

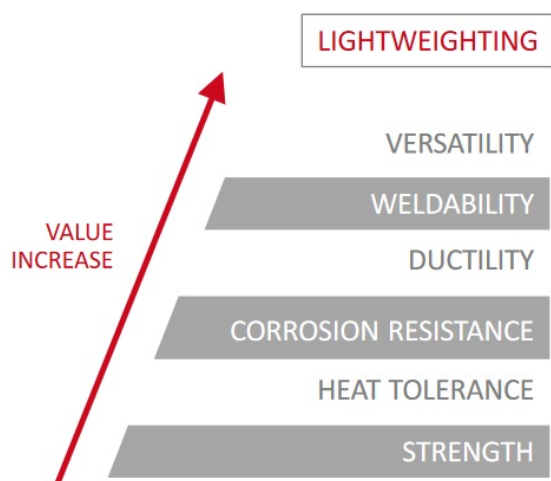
# Is there a meteoric market rise for scandium next?

It is extremely rare to find a metal where the potential demand is much greater than what anyone can supply. It has happened the past year with the emissions metals palladium and rhodium which were up 75% and 366%; so it makes good sense that scandium may be next.

## Scandium-Aluminum alloy is a key material in the lightweighting industry

Lightweighting of vehicles is a massive new trend this decade as we switch over to electric vehicles. Just 2% scandium added to aluminum increases strength, heat tolerance, corrosion resistance, and weldability. A lighter vehicle will require less energy (less gasoline or less lithium-ion batteries) to move a set distance.

Scandium offers improvements in aluminum particularly suited to the transport sector; marine, automotive, and aerospace.



Scandium's place in lightweighting is on the rise which means the need for new scandium mines has never been greater. Whilst still a niche industry with a high scandium metal price, if a miner was able to produce significant volumes then prices

would go down, which in turn would mean order volumes would go up.

A 2019 scandium report stated:

*“The major factors driving the growth of market studied are the accelerating usage in solid oxide fuel cells (SOFCs), and growing demand for aluminum-scandium alloys. On the flipside, lack of awareness, high cost, and inconsistent supply are hampering the growth of the studied market.”*

*“According to the aircraft designers, about 0.1% to 0.5% trace amount of scandium added to aluminum can help to increase not only the strength of aluminum but also helps to reduce the weight of aircrafts by 15% – 20%.”*

**Scandium demand will surge as scandium prices fall as new scandium supply comes online**

## SCANDIUM

### DEVELOPING A NEW ALUMINUM ALLOY MARKET — NOW

SUPPLY CONSTRAINED?	>	A HISTORICAL PROBLEM WITH A SOLUTION ON THE HORIZON
COST CONSTRAINED?	>	NEW DIRECT-MINED RESOURCES ARE LOWER COST
VALUE UNDERSTOOD	>	KNOWN STRENGTH AND ALLOY PROPERTY IMPROVEMENTS
LARGE WAITING MARKETS	>	A BETTER ALUMINUM FEEDING THE LIGHTWEIGHTING TREND



**Scandium is used in some fuel cells**

A little known fact is that scandium is used in certain fuel cells as the electrolyte. For example, Bloom Energy sells a solid oxide fuel cell (SOFC) that produces electricity directly from oxidizing a fuel. Scandium oxide (Scandia) with

zirconia (ScSZ) is the electrolyte. Scandium in SOFCs enables a lower operating temperature resulting in longer-lived equipment and less costly materials of construction. Bloom Energy in the US is the leading SOFC manufacturer and one of the largest scandium users.

### **Scandium's greatest potential is in light-weighting such as with aluminum alloys**

The space and aviation industry is very aware of scandium and its lightweighting effects. Given the massive fuel savings lightweighting has enormous potential.

With the current movement to vehicle electrification, lightweighting becomes so much more important for mass market vehicles. A lighter electric car will mean more power and range for the same size battery.

Airbus has already been involved in designing new lightweight scandium-magnesium-aluminum alloys. One example is the lightweight bike shown below.

