shaun Verner, Managing Director.

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Metals Industry Update

Chrysler

At CES 2022, Chrysler's top executives announced that the brand would transition to an all-electric vehicle lineup by 2028. Chrysler, one of 14 brands under the Stellantis flag, will also introduce its first battery-electric vehicle in 2025. Stallantis has committed to a $35 billion investment in being fully electric.

Ford

Ford has increased production plans for its electric F-150. Plans for the so-called "Lightning" pickup have gone from initial production of 40,000 trucks to 80,000 in order to respond to consumer interest. The company announced on January 4 that it would increase production again to meet demand. Ford is expected to start delivering the EV pickup truck during 1H 2022.

US Trade Deficit

According to the US Commerce Department, the trade deficit between the United States and the rest of the world grew by 17.5% to nearly $98 billion in November. The trade gap number surpassed September's $97 billion. Imports were up in every category and exports declined by 2.1%.

US Unemployment

The unemployment rate in the U.S. fell below 4% and wages experienced an increase.

Rivian Automotive

California-based Rivian's announced that they will build the electric truck and commercial vehicle maker's second facility east of Atlanta and eventually hire about 7,500 workers. The Rivian plant is expected to cost $5 billion.

Indonesia and Coal

Indonesia is the world's largest exporter of thermal coal shipping about 400 million tonnes out of the country in 2020. The Indonesian government, however, banned the export of coal during the month of January 2022 due to low supplies at domestic power plants. Indonesia, one of the world's top 10 global greenhouse gas emitters, export coal primarily to China, India, Japan, and South Korea.

U.S. Vehicle Sales

Although well below the average of 17.2 million units during 2014 and 2019, the industry isn't lamenting final 2021 deliveries of 15 million units due to selling what can be considered as limited production of higher margin models.

Rolls-Royce Motor Cars

The British brand announced that it had record annual sales of its luxury status vehicles. The German-owned carmaker said sales grew almost 50% with records set in most regions. "2021 was a phenomenal year for Rolls-Royce Motor Cars" said Chief Executive Torsten Muller-Otvos in a statement. Rolls-Royce is also planning to introduce Spectre, its first all-electric car.

ASK Chemicals Group

ASK Chemicals Group, headquartered in Hilden near Düsseldorf (Germany), has successfully opened their new manufacturing facility in El Carmen, Mexico. With this step, the company is strengthening its position in the North American foundry market and advancing its expansion strategy. Production is starting up with no bake and cold-box binders. Other product lines will follow during 2022.The new site is designed to meet current and future demands of the growing Mexican market - one of the most important markets for the international automotive industry and its suppliers. As a responsible manufacturer, the Mexican plant has been designed according to the latest manufacturing and safety standards. Bob Gage, Executive Vice President (North America): "I am very proud of our team in Mexico - opening a plant during the pandemic was extremely difficult and presented many challenges. The fact that the plant is now operating is an important and strategic step for our company. We look forward to better serving our Mexican customers and building a successful future together."

Commercial Metals (CMC)

CMC announced this morning (1/10/22) that it intends to build a brand-new long products micro-mill somewhere in the eastern United States. According to an official press release, the new micro-mill will serve the Northeast, Mid-Atlantic and Midwestern regions. Site selection for the new mill is underway. (Source AIST)

Harley Davidson

Harley Davidson recently announced a deal with AEA-Bridges Impact Corp. and Taiwan-based Kymco to contribute money to Harley's LiveWire group.

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NHQ REMAINS IN SOLD-OUT POSITION



NHQ furnace being cracked and readied for processing

As one of the newest SiC furnace facilities on this planet, it never ceases to be interesting to receive updates from New He Qiao Shareholding Company (NHQ). For one thing, it is noteworthy to get a taste for how the company is weathering the COVID and energy issues that face manufacturing worldwide.

When we checked in with NHQ in November 2021, they advised that improvements to transformer group No. 2 had been postponed due to continued issues associated with the COVID pandemic. The most recent plan is to complete this project during 1H 2022, which will increase the productive capacity of the SiC furnace plant.

