SiC & MORE

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INFLATION REDUCTION ACT (IRA) UNCERTAINTIES LEAVE COMPANIES GUESSING

By: Paul Harris



The underlying requirements of what constitutes foreign interests and how these would be defined and assessed under the 2022 Inflation Reduction Act are holding up investment decisions, delegates at the Fastmarkets 15th Lithium Supply and Battery Raw Materials conference in Henderson, Nevada heard in June.

A panel discussion focused on the 30D and 45X tax credits available under the Internal Revenue Code. 30D is a credit of up to US$7,500 for people who buy a new, qualified plug-in EV or fuel cell electric vehicle until 2032. 45X provides a 10% income tax credit for domestic manufacturing of certain components for solar and wind energy, inverters, batteries and critical minerals produced and sold from January 2023.

Andrew Leyland MD of Supply Chain Insights said the US administration is looking to benefit from partner nations including Canada, Mexico, South Korea, Chile and Australia, and is trying to expand that list with FTA-type rights, which may include the EU, Indonesia, Argentina and Brazil. "If you are not one of those countries IRA is a negative. The aim is to move the supply chain away from China, and the government doesn't want to subsidize the supply chain of its competitor."

Eric Norris, president of energy storage at US chemical company Albemarle said IRA has already provoked a rapid increase in investment in the sector. "It has de-risked and accelerated private industry to make regional supply chains," he said. Albemarle figures to show a doubling in the announcement of new battery plants in the USA through 2030 to around 1000GWh a year compared with before the 2022 IRA announcement. "IRA is massive. ... The regulatory environment is helping to create scale," said Norris. However, panelists commented that many of those projects had already seen an investment decision before IRA.

Foreign interest

The panelists said that the level of *foreign interest* in a project has not yet been clearly defined, which is an issue for companies with foreign partners, investment or licensing technologies from countries such as China.

"There is the issue of spirit versus the letter of the law. The spirit will be determined by whoever is sitting in the White House. The market seems to think countries will be the foreign interests, but it could be companies and individuals," said John Miller, MD and ESG policy analyst at Cowen.

Leyland said whilst still subject to guidance, if an asset is owned, controlled or under the jurisdiction of a foreign government it technically shouldn't qualify for the benefits. "The percentage of control hasn't yet been released yet, but 25% could be the level."

The perception of Chinese influence in the ownership or participation in a project could preclude access to 45X benefits granted by the Act. "There will be a lot of political pressure in the way the guidance issued and the way the IRS supervises it to ensure IRA benefits US and its partners," said Austin Devaney, chief commercial officer of Piedmont Lithium.

Leyland highlighted that cutting off projects from benefits where the technology has been licensed from China could be counterproductive given that China has the leading battery technology. "Influence of jurisdictions when licensing technology is not clearly defined and could fall out to political pressure and guidance," he said.

Tax benefits

Miller said the benefits are tax credits rather than grants. "There is no finite bucket of federal money. [30D] will go to individuals with a federal tax application. You can offset quarterly expected tax obligations, but the US Treasury is not trying to set this up as a derivative market. 30D technically goes to the individual, but it allows the automotive dealer to claim it," he said.

A key difference from these incentives compared with others offered by the government is that the "federal tax policy gives

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FRANCISCO BATISTA REPORTS FROM BRAZIL



a) Energy: Since November 2022, the Marginal Cost of Operation ("MCO") of the Brazilian electric system has been R$ 0/MWh as a consequence of the enormous amount of rainfall accumulated in the reservoirs during the last rainy season. As of today, reservoir levels are all above 85%, which is a new record-high. The energy spot price has a regulatory "Floor" of R$ 69.04/MWh ($14/MWh) and a Cap of R$ 678.29/MWh ($139/MWh) which avoids energy contracts of reaching the MCO value. Future energy price curve is very low: 2024: R$ 75/MWh ($15.6/MWh); 2025: R$ 102/MWh ($21.2/MWh); 2026: R$ 112/MWh ($23.3/MWh), and; 2027: R$ 115/MWh ($24/MWh) which stimulates consumers to contract energy in the short-term only.

