INFERENTIAL FOCUS

*in*FOCUS Context Update

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The Rise of EVs: The Lithium Commodity Conundrum

On January 25, General Motors CEO Mary Barra announced an investment of more than $7 billion in four Michigan manufacturing sites. The investments will include $2.6 billion for a new battery plant through a joint venture with LG Energy Solutions and $4 billion to convert its Orion Assembly plant in suburban Detroit to produce electric pickup trucks. The truck plant and the new 2.8 million-square-foot battery plant are expected to begin production in 2024. "We will have the products, the battery-cell capacity and the vehicle-assembly capacity to be the EV leader by mid-decade," the CEO said in a statement. But whether the U.S. automaker will have the commodity materials needed to produce the batteries at Orion and how much those materials will cost are now in question. Battery-cell production is a crucial piece of the supply chain for electric vehicles, and while automakers other than Tesla have largely outsourced their production to third-party suppliers, several are now scrambling to wrest control over that production as well as access to the raw material needed for the batteries. Yet for the key component of today's preferred battery, lithium, surging demand and concerns over environmental degradation have resulted in skyrocketing prices and lower margins for batteries and auto manufacturers. As governments, companies and investors rush toward an all-electric transportation future, the economics of battery production will be a bumpier road than at first blush. But environmental, supply and cost restraints must eventually be overcome in order to make EVs affordable and profitable. (*CNBC*, 1/25/22)

The Original Context(s)

In a 2017 *inFocus* titled "The Rise of EVs," we outlined that the auto industry was in the midst of a restructuring, including, but not limited to, changing production to electric cars. We noted that "the move to electric cars will not be a seamless transition, as automakers must figure out how to make such vehicles profitably." We concluded that "the rise of electric vehicles will have implications for the auto companies, and the makers of batteries and battery components, among others" (see **inF 1209**).

Next, in a March 2021 update, we enumerated the many implications, opportunities and risks that were likely to come from the auto industry's restructuring to manufacture EVs. Among those were significant investments and innovations to be made in battery technologies, changes to the composition of batteries and impacts on what commodities would be needed (see **inF 1607**).

New Observations: Demand for Batteries Is Surging…

- In China, 2.14 million new-energy vehicles (NEVs), the vast majority battery-powered, were sold in the first ten months of 2021, almost triple the same period in 2020, according to data from the China Passenger Car Association (CPCA).
- In Europe, more than 20 percent of new cars sold in December across 18 European markets were all-electric, while diesel cars (including diesel hybrids), which previously were the most popular, accounted for less than 19 percent of sales. This was an all-time record for European EV sales, and the first time battery-electric car sales overtook diesel in Europe.

- The all-electric car segment in the U.S. increased 94 percent year-over-year during the first 10 months of 2021, with about 378,466 EVs registered. That represents about 2.9 percent of the total auto market compared to 1.7 percent a year earlier.

- Tesla sold 308,600 vehicles worldwide in the fourth quarter of 2021, up from the company's previous delivery record of 241,300 in the third quarter. For the year 2021, Tesla's total sales were more than 936,000, up about 87 percent over 2020's deliveries. Tesla will be adding production capacity with two new factories coming online in Austin and Berlin.

- In December, Toyota Motor Corporation said it would make 3.5 million electric vehicles a year by 2030, an increase from the previous target of two million. The company has committed $70 billion to this goal.

- Toyota said it would increase spending on battery research and production to ¥2 trillion, up from a previous plan of ¥1.5 trillion. The company has commitments to build a battery plant in North Carolina.

- In December, Volkswagen announced it would increase spending for battery-electric vehicles by about 50 percent, to €52 billion ($59 billion) by 2026.

- In August 2021, EVE Energy, one of China's top-10 lithium-battery producers, announced plans to build two lithium-ion production facilities with a total capacity of 30 gigawatt hours in Central China's Hebei Province.