Regarding electricity prices, in November, NHQ management told ***SiC & More***, "It has increased by 20% because Vietnam is buying electricity from China, now China is lacking power, it leads to the increase of Vietnam's energy." Despite the increase in the price of kWh, NHQ has enough power to operate at capacity. Management commented, "Yes, currently we can get sufficient energy to run full capacity." The energy might be expensive, but it's vital the NHQ's future that they meet commitments to customers.

In fact, when it comes to customers, according to management, "Yes, orders of 1st quarter is almost full and loading arrangement is busy before and after lunar new year holiday."

When it comes to raw materials NHQ confirmed that anthracite remains at record breaking levels. Considering the impact that energy and anthracite have on manufacturing costs, one can quickly appreciate that the recent run-up in SiC pricing is totally justified.

Like most other industries and occupations, the COVID pandemic continues to take its toll on SiC producers. NHQ continues to weather the COVID storm but has also implemented stringent company policies to mitigate the effects of the virus. NHQ recently informed customers, "Trying our best to overcome the difficulties and maintain our production and delivery", and to this point the company has been successful in meeting commitments.

When asked about the pitfalls to a successful 2022, management responded, "In 2022 the biggest obstacles for us will be COVID and energy."

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AEA will contribute $400 million in cash held in trust and Harley and Kymco will both invest $100 million. The deal, when closed, means LiveWire shares will be traded on the NY Stock Exchange under the symbol LVW. This move also means that LiveWire will be the first publicly traded EV motorcycle company in the U.S. The forecast is for LiveWire to reach sales of $1.7 billion by 2026.

Lithium Ion Battery Pack

A late Q4 report from BloombergNEF showed that lithium-ion battery pack prices fell 6% from 2020 to 2021 and 89% in real terms to $132/kWh. In 2010 the price per kilowatt-hour was $1,200.

US Steel

US Steel recently announced that it would construct a new $3 billion mini mill in Osceola, Arkansas. The new mill will be located near the Big River Steel mill and the two new electric arc furnaces will add another 3 million tons per year of raw steel bringing the facilities to 6.3 million tons per year.

Nucor Corp

On January 12, Nucor announced that it would build a new $2.7 billion sheet metal plant in West Virginia. The facility is expected to be operational during 2024.

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Al203 Update



Crude alumina lumps

Just two short months ago, ***SiC & More*** reported that pricing on BFA parcels leaving China during January and February would reflect additional pricing angst and supply would remain tight. A trader recently confirmed our thoughts when he said, "Brown fused leaving China in January will be at some of the highest prices in history. Maybe not the highest, but darn close."

The price of bauxite has obviously increased and the same can be said for kWh pricing. However, the closing of aluminum oxide smelting (furnacing) plants in China, with emphasis on the Henan province, enters into the equation. In other words, the "Olympic Blue Sky" policy has created a supply issue by forcing the temporary or permanent closing of many of China's 60 sizeable aluminum oxide plants. According to a reliable source, less than 25 facilities were running during early January and none of them are operating over 80% of capacity with the majority of them running at 50%. As we close out January, global demand for BFA still exceeds supply.

Most BFA furnace plants that were temporarily closed under the "Olympic Blue Sky" policy are expected to remain closed until the last week of February. That is also the case for most fused MgO and DBM plants.

The pricing impact since the beginning of 2021 has been staggering. For example, BFA arriving in NOLA during January 2021 might have been selling in the range of $600-615 net ton. In January of 2022, however, that same material was selling in the range of $880-905 delivered to NOLA.

When asked about pricing during Q2 2022, a trader offered, "Many international BFA buyers are on the sidelines believing that once the Olympics have concluded the Chinese government will open the spigot and let virtually all of the high energy consuming smelters that create pollution run at or near capacity. On the other hand, I have talked to smelters who believe this is survival of the fittest and the smaller producers that have no intentions of investing in emission controls will not reopen. This will keep supply low and prices at a healthy level."

SiC & More also checked in with Leonardo Curimbaba of the Curimbaba Group. The Curimbaba family is a diverse producer of fused minerals owning and operating the ELFUSA division that is well known for its aluminum oxide production. According to Leonardo, "Regarding Al2O3, I'd like to say that ELFUSA is operating at full capacity. The main problem faced right now is related to the logistic to export ELFUSA's products overseas. Freight is extremely high and it's really difficult to get room in the vessels." Although that is unquestionably an issue, it is also a problem facing virtually every manufacturing concern attempting to move cargo, whether by ship in either bulk or containers, by barge, or even by rail or motor freight.