The 2023 El Niño is building up to be one of the strongest ever which will likely reduce the rainfall in the next rainy season (Oct/23 - Apr/24) in the north and northeast regions of Brazil, however, the same El Niño increases by a lot the amount of wind generation in the northeast region (with installed capacity of 21GW), which is more than sufficient to offset the negative impact in hydro generation in that region (with installed capacity of 11GW). On top of that, El Niño is already increasing the rainfall in the south of Brazil, which is the primary reason for keeping the MCO at R$ 0/MWh. The conclusion is that nobody expects this El Niño to be a factor in the price of energy and there is no other factor that could push energy prices up in the foreseeable future.

b) Macroeconomics: Brazil is experiencing better than expected numbers in its economy. Inflation is dropping fast (+0.23% in May/23; +3.94% in the last 12 months), GDP is positive (+1.9% in first quarter of 2023) and stable unemployment rate. There are, however, some yellow flags to keep in mind: GDP was positive exclusively because of the agricultural record activity aligned with still high FX rate (R$ 4.9/$1) and high soft commodities prices. In terms of political scenario, the federal administration has finally presented the new fiscal policy and submitted it to congress which has approved it in the first stage with minimal changes. Although the new policy is worse than the current one it is better than the market expected from a leftist administration. The fiscal deficit is forecasted for the next two years but is still manageable.

The unexpected economic good news along with a less unfavorable fiscal scenario created a momentum for the Central Bank to start cutting the interest rate (currently at 13.75%). The forecast from Focus Report (the 100 largest financial institutions in Brazil) is that interest rate will reach 12.25% by the end of 2023 and 10.00% by the end of 2024. The FX rate is already reflecting this positive scenario by dropping from R$ 4.9/$1 (May/23) to R$4.8/$1 (Jun/23) and being forecasted to level off at R$ 4.5/$1 along 2023.

c) Commodities: we are starting to see some easing on domestic prices, but exports remain strong even in a lower FX rate scenario.

d) Politics: Lula is proving to be a completely different politician than his first two terms (2003-2010). He is unable to gather support among the political centrists (strongest force within the congress), which made him lose most major votes to date. It is expected that the new fiscal policy will be approved in the next 60 days but nobody can predict how much farther his administration will be able to go after that. Tax reform is next in line, but this is a very sensible subject that will heavily affect different segments of the economy as well as municipalities and states. Lula is still missing the necessary votes and support to move forward with it.

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SIC PRICES CONTINUE TO SOFTEN

The sluggish demand for SiC that was mentioned in issue #97 continues to characterize the state of the industry on a global basis. A producer recently commented, "The market situation continues stagnate. It is too quiet out there."

Although worldwide SiC prices are not dropping as dramatically as they did during Q1, there is still a slow incremental erosion taking place that seems likely to continue throughout the balance of 2023. When ***SiC & More*** asked a trader for an explanation, we heard the following, "It's simply a function of supply and demand. China's economy remains soft and when their ferrous metals business is slow, the entire world feels the effects. China produces over a billion tons of raw steel per year, which is over ten times that of the U.S. so when they are down just a few percent, the refractory, metallurgy and abrasives industries all suffer."

To put that in perspective, China's daily raw steel production dropped nearly 6% during May and prospects for June didn't appear to indicate an upswing. According to *WorldSteel,* the EU was down 16.3% in May 2023 compared to the same period 2022. The U.S. is down 5% YTD 2023 vs 2022.

Another trader commented, "I was thinking SiC prices might actually rebound by the first of 2024, however, I have grown skeptical of that possibility in recent months. China is slow. MgO prices have dropped more than SiC. This is not a great marketplace."

What can readers expect as we move deeper into 2023 and take a glimpse at 2024? Continuing with the trader from the previous paragraph, "If you held my feet to the fire for a price prediction, I would forecast global prices will drop during Q3 and Q4, which generally means end-use markets in the Americas and Europe will continue to soften into Q1 2024. But I do believe the largest price decreases are behind us."