(*NewsChina*, 1/22; *Reuters*, 12/9/21 and 1/5/22; *Wall Street Journal*, 12/15/21; *Bloomberg*, 1/3/22; *Motor1.com*, 12/12/21; *Green Car Reports*, 1/18/22)

New Observations: …And Rising Demand for Lithium Has Resulted in Skyrocketing Prices

- Electric vehicles use more than 10,000 times as much lithium as a single smartphone and require six times the total mineral inputs of conventional cars.

- An index of lithium prices doubled between May and November, according to Benchmark Mineral Intelligence (BMI). In December, the index was at its highest level in five years.

- Prices of lithium carbonate in China jumped to a record high of $41,925 a ton in December, according to BMI. The midpoint of the December price was $39,250 a ton, up 485.8 percent from the same period one year earlier.

- On October 29, Australia's Pilbara Minerals auctioned its lithium, sourced from hard rock or spodumene, at $2,350 a ton, an 88 percent increase from $1,250 at its July auction. Spodumene contracts for the start of 2022 are at about $1,500 a ton, at the highest end of the typical range of $400 a ton to $1,500 a ton in 2021.

- Fixed prices for the length of a contract are now rare compared with previous years, as producers are seeking to renegotiate the price of the contracts because of pricing volatility.

(*Wall Street Journal*, 12/13/21; *Reuters*, 1/5/22 and 11/23/21; *New York Times*, 5/4/21 and 9/28/21)

New Observations: Money Goes for the Lithium "Gold Rush"

- China's Ganfeng Lithium, the country's largest lithium-salts producer, signed two acquisition deals worth $272.5 million, and they include the purchase of lithium projects in Argentina, Mexico and Germany.

- Zijin Mining announced in October that it would buy Neo Lithium, a Canada-based company, and its 3Q lithium-brine project in Argentina for $960 million in cash.

- In early December, Koch Strategic Platforms, a division of Koch Industries, invested $100 million in Standard Lithium Ltd., a company that is working with a German firm to produce lithium chemicals in Arkansas.

- In November, Lithium Americas, a Canadian startup working to produce lithium in Nevada, outbid China's Contemporary Amperex Technology (CATL) to reach a deal to acquire an Argentina-focused lithium producer for about $400 million. Lithium Americas already co-owns a project in Argentina, but hasn't yet produced any lithium. It had a market value of about $4 billion as of December 2021.

- In the first three months of 2021, U.S. lithium miners raised nearly $3.5 billion from investors, seven times the amount raised in the prior 36 months.

- LG Energy Solution Ltd., an electric-vehicle battery supplier for General Motors, Tesla, Volkswagen and Hyundai Motor, opened at 597,000 won ($498.53) on its first day of trading on South Korea's stock exchange. This was almost double the IPO price of 300,000 won.

(*Wall Street Journal*, 12/13/21; *Northern Miner*, 10/25/21; *New York Times*, 5/6/21; *ChinaNews*, 1/22; *MarketWatch*, 1/26/22)

New Observations: Environmental Concerns About Lithium Mining Could Cause a Long-Term Supply Issue

- In December 2020, mass demonstrations against lithium mining began in several Serbian cities, and Rio Tinto suspended operations of its Jadar lithium project. In summer 2021, Rio Tinto pledged more than $2 billion to develop a lithium project in Serbia, but in January the government withdrew Rio Tinto's exploration license completely because of unrelenting demonstrations.

- In 2019, protests began in Chile, the world's second-largest lithium producer, focused on environmental degradation caused by mining and its excessive demand for water leading to rivers drying up. In December 2021, voters elected Gabriel Boric, a former student activist, as president of the country. Boric's campaign platform included increased taxes on miners and the creation of a national lithium company.

- Chile's SQM, which produces 20 percent of the world's lithium, recently said the company is seeking to increase capacity from 140,000 tons of lithium carbonate to 180,000 tons by 2022. The firm claims it wants to "produce lithium as green as possible," including by reducing saltwater extraction by half by 2030 and by becoming "carbon neutral" by 2040.

- In Minyak Lhagang, in the Tibetan regions of China's Sichuan Province, people have protested against operations of the Ronda Lithium Corporation.