There remain a few other issues as well. For example, China has implemented a "Zero Covid" policy whereas a city can be virtually shut down to avoid the spread of the virus. This policy creates disruptions, lockdowns, closures, transportation issues, manufacturing, etc. Since the beginning of the year, cities like Xi'an (13 million residents), Tianjin (major port city of 14 million), Luoyang (7 million), Yuzhou (1 million), and others have suffered disruptions if not total lockdown. Obviously, this sort of policy will disrupt production and delivery.

As far as BFA pricing is concerned, there are many variables in play that could affect the price going forward. As it stands today, virtually every BFA end-use market will see price increases well into Q3. If the spigots do get turned on during March, and supply is readily available, many are convinced that transportation issues will continue to linger. A processor said, "I expect prices to increase during Q2 and Q3 and hopefully stabilize during Q4. After all, it's my job to plan for the worst and hope for the best."

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MgO & More

In issue #88 of ***SiC & More*** (July 2021) a trader said, "When it comes to MgO, I think the Chinese, who control the majority of the fused and DBM supply, are playing the long game. The continued consolidation will eventually lead to four or five larger and more powerful groups controlling supply and pricing. In some ways this could add stability to what has historically been a somewhat volatile market. We will see."

In both issues #88 and #89, we expected end-use market prices to increase on both FM and DFM, as well as bauxite and BFA, during the balance of 2021 and throughout 2022. So far, those thoughts have come to fruition.

A large percentage of the MgO price increases can be attributed to the curtailments and shutdowns of key producers due to environment issues. Most of the large DBM producers have made significant investments in pollution control equipment and continue to make improvements in order to remain operational. Although these investments are good for the environment, there is a cost associated with the capital improvements that is being passed down the supply chain.

Although demand for DBM has exceeded supply for the better part of the last 12 months, a short-term oversupply has existed for FM. Prices on FM actually faltered a bit during early January 2022 due to the oversupply. That is about to change. There have been announcements and rumors over the last few weeks that lead many to believe that DBM and FM producers will have energy either further curtailed or shutdown altogether. Several facilities will have production completely shutdown from January 28 through March 15. The shutdown will all but ensure that demand will exceed supply of DBM and FM.

There is no doubt that the China's Central Environmental watchdog is hard at work and has been cracking down on illegal mining of bauxite raw ore specifically in Shanxi and Guizhou. This has been the case since early December and the result has been less production and tighter supply. In particular the supply of high-grade material has been tenuous.

A trader opened up on his opinion of recent events in China that have led to shortages and price increases. "Many customers in Asia, Europe, and especially in the U.S. suspect that the Chinese are manipulating the commodity markets. I don't know about other markets, however, I am certain that the issues associated with the commodities I follow originate with environmental and energy curtailments or even total shutdowns of furnace or mining operations. The current cost of kilowatts in most Chinese provinces is similar to what one might have paid in the EU or U.S. during 2019 or 2020. Nowadays prices are through the roof in the EU and many Chinese producers are paying 8 cents per kilowatt assuming they have access to the power."

This leads us to believe that end-use market prices are certain to remain at high levels throughout Q2 and probably deep into Q3 2022. Although some traders believe that prices will soften after the Olympics, one processor said, "I don't see end-use market prices going south until the end of 2022 or possibly into Q1 2023."

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DIGGING THROUGH THE ARCHIVES

This is the eleventh segment from the dusty but irreplaceable *SiC & More* archives. The initial segments were dedicated to abrasive-related topics and, due to popular demand, we continue to move forward with sections related to refractories. All eleven of the segments have been taken from a paper that was discovered in a file several years ago but does not bear the name of the author.

The ceramic industry is one of the largest users of silicon carbide refractory products. Saggers or setter tile and posts are used for building up the structure to carry the ceramic ware to be fried in the kilns. Pottery, tableware, sanitary ware, electrical porcelain, porcelain insulators, and bonded abrasive wheels and shapes are fired on such structures. The high thermal conductivity of the silicon carbide kiln furniture results in a faster and more uniform firing of the ware and the high resistance of silicon carbide to thermal shock affords structural shapes which have a satisfactory life experience on repeated trips through the kilns.

