

Manganese - the third electric vehicle metal no one is talking about



March 24, 2017 | Base Metals, Battery Metals

Highlights

- Manganese is a critical and irreplaceable element used in steel production;
- The steel industry is poised to continue growing, providing a steady source of demand for manganese;
- Significant additional upside will come from cleanenergy applications;
- Vertically-integrated companies will be primary drivers of the forward momentum in the manganese industry, which at this point is concentrated and in need of disruption.

Lithium and cobalt have been on an absolute tear, riding the wave of Tesla and the broader electric revolution. There is another metal, however, used widely as a battery component that has received less notice from the markets. That metal is manganese (Mn), a chemical element that is normally found together with iron.



Since the beginning of 2016, cobalt's price has jumped 120%, lithium has moved up 77%, and manganese has recorded a 42% gain. While all three metals have seen their prices rise recently, it appears that manganese has been outshined by its two fellow EV metal counterparts.

TSX-V : AIS . OTCQB : AISSF

A.I.S. Resources Limited

www.aisresources.com

We believe this situation will change quickly, as demand for manganese is set to outpace supply, especially for higher-grade materials found only in specific corners of the globe.

Introduction – Manganese Is Critical

Manganese is an essential ingredient in steel. And according to the US Geological Survey's (USGS) Mineral Resources Program, the United States is completely dependent on manganese imports; it has no production facilities of its own. The US needs about 500,000 tons (1.1 billion pounds) of manganese per year, the majority of which is consumed by the steel industry.

Acutely aware of this situation, and the fact that most of the world's manganese is produced by just a few countries (some of which are risky jurisdictions), the USGS has deemed manganese a "critical mineral." A critical mineral is one defined as being essential to the economy, as well as being at significant risk of incurring supply interruptions. The USGS has also singled out manganese because of its importance due to its increasing use in emerging technologies.

Solid Growth In Demand

In steel production, manganese serves the important function of removing oxygen and sulphur when iron ore is converted into iron. It is also used as an alloy that increases both the strength and flexibility of steel. In ore production, about 30% of the manganese is used to refine ore and about 70% is used as an alloy in the final product.

Manganese is not on the radar of many investors, but it is widely used in metallurgy. In fact, it is the fourth most commonly used metal by tonnage – after iron, aluminum, and copper. And during the past ten years, the world has generally produced increasing amounts of steel every year.

Between now and 2020, the International Manganese Institute projects that the global steel industry will continue growing at a clip of about 2% annually.



The United States is expected to lead the way in 2017, with a projected 4.4% increase in steel production. This number is expected to surge even further as President Trump turns his attention towards pushing legislation for a \$1 trillion infrastructure plan.

In addition to the steel industry, manganese is also utilized in animal feed and fertilizers, two sectors with demand that will continue to grow in concert with the world's population.

Moving forward, we see significant growth in the manganese market due to its applications in clean energy. More specifically, we anticipate the growing use of nickel-metal hydride (NiMH) electric vehicle batteries and lithium-ion (Li-ion) batteries to be major catalysts for manganese demand. NiMH batteries are predominantly used in hybrid vehicles, including the Toyota Prius. The Li-ion battery, of course, takes centerstage due to Tesla's notoriety and lofty production targets.

The newest up-and-coming technology to use manganese is the so-called lithiated manganese dioxide (LMD) battery. A typical LMD battery uses 61% of manganese in its mix and only 4% lithium. LMDs have numerous benefits, including providing higher power output, thermal stability, and improved safety compared to regular lithium-ion batteries.

LMDs are already in production, and are currently used

TSX-V : AIS . OTCQB : AISSF

A.I.S. Resources Limited

www.aisresources.com

in electric cars like the Chevy Volt and Nissan Leaf. These cheaper electric cars, as opposed to the narrower luxury-segment that Tesla operates in, should be a significant part of the budding clean energy revolution.

Finally, there is a game-changing application of manganese worth mentioning: off-the-grid power. Tesla and its Powerwall batteries are breaking ground here, and the market is only poised to grow.



(Credit: Inside EVs)

In summation, there are several drivers that should boost manganese demand, both traditional and cutting edge.

Manganese will continue to be a key element in steel production, and the industry should continue to grow at a steady pace. Steel production will ensure that manganese remains as one of the most widely used elements in the world. On the technology side, electric vehicles, off-the-grid power systems and other energy storage applications will require significant amounts of high-quality manganese.

Risky Business On The Supply Side

Most manganese production globally is concentrated in four countries: Australia, China, Gabon, and South Africa. 90% of the world's manganese reserves are found in these four countries, along with Brazil and Ukraine. Remarkably, nearly 70% of global manganese reserves are contained in the Kalahari District of South Africa.



Mamatwan manganese mine in the Kalahari District of South Africa. (Source: USGS)

South Africa's deposits tend to be high-grade. Australia, Gabon, and Brazil, however, feature even higher grade deposits. This bodes well for the explorers and developers operating in these countries.





In the United States, there has not been any manganese mining activity since 1970. There are a few areas where it is possible to find manganese-enriched rocks (Maine and Minnesota), but the grades are substantially lower than what is available around the globe, so mining manganese in the United States does not make economic sense. As a result, the U.S. imports all of its manganese.

TSX-V : AIS . OTCQB : AISSF

A.I.S. Resources Limited

www.aisresources.com

61% of the United States' manganese imports come from Gabon. Australia is the second-largest provider of manganese to the U.S., with 21% of the total. South Africa (7%) and Brazil (5%) are the third and the fourth largest manganese exporters to the United States.

China, meanwhile, is the world's number two producer of manganese and also one of its largest consumers. Demand for imported manganese ore in China more than doubled between 2006 and 2016. As of 2016, almost two-thirds (62%) of manganese ore in China was imported. The gulf between manganese production and consumption in China has been widening since 2001.



China, like the United States, imports most of its manganese from South Africa, followed by Australia, Gabon, and Ghana.

Unlike steel, where demand is notoriously steady, the supply of manganese is declining. In 2016, the USGS estimated that the world produced 8.6% less manganese than in 2015.

	Mine production		Reserves ¹¹
	2015	2016°	
United States	—	_	
Australia	2,450	2,500	91,000
Brazil	1,090	1,100	116,000
China	3,000	3.000	43,000
Gabon	2,020	2,000	22,000
Ghana	416	480	12,000
India	900	950	52,000
Kazakhstan	222	160	5,000
Malaysia	201	200	NA
Mexico	220	220	5,000
South Africa	5,900	4,700	200,000
Ukraine	410	320	140,000
Other countries	678	680	Small
World total (rounded)	17,500	16.000	690,000

(Source: USGS)

This is one of the imbalances that resulted in the recent upward price action in manganese. The price of manganese has risen over 42% since the beginning of 2016.

The estimated demand for manganese in 2022 is forecasted to reach 28.2 million metric tonnes. Compare this to historical rates of manganese production, which peaked in 2014 at 18.0 million MT. Clearly, the widening gap between supply and demand in the manganese space should lead to a healthy price increase over the next few years. We believe that one manganese explorer, in particular, is poised to take advantage of this dynamic, and its management team already has one exit under their belt in the manganese sector.

Article Link