

# The Future of Energy Storage: Liquid-Metal Batteries and the Role of Antimony

written by InvestorNews | August 13, 2023

One of the standout attributes of the liquid-metal battery is its competitive edge over lithium-ion batteries. Not only is it more affordable, but its design simplicity, superior chemistry, and impressive durability make it particularly appealing. As Sadoway notes, the battery's non-flammable nature, resistance to capacity fade, and data suggesting an operational life of two decades retaining 95% of its capacity make it a formidable contender in the energy storage sector.

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## Molten Metals Aims to Meet the Rising Demand for Antimony in Energy Storage

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Supply chain disruptions and geopolitical concerns caused Western governments to re-examine the source of critical metals that will drive the economic engine for decades to come.

Media attention seems focused on the battery metals required for electric vehicles ("EVs"), including lithium, cobalt, graphite, and rare earths, but antimony was one of the few metals that is on all of the critical metals lists across Australia, Canada,

China, the EU, Japan, and the USA.

## **The importance of antimony**

Currently, Antimony is primarily used as a flame retardant in items such as paints, plastics, and textiles. It is also used in brake pads, ceramics, glass for televisions and monitors, and rubber. When alloyed with lead, it is found in metal products used in ammunition and lead-acid batteries.

As we strive towards transitioning to a carbon-free society, it is essential not only to harness renewable energy but also to store it efficiently. The future increase in demand for antimony lies in its potential to become a crucial component in battery technology.

Antimony's unique property as a heat retardant is essential in preventing thermal runaway in batteries, making it a crucial element in the development of effective energy storage systems. Its heat retardant properties enable the mass scalability of batteries, making it the only metal capable of achieving this goal.

## **Antimony molten salt batteries**

[Ambri Incorporated](#), a US-based energy storage company, has developed a long-duration liquid metal battery technology for the power grid with backing from prominent investors, including Bill Gates, [Khosla Ventures](#), and [SoftBank Group](#), and funding from the [US Department of Energy](#).

Ambri's battery technology uses solid antimony as the positive electrode, liquid metal calcium as the negative electrode, and a salt electrolyte consisting of calcium and chloride. The use of these metals allows for a reliable, low-cost, long-lasting, and safe energy storage solution that can enable the integration of

renewable energy sources into the electric grid.

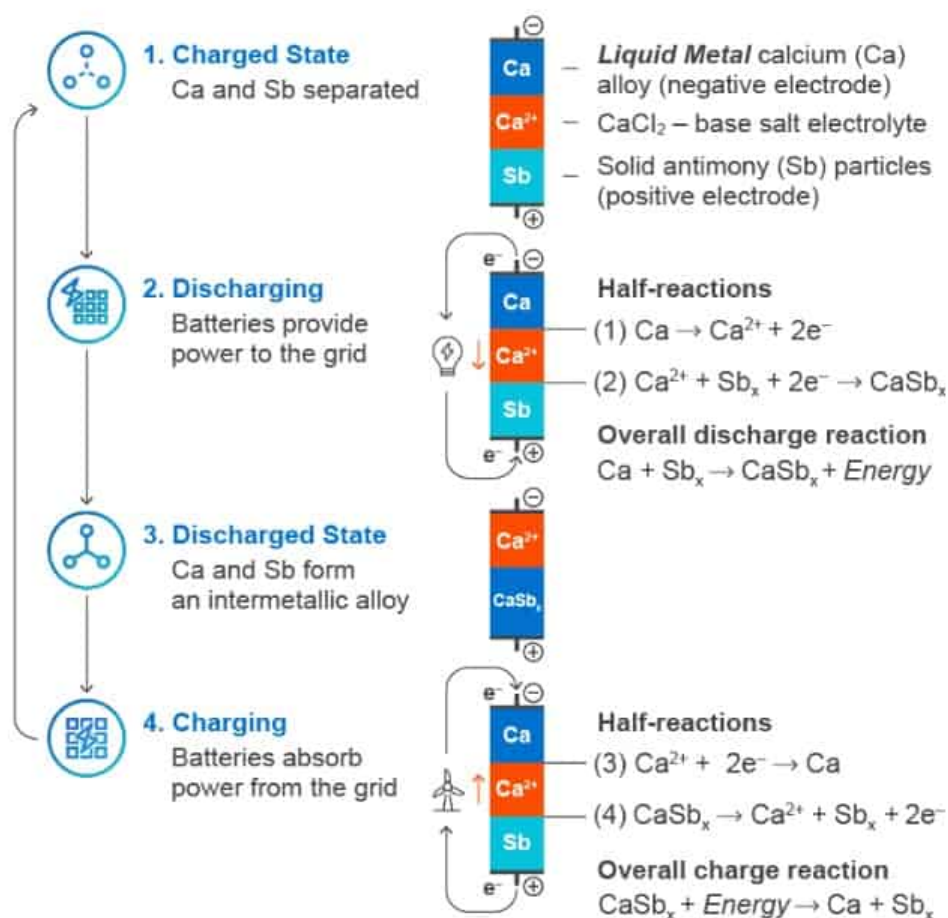
As Ambri continues with its commercialization efforts, it is estimated that its forward contract sales will require over 25% of the global production of antimony outside of China by 2026.