Silicon carbide brick are used for many special applications in furnace construction. In boiler furnace walls they have this advantage that the molten ash does not adhere to them nor react chemically with the material so that the furnace can be cleaned of ash without serious damage to the brick. Silicon carbide circle brick (shaped as segments of a ring) are advantageous for installation as water gas generator linings for much the same reasons. The clinker breaks away clean, giving longer life to the lining.

For checker brick installation, the bricks are stacked in an open assembly so that gases may pass freely through the pile, which is enclosed in a refractory housing. Checkers are used with furnaces for heat transfer operations in which hot exhaust gases passing through the unit impart heat to the bricks. When the latter are hot the direction of flow is reversed so that entering air or gases of lower temperatures are preheated by the hot bricks for subsequent use in the combustion process or for other purposes. The high thermal conductivity and emissivity of silicon carbide speed the heat transfer and its thermal shock resistance gives added life to these installations. Silicon carbide checker brick structures are also used to advantage in petroleum and gas cracking units.

Another heat transfer operation where silicon carbide refractories are used is in recuperator tubes. The tubes are set in banks and the hot gases usually flow over and between the tubes imparting heat to their outer walls. In special cases, this procedure is reversed with the gaseous medium to be heated flowing around the tubes and the hot gas heat source passing through the interior of the tubes. In recuperative installations there is no necessity for reversing the direction of gas flow, as in the case of regenerative checkers, and this obviates the need of the expensive valve reversing mechanisms required for the latter. Recuperator tubes are generally four or five feet in length, have an outer diameter of about six inches and a wall thickness of less than one inch. These shapes are produced by tamping. Recuperators have been used to advantage in soaking pit furnaces, continuous reheating furnaces, billet and slab heating furnaces, revolving and stationary glass pot furnaces, glass tanks, porcelain enameling furnace heat reclaimers, etc.

Silicon carbide tiles are used for furnace hearths. The high thermal conductivity allows quick penetration of the heat from the source beneath the hearth so that operating temperature is attained more quickly and more uniformly in the ware chamber. Silicon carbide muffles are employed to pass heat rapidly from a heating chamber to the charge inside the muffle while protecting the ware from direct impingement of the flame or deleterious effects of the furnace atmosphere. The metal industry uses silicon carbide muffles for annealing and other types of heat-treating furnaces. Similar but very much larger muffle type furnaces are used in the manufacture of hydrochloric acid and for other specialized chemical processes.

In issue #92, SiC & More will complete the refractory segment with emphasis on other refractory applications and refractory cements.

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Tirupati Graphite plc

('Tirupati' or the 'Company')

Transformational Flake Graphite Processing Technology

PRESS RELEASE: Tirupati Graphite plc (TGR.L, TGRHF.OTCQX), the specialist graphite and graphene company developing sustainable new age materials, is pleased to announce a technological milestone which will significantly improve performance of the Company's primary graphite and downstream specialty graphite production processes.

In July 2021, the Tirupati Graphene & Mintech Research Centre ("TGMRC") established a pilot scale version of its unique Column Flotation System ("CFS") which it developed for use across the Company's primary and downstream specialty graphite production plants.

After concluding successful trials, Tirupati will be shipping the first commercial scale CFS with a 1.5 MT per hour capacity, for installation and operation at its 9,000 tpa Vatomina graphite production plant in Madagascar.

The CFS developed by the Company has demonstrated a number of advantages over conventional flotation cell technologies commonly used in graphite processing including the ability to:

- reduce power consumption during the flotation stage of the process by c.40%;
- eliminate corrosion and wear in flotation thereby reducing maintenance, costs and production downtimes; and
- reduce the number of processing/floatation stages required to achieve desired graphite purity levels thereby lowering overall costs of production.

The Company will be incorporating the new CFS in its upcoming capacity expansion projects replacing three out of four flotation stages. This can be achieved without changing the planned timelines and is expected to deliver significant commercial and operational improvements, further strengthening the Company's status as a lowest cost quartile producer of natural flake graphite. Significant benefits on cost and efficiency are expected in the upcoming 18,000 tpa Sahamamy expansion due to complete at the end of Q2 2022 and in the follow on 54,000 tpa of additional capacity planned to be built in Madagascar by 2024. The Company will update the markets further in due course.