Feedback from most of the SiC furnace plants outside of China lead one to believe that ownerships and managements remain apprehensive about the cost structure associated with producing SiC. The price of kWh's are erratic, pet coke and anthracite prices are volatile and often supply is an issue, and the environmental pressures seem to accelerate.

Despite the pricing forecasts that seem to indicate further softening, looking into the future, one must realize that the availability of energy is going to continue to be an issue. Hearken back to issue #97:

*The driving forces behind the (price) increases were easily identified by **SiC & More** but more importantly, we focused on what could be an industry structure upheaval. As this newsletter has reiterated over and over again, first and foremost, is the price of kWh. In issue #94, "The energy issue is essentially a worldwide crisis. To put just the unstable kWh pricing into perspective, consider SiC furnace operations that were accustomed to paying 5-8 cents per kWh have been paying a firm 10-15 cents with spot purchases of 25-30 cents with some prices even higher than 30 cents. It takes approximately 7000 kWh to produce a ton of SiC crude. In other words, depending on the region, energy alone has contributed from $350 to over $2,000 per ton to production cost."*

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you a benefit if you do a behavior," said Miller. "You have to make something to get something. You don't get something in advance," said Austin Devaney, chief commercial officer of Piedmont Lithium.

Permitting

While the US government seeks to incentivize battery supply chain development, Devaney said there is no intent to ease environmental regulations to reduce mineral project permitting times. "The US doesn't want to relax permitting standards. Permitting is more about litigation reform and litigation reform is the critical piece to speeding projects along, and coordination between different government institutions," he said.

"IRA helps with the financing of materials: it doesn't help with permitting or other barriers. It just makes one of the many headaches of bringing a project to market, slightly easier," said Leyland.

Albemarle call to action

Albemarle's Norris issued a *call to action* for partnerships to help build regional supply chains to facilitate the energy transition. Norris said Albemarle aims to increase its lithium production capacity from 200,000-225,000tpa in 2022 to 400,000-650,000tpa in 2030, including the incorporation of "newly developed extraction technology," while also boosting its conversion capacity from 200,000tpa to 500,000-600,000tpa.

"We are building the Mega-Flex plant in Richburg, South Carolina, we are restarting the Kings Mountain mine in North Carolina, expanding Silver Peak in Nevada and have built a new research central," said Norris.

Albemarle forecasts lithium demand growing to 3.7Mtpa 2037, which is about 500,000t more than production is forecast to be, "despite massive effort by the industry. We have been consistently wrong to the downside [for demand]," he said.

The company said global supply would be 3.2Mtpa by 2030 with 430,000t in North America, 800,000t in South America, 300,000t in Africa, 930,000t in Australia, 650,000t in China and 90,000t in Europe.

Norris said partnerships will be key going forward as they provide, "a big lift in understanding the needs in the supply chain," he said, citing the company's agreement with Ford. This includes recycling collaboration, domestic and FTA (free trade agreement) country supply and a sustainable mining focus.

The Mega-Flex plant will recycle black mass, the waste product from battery recycling, as well as produce from lithium raw materials.

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IGOR BURAK AND ZAPORIZHABRASIVE



An operator at Zaporizhabrasive tending to an aluminum oxide furnace.

SiC & More, via Kyryl Shapovalov (Head of Foreign Trade Dept), has had the privilege of reporting on the glaring realities of doing business in Ukraine while in the middle of a war zone. That opportunity continues for ***SiC & More*** by means of an interview with Mr. Igor Burak, the newly appointed Chairman of the Executive Board of Zaporizhzhia Abrasive Plant (Zaporizhabrasive).

Despite the blackouts and shelling caused by the war, Zaporizhabrasive has not missed a single day of work. The company has remained committed to fulfilling its contracts with loyal customers and has managed to deliver products to many different parts of the world.

During Q1 2023, Zaporizhabrasive produced just shy of 6,000 metric tons of products. According to Chairman Burak, "Production of electrocorundum (aluminum oxide) was about 1,500 m/t while SiC represented 4,000 tons, which is a 20.8% increase over Q1 2022." In Q1 2023, the company also produced 31 m/t of ceramic abrasive tools whereas in Q2 2022 there were no such products produced.