However, the current supply lacks the necessary capacity to fulfill this demand, leading to an imbalance in the supply-demand equation. This highlights the urgent need for investment in new antimony mines and refining (“roaster”) facilities.

## FIGURE 1: Ambri’s Molten Salt Battery Chemistry



### Our Chemistry



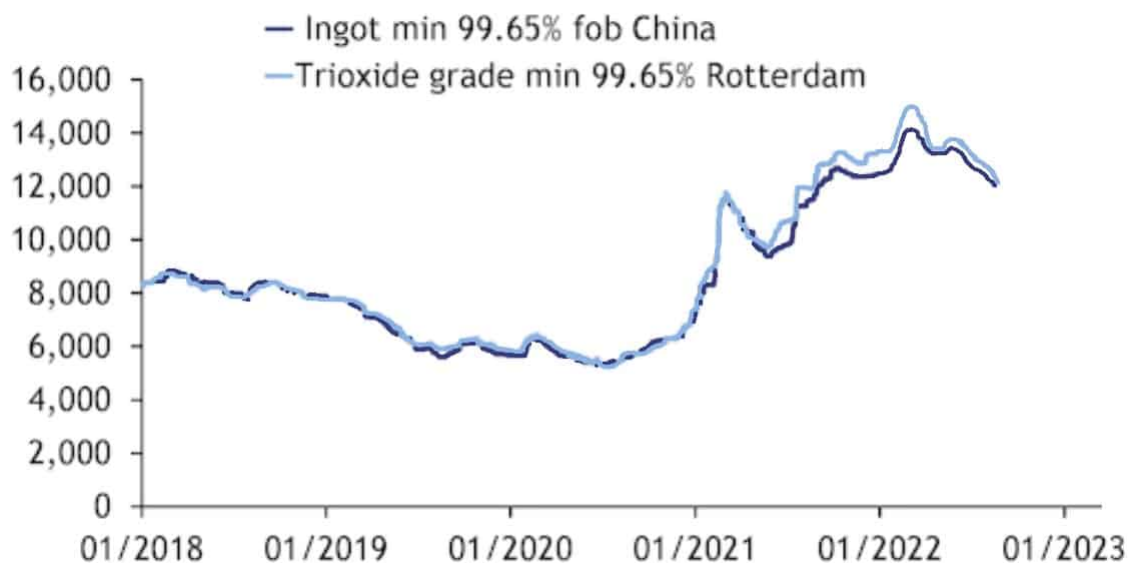
Source: [Ambri's website](#)

## Lack of supply and increasing demand drives the price higher

Currently, the global supply of antimony is heavily reliant on China, Russia, and Tajikistan, which produced over 88% of the world's supply in 2022, according to the [US Geological Survey](#) ("USGS").

Antimony prices have surged this year to a record high, currently trading at US\$13,000 per tonne, more than double the US\$5,500 per tonne rate in 2019.

**FIGURE 2: Antimony Market Prices (US\$/tonne)**



Source: Argus Media

## Newly Listed Molten Metals Corp.

Listed in August 2022, [Molten Metals Corp.](#) (CSE: MOLT| FSE: Y44) is a Canadian mineral exploration company and one of the few companies actively developing antimony assets in North America and Europe, reducing the foreign dependence on this resource.

The Company has four properties, which include a former antimony mine in Nova Scotia, Canada and it has two antimony-gold projects and one tin project in Slovakia. All of the Slovakian projects are brownfield sites, either past-producing mines or previously explored.

In Nova Scotia, Molten Metals' [West Gore project](#) is home to one of Canada's foremost historic antimony mines, which has been abandoned since the 1960s. The Company is currently testing the remaining stockpiles and tailings at the site, in an effort to extract valuable antimony and revive the mine.

According to the Company's website, these stockpiles could contain up to 570 tonnes of antimony and 2,500 ounces of gold, worth approximately US\$7.4 million and US\$5.0 million at today's price, respectively. These estimates were taken from a report released by George Packard in 1949 using a survey undertaken by Nova Scotia's Department of Mines.

The Company is also focusing on the past-producing [Trojarova project](#) in Slovakia with a well-preserved mining infrastructure and a historic resource calculation, which, if correct, would make it one of the world's largest unmined antimony projects globally.

Upcoming exploration plans include confirmation sampling and drill hole twinning to complete a NI 43-101 initial resource to validate the historical resource. Molten Metals could have one of the largest antimony resources globally if it can confirm the historical resources that were calculated in the 1980s and 1990s when Slovakia was part of the Soviet Union.