- Lithium Americas' open-pit project in Nevada, given final approval in the last days of the Trump administration, has drawn protests from members of a Native American reservation, ranchers and environmental groups because, according to the company, the mine will consume 3,224 gallons of fresh water per minute, which could cause the water table to drop by an estimated 12 feet.

- In Portugal, the people of Covas do Barroso, home to Europe's biggest lithium reserve, are worried that lithium-mining exploitation will cause deforestation, air pollution, water contamination and noise and basically end their way of life.

(*rfi.com*, 1/9/22; *Wall Street Journal*, 12/13/21; *Euractiv*, 11/4/21; *New York Times*, 12/28/21 and 5/6/21)

New Observations: …All Leading to Higher Battery Prices and Lower Battery Margins

- China's EVE Energy, one of the country's top-ten lithium battery producers, reported its gross profit margin had declined by 10 percent in the third quarter, year-over-year, because of lithium prices. It was the fourth consecutive quarter that the company recorded a decline in its gross profit margin.

- On October 26, 2021, BYD, China's largest NEV company and second-largest domestic battery supplier, announced that, effective November 1, it would raise unit prices of its battery products by no less than 20 percent. BYD had earlier reported a 3.5 percent decline in gross margin for its 2021 first half.

- BYD's C08M lithium batteries are used not only in its own EVs but also in those manufactured by Toyota, Beijing Automotive Group and Ford.

- In mid-October, Gotion High-tech, a Chinese battery producer and partner with Volkswagen, told customers that it needed to raise battery prices due to pressure from higher commodity prices.

- In May, Tesla raised the sticker price of its Model 3.

(*NewsChina*, 1/22; *Financial Times*, 12/6/21; *Bloomberg*, 11/30/21; *Nikkei*, 10/27/21)

New Observations: Investing in Different Battery Materials and Technologies

- Berkshire Hathaway Energy, Controlled Thermal Resources and Materials Research are working to extract lithium at the Salton Buttes in Imperial County (CA) from water that has already passed through currently operating geothermal plants. The group expects to complete a demonstration plant for such lithium extraction by April 2022.

- California-based Lilac Solutions and Standard Lithium of Vancouver (BC) have opened demonstration projects using a direct brine-extraction technology. Standard Lithium is tapping into a brine source that has already been extracted from the ground by an Arkansas chemical plant, so no additional groundwater is needed. Lilac Solutions is also working on direct lithium extraction in Nevada, North Dakota and one other location.

- Natron Energy is developing a rechargeable battery that uses sodium instead of lithium.

- Ion Storage Systems is developing solid-state batteries that can last longer than today's standard technology.

- China's CATL, the world's largest battery manufacturer for EVs, is launching a new business around battery swapping called Evogo. Located in 10 Chinese cities, Evogo uses a new 26.5 kWh bar-like battery, which can be bought singly or in a pack of three. One bar enables a driving range of about 124 miles, while a three-pack is used for long-range driving. The swapping system is compatible with 80 percent of global battery-electric vehicle models, including Tesla.

- By the end of 2021, China had built 75,000 charging stations, 2,617 million charging piles and 1,298 battery-swap stations.

- Silicon Valley start-up Mitra Future Technologies is focused on producing lithium-ion battery cathodes that use more iron and less nickel and cobalt. Mitra recently closed $20 million in Series A funding.

(*Wall Street Journal*, 1/10/22 and 11/16/21; *New York Times*, 5/6/21; *Green Car Reports*, 1/18/22; *China Daily*, 1/19/23)

Batteries have always been a hurdle to clear in the race to electrify global transportation. With more than half of the world's lithium production being used to make rechargeable batteries for cars, mobile phones and laptops, the growing need for supplies of this lightweight commodity is increasing exponentially, at the same time that environmental groups and governments are pressuring lithium miners. Prices are surging, which not only puts profits for battery and auto manufacturers in jeopardy but also will likely raise the price of EVs – something that governments would push to rectify in the forms of subsidies and grants. China has removed subsidies, and sales are soaring. While semiconductor supply chain issues have constricted car sales over the past year, pressures are now building on miners, suppliers and automakers to solve the lithium commodity conundrum.