Chairman Burak added, "In 2022, in general, despite the fact that the production volume of output in quantitative terms fell in relation to 2021, in monetary terms, growth was observed, and the enterprise was profitable. The main profit for the enterprise was brought by the sale of silicon carbide and its products."

During 2022, 5.9% less products were exported compared to 2021. Chairman Burak explained, "That is, the war reduced the Ukrainian market of abrasive products to a large extent almost by half. In 2022, the capacities of our enterprise were used 40% less than in 2021. Despite this, starting production at the beginning of the war, we set ourselves the task of responding to the requests and wishes of customers as much as possible and finding the best logistical solutions for the timely delivery of products to customers."

Chairman Burak continued, "We supply about 90% of our products to the European market. We have very ambitious plans to increase the supply of products to European partners. We aim to expand not the European but also the Asian and American markets. To find new partners and opportunities, our team has visited several major international exhibitions in Italy, Germany, and Turkey over the past month. This movement forward will continue despite the war."

Zaporizhabrasive prides itself in having a portfolio of products that meet the industry's highest standards of quality and efficiency. For example, Zaporizhabrasive produces a full line of FEPA F and FEPA P grit sizes for the abrasive industry as well as a complete list of fractions for the refractory industry. In addition, the Zaporizhabrasive portfolio includes brown fused aluminum oxide micro grits produced on a wet sedimentation line as well as boron carbide and boron nitride. This impressive grouping of products are sold in over 30 countries including Austria, Germany, France, England, Spain, Belgium, Switzerland, Italy, Germany, Czech, Turkey, Poland, U.S. and others.

Chairman Burak and his team intend to take this impressive portfolio of products to other markets such as in Scandinavia where high quality, just-in-time delivery, and impeccable customer service are a priority. Zaporizhabrasive is proof that not only can a company survive in disastrous times, but it can remain progressive and thrive through the efforts of its work force and the vision of its leadership.



Customer orders being staged and loaded for dispatch out of one of the Zaporizhabrasive warehouses.

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DIGGING THROUGH THE ARCHIVES

It's an adventure locating old documents in your library and the process can often be enlightening. This is the 17th segment from the dusty but irreplaceable *SiC & More* archives. The literature that has been pulled from the archives makes it apparent that the evolution of the business often goes unnoticed. These segments are also great reminders of the many years of tedious research done by those that came before us in this remarkable industry. We close this particular segment of *Digging Through the Archives* with emphasis on *Facts About Silicon Carbide* with the following short excerpt that does not bear the name of the author.

Continued from issue #97:

Rectification and Luminescence: B. Claus studied the effect of the oxidized surface layer of the crystal and explained the rectification effect of silicon carbide as due to these layers. This layer has been described as the cause of the luminescent phenomena which appear on the surface when a probe carrying a voltage is applied to the surface. The luminosity varies in color and appearance with the sign and amount of the voltage. The luminescent effect appears to have been first reported by a O.V. Lossev and was further studied by B. Claus.

Thermal Properties: Silicon carbide is stable at relatively high temperatures. It dissociates, without fusing, at about 2,250 degrees C. Air will oxidize it above red heat, but only slowly. It has high thermal emissivity. The thermal conductivity is high and thermal expansion low, compared with other refractory materials.

These properties make silicon carbide an important special refractory material but when bonded into refractory shapes it is obvious that the components of the bond will effect the numerical data for these properties. Since it is only as refractory shapes that the figures have real significance, further discussion of these properties will be left for the section covering refractory products.

Since George G. Acheson first began experimenting with mixtures of clay and carbon in an arc-type laboratory furnace attempting to convert the carbon into diamond, there have been thousands of papers written about the attributes and applications of silicon carbide. Over the past 130 years, since those first Acheson experiments, applications have come and gone yet this "accidental discovery" continues to have a rich history and arguably the greatest discoveries are still in front of us.