Shishir Poddar, Executive Chairman of Tirupati Graphite, said:

"Global flake graphite demand continues to grow driven by the acceleration in the transition to electric mobility and growth in other flake graphite consumption arenas such as flame retardant and thermal management applications. As such, we are increasingly confident in our strategy of rapidly increasing our production capacity.

"Our dedicated research centre in India which is the technological backbone supporting the Group's operations, has enabled us to commercialise our Column Flotation System with many unique features allowing us to further reduce our costs and increase efficiencies at our primary flake graphite operations in Madagascar, downstream specialty graphite operations in India and, in due course, our primary flake graphite projects in Mozambique as well.

"We believe in continued innovation and technological improvements and continue to make progress towards being an important contributor to the energy transition economy and in the process seize the opportunities for creating sustainable values for our shareholders."

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TOP 20 BEST SELLING ELECTRIC CARS IN 2021 AND THE RISE IN PRICE OF THE GRAPHITE, LITHIUM, COBALT AND MANGANESE USED IN THEIR BATTERIES

	Model	Sales	C ($)	Li ($)	Ni ($)	Co ($)	Mn ($)	Per Car 2021 ($)	Per Car 2020 ($)
1.	Tesla Model 3	418.7K	18.4M	393.6M	255.6M	72.7M	1.6M	1,772	847
2.	Wuling Hongguang MINI	343.7K	3.2M	62.2M	12.1M	15.6M	2M	277	108
3.	Tesla Model Y	327.3K	16.3M	372.4M	313.2M	94.1M	3.2M	2,442	1,237
4.	Volkswagen ID.4	102.8K	5.8M	129.4M	106.9M	46.7M	6.5M	2,873	1,445
5.	BYD Han EV	76.6K	5.1M	87.1M	-	-	-	1,204	342
6.	Volkswagen ID.3	67.8K	3.3M	74.7M	58.9M	27.1M	4.5M	2,486	1,236
7.	Changan BenBen e-Star	66.1K	1.6M	38.8M	17.9M	23.1M	3M	1,280	587
8.	Renault Zoe	65.7K	2.7M	62M	48.6M	22.4M	3.9M	2,124	1,054
9.	Chery eQ1	64.9K	1.7M	37.2M	14.3M	18.6M	2.4M	1,143	507
10.	Kia Niro	59.2K	2.5M	60.3M	40.6M	43.7M	3.8M	2,550	1,253
11.	Great Wall ORA Euler R1	55.4K	1.4M	34M	17.1M	22.1M	2.9M	1,397	651
12.	Hyundai Kona	55K	2.3M	55.4M	37.3M	40.2M	3.5M	2,520	1,239
13.	Nissan Leaf	55K	2.1M	54.4M	30.6M	39.6M	5.1M	2,398	1,140
14.	Roewe Clever EV300	53.6K	1.1M	26.3M	16.2M	14.3M	2.5M	1,128	538
15.	Xpeng P7	53.1K	3.1M	67.4M	46.7M	29.5M	3.2M	2,822	1,378
16.	BYD Qin Plus	49.2K	2.5M	42.4M	-	-	-	913	259
17.	Ford Mustang Mach-E	49.1K	3.2M	73.3M	57.4M	26.5M	4.6M	3,361	1,669
18.	GAC Aion S	46.6K	2.1M	51.4M	26.3M	33.8M	4.4M	2,530	1,182
19.	Hozon Neta V	44.4K	1.2M	27.8M	14.2M	14.4M	2.2M	1,349	624
20.	Audi e-tron Quattro	43.6K	2.8M	67.3M	45M	48.7M	4.3M	3,861	1,895

Source: **Adamas Intelligence** Battery Capacity & Battery Metals Tracker Registrations light duty vehicles in 100+ countries Jan to end-Nov 2021 Graphite, Lithium Carbonate Equivalent (LCE), Cobalt Sulphate (100% basis), Nickel Sulphate (100% basis) prices: **Benchmark Mineral Intelligence** Dec 2021/2020. Manganese Sulphate (100% basis): Asian Metal Dec 2021/2020

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