## **Offtake agreements and future capital**

Molten Metals recently [announced](#) that it executed a non-binding Memorandum of Understanding ("MOU") for a long-term antimony

supply agreement with Swedish company [Scandinavian Steel AB](#).

The agreement will be subject to a specific financial investment into the development of one or more of Molten Metals' projects and a provision to upgrade the MOU to a binding offtake agreement within a reasonable time frame.

## Final thoughts

Molten Metals (CSE: MOLT| FSE: Y44) has a strong focus on antimony, which is increasingly in demand due to its use in batteries. In the short term, the Company plans to process the remaining stockpiles of tailings at its Nova Scotia project and advanced its mines in Europe. The company has two antimony-gold projects and one tin project in Slovakia that could provide a near-term, large resource and additional upside.

With a market cap of only C\$1.9 million and a tight share structure of only 16.9 million shares outstanding, if you have confidence in the antimony theme, it should be a stock to watch.

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# Molten Salt Batteries – Hot but not Flammable

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When we first wrote for InvestorIntel on Molten Salt battery technology almost half a decade ago, the technology was already five years in the making, but it has now taken a further five years for it to get traction amongst end-users.

However, in this Third Wave of [battery metals](#), Antimony (the

prime component in Molten Salt batteries) has joined the ranks of battery metals and the hunt is on for that scarce commodity, the non-Chinese Antimony miner.

### **Antimony – Lighting a Fire under the Price**

The price of this metal has taken off in recent times on a combination of global shortages caused by the Pandemic and the coup in Burma, long-term underinvestment, declining Chinese production, and the arrival of Molten Salt batteries in the commercial marketplace.

The effect was stunning, with Antimony breaking out of a multi-year malaise and becoming the hottest metal in the last six months (though tussling with Tin for that title).



### **Mass Storage Devices**

The important consideration is that mass storage devices do not even need to be connected to the grid and thus can be in the middle of nowhere bridging the infrastructure gap (and cost) that weighs on emerging economies (and isolated mine sites).

And then there are liquid metal batteries using molten salts. The origin of using these salts for storing energy goes back to the Second World War.

Molten salt is a solid at standard temperature/pressure but enters the liquid phase under elevated temperatures. Liquid metal batteries can be stored indefinitely (over 50 years) yet provide full power in an instant when required. Once activated, they provide a burst of high power for a short period (a few tens of seconds to 60 minutes or more), with output ranging from watts to kilowatts. The high power is due to the high ionic conductivity of the molten salt, which is three orders of

magnitude (or more) greater than that of the sulphuric acid in a Lead-acid car battery.



A team of researchers at MIT led by Professor Donald Sadoway worked on a liquid battery system that could enable renewable energy sources to compete with conventional power plants.

The research was put into a commercial venture, called [Ambri](#), which was funded to the tune of \$15M by Bill Gates, energy giant Total, the US Department of Energy's Advanced Research Projects Agency and Khosla Ventures (run by Sun Microsystems co-founder Vinod Khosla).

### **What this means for antimony Demand**

Each GWh of Ambri batteries requires less than 1% of current annual production of these (calcium and antimony) anode and cathode materials. This is the closest we have to divining how much Antimony that the Ambri product line might consume if it gains traction. Current antimony production is around 170,000 tonnes per annum, implying that a Gigawatt of Ambri cell utilizes 1.7 tonnes of Antimony.

Higher prices are rather a “chicken-and-egg” issue for the likes of Ambri. To be sure of adequate supplies of metal higher prices are needed (probably over \$8,000 at least) and yet if they go too high then the viability of the economic equation is cast into doubt.

### **[United States Antimony Corporation](#) (NYSE American: UAMY) – Collateral Beneficiary?**

As the main Antimony producer in North America (and we use the word “producer” very generously) this company was finding it hard to get two dimes to rub together in 2020. To add to the



woes its long-term CEO (who was in his 80s) died.

The price of the stock started to rise slightly on the Antimony price rally but then.... in February of 2021 it announced an offtake deal with Ambri... then followed a massive financing (\$14.3M) with Roth Capital Partners... the stock then soared and the rest is history. The fact that it doesn't have a proper mine is a mere detail.



Despite all that such is the uplift that Antimony stocks can achieve in a market starved for options in this metal. The only other plays are the gold/silver miner, [Mandalay Resources Corporation](#) (TSX: MND | OTCQB: MNDJF) that has Antimony as a byproduct from its Costerfield mine, and [Perpetua Resources Corp.](#) (NASDAQ: PPTA | TSX: PPTA) (formerly called Midas Gold – that is controlled by the famed Paulson hedge fund group) but is not in production at its Stibnite Mine.

## **Conclusion**

If Liquid Metal Batteries become the killer application in grid-linked storage (or non-grid linked) then it potentially lights a fire under Antimony demand and pricing.

To mix some metaphors, molten salt batteries have flown under the radar thus far but definitely have a place in the evolving battery universe and hopefully will take the Antimony market along for the ride.