SiC & More will continue to dig through the archives searching for nuggets of information while also making efforts to report on cutting edge technology such as SiC slowly replacing Si in EV batteries, Yellow SiC and their renewable hydrogen via direct unassisted photocatalysis project, and CUMI's high purity SiC single crystal project for the hi-tech industry. Yes, the best is yet to come.

CUMI

As recently as November 2022, ***SiC & More*** sat down with Anantha seshan Narayanan (Ananth) when he provided a bit of history and vision in jus a few paragraphs.

CUMI is part of the 120-year-old Murugappa Group, one of India's leading business conglomerates. CUMI started as an Abrasives company in 1954. With value chain integration, CUMI has expanded its portfolio to become a Mines to Market Company with integrated operations including mining, power generation, fusion, manufacturing, marketing, and distribution. CUMI operates as a global player – a global vision that preserves the local ethos. Whether in India or around the world, long-standing relationships and networks have enabled CUMI to become what it is today – a leading materials science engineering company.

In addition, at that time, Ananth said, *Apart from strengthening and improving its core businesses, CUMI is working towards addressing future trends and emerging areas like high purity silicon carbide for semiconductors, graphene, synthetic graphite, ceramics for electric vehicles, energy storage solutions in cold chain logistics, building cooling and thermal protection for EV batteries.*

Most recently, Ananth reiterated the focus on addressing future trends and emerging technologies when he told ***SiC & More***, *At CUMI our focus now is on producing silicon carbide raw material at the required purity levels and build it into commercial scale. Towards this, investments are being made in the fusion and chemical treatment facilities which are expected to come on stream by early next year. The investments we have made in crystal growth reactors is to understand the quality parameters that we need to achieve in the raw material to deliver good quality crystals.*



CUMI high purity SiC for growing single crystals for the hi-tech industry.

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TIDBITS FROM CURIMBABA GROUP

SiC & More recently checked in with Leonardo Curimbaba, Managing Director of the Curimbaba Group. Always of interest to readers are the subjects of Sublime, SiC, and Curimbaba's aluminum oxide business.

Sublime, Africa's only SiC producer, is still operating with two (2) furnace groups. The furnace plant was planned to operate at about the same production level as in 2022 and that appears to still be the case. According to Leonardo, "Although we have the capacity to produce more out of the furnaces, the market is not promising." No doubt, ample supply out of China leading to price erosion has most producers on edge. For review, during the summer of 2022, in order to meet customer demand, Sublime restarted transformer group #1 after about six (6) months of repairs after sitting idle for a few years.

Regarding aluminum oxide, ELFUSA is still enjoying respectable sales and operating at 80% of capacity. However, a concern is the Brazilian Real exchange rate. The Real has increased value by about 8% over the past six months and that obviously puts pressure on both the domestic market and on exports.

As always, it's a pleasure to get a quick update from Leonardo regarding activities at the Curimbaba Group. The Curimbaba family has been producing fused minerals since 1961 with its initial bauxite mining and processing venture. The Curimbaba name remains synonymous with bauxite, aluminum oxide, proppant, and silicon carbide amongst other industrial minerals and value-added products.

WOLFSPEED

Source: www.wolfspeed.com

At Wolfspeed, we are driving the industry transition from silicon to Silicon Carbide. To meet the increasing demand for our groundbreaking Wolfspeed technology that supports the growing electric vehicle (EV), 4G/5G mobile and industrial markets, we are establishing a Silicon Carbide corridor on the East Coast of the United States.

We have built the world's first, largest, and only 200mm Silicon Carbide fabrication facility in Marcy, New York. This brand new, fully automated power wafer fabrication facility will be automotive-qualified as well. It is complemented by our mega materials factory expansion currently underway at our Durham, North Carolina headquarters. The new fabrication facility dramatically increases capacity for our Wolfspeed Silicon Carbide business and supports the transition from silicon to Silicon Carbide.

Besides the aforementioned excerpt from the Wolfspeed web site, a group of lenders led by Apollo Global Management, Inc. recently announced that $2 billion will be available to support Wolfspeed's expansion plans in the U.S. The financing package will make $1.25 billion available immediately with another $750 million available for future drawing.

Silicon Carbide & More

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