### **A super light weight bike made from Sc-Mg-Al alloy by Airbus subsidiary APWorks**



Source

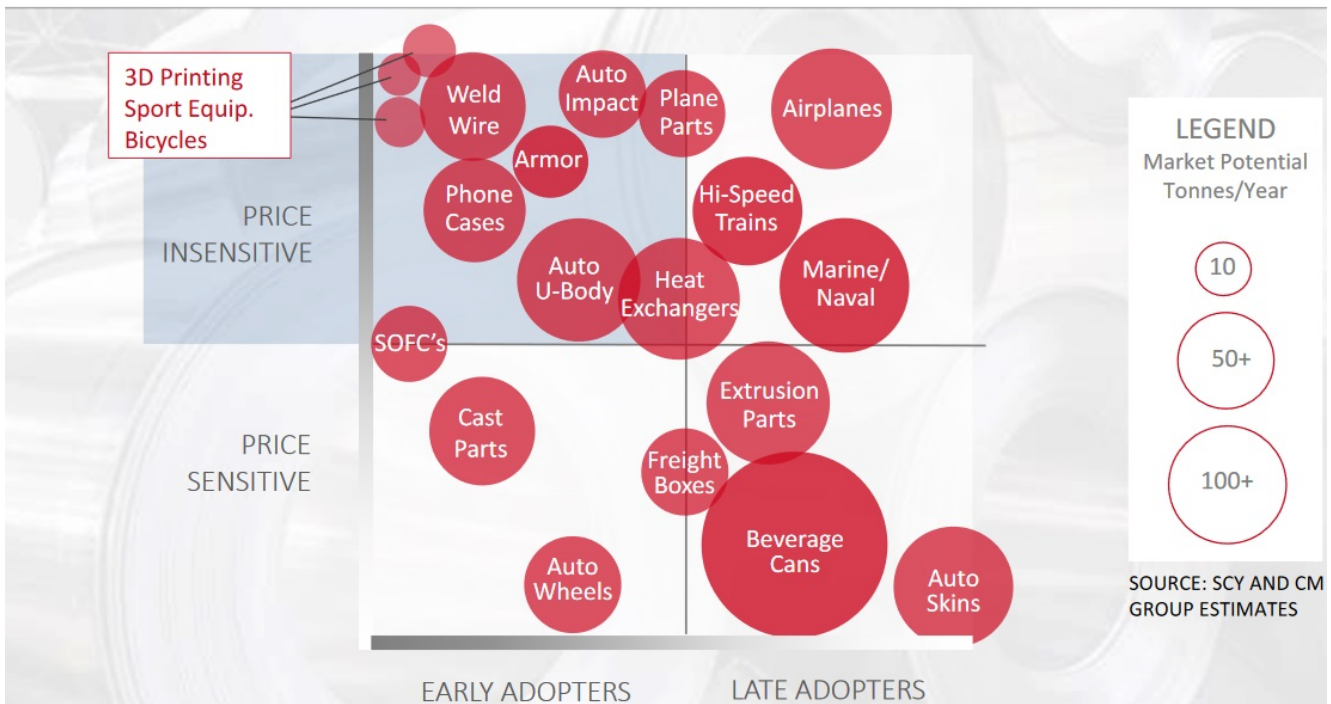
The problem to date has been that global scandium supply is only around 10 tonnes, which means scandium is expensive. Once larger scandium supply is made available then prices can fall. Miners with good grade scandium projects can still be profitable.

**The potential market for Al-Sc alloys is enormous once costs come down**



# SCANDIUM

## THE MARKET FOR Al-Sc ALLOYS IS LARGE AND DIVERSE



### Scandium International Mining Corp.

Scandium International Mining Corp. (TSX: SCY) 100% owns the Nyngan Scandium Project, located in New South Wales, Australia. Scandium International's New South Wales lateritic clay belt, represents a recent game-changing discovery of scandium grades approximately four times the grade of existing sources. The resources are surface mineable enabling the company to deliver scandium at a large enough economical scale to promote much wider use and development of the metal.

Scandium International is at the stage where they can now offer an aluminum-scandium alloy (Al-Sc2%) master product using scandium from their Nyngan Scandium Project. This is highly significant as potential customers can now sample a final Al-Sc product. As the Company stated in their recent news release:

*"The aluminum industry largely relies on independent master alloy manufacturers to make and supply alloying products, including small amounts of Al-Sc 2%."*

Sampling a product is an essential stage that most miners go through before having their product accepted and subsequently sign off-take agreements.

Also of utmost importance is increasing scandium production volumes so as economies of scale kick in to lower scandium prices to more affordable levels. Scandium International stated:

*“The Nyngan mine scandium output will change the scale of Al-Sc2% master alloy manufactured, globally, and the Company can utilize that scale advantage to effectively minimize the manufacture cost of scandium feedstock to the aluminum alloy customer.”*

The next step for Scandium International is to assess and then build a large-scale demonstration plant for conversion of scandium oxide to Al-Sc2% master alloy.

Scandium International stated:

*“The size of the demonstration plant is being investigated, but will be flexible in operation and output, and will allow for much more direct customer/supplier relationships with potential scandium product customers globally.”*

Scandium International's goal is to build the world's first primary scandium mine as soon as possible (~2021) from their 100% owned Nyngan Scandium Project. All key approvals are in place, including a mining lease, making the Project 'shovel ready'. The May 2016 Definitive Feasibility Study resulted in a Phase 1 project NPV8% of US\$225 million, and a IRR of 33%, and only US\$87 million CapEx, based on a cost estimate for the Project of US\$557/kg scandium oxide, selling price of US\$2,000/kg scandium oxide, and 37,690 kilograms (37.69 tonnes) of scandium oxide production per year. The Project has potential to expand as scandium product demand grows. Exploration at the site has defined a measured and indicated resource 7x larger than what was used in the currently planned

20 year mine life outlined in the DFS.