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## Scandium: The 'super alloy' of the future that's also the 'secret sauce' in solid oxide fuel cells



Global production of scandium is just a dribble, ranging between 15 to 20 tonnes per year. Picture: Getty Images

By **JESSICA CUMMINS**  
STOCKHEAD  
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There aren't too many geologists in the world that know a lot about scandium – there are few reliable sources of it, very limited adoption in commercial applications and it's usually produced as a by-product of other metals (nickel, uranium, and titanium).

Global production of scandium is scanty to say the least, ranging between 15 to 20 tonnes a year in the form of scandium oxide with the top producers being Russia, China and the Philippines.

Often lumped in with the rare earths family, the light silvery metal has long been considered an 'if' metal – as in “if only it were available in large volumes to meet potential demand it could transform fuel consumption and accelerate the hydrogen economy”.

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Scandium's primary and most long running use has been as an alloy with aluminium to increase strength and weldability, protect against corrosion, and make products such as baseball bats and bicycle frames lighter.

Only the smallest amount of scandium (between one and two per cent to 98 or 99 per cent aluminium) is needed to achieve this, which means aircraft and jet fighters can be assembled faster and at 15-20% reduction in weight.

Longer term, experts believe one of the biggest markets for scandium will be the aerospace industry but John Mavrogenes, professor at the Australian National University, told [Stockhead](#) another exciting forward-looking opportunity for scandium is as a 'super alloy' for electric vehicles.

“Electric vehicles are extraordinarily heavy because of the weight of the battery, so one area of opportunity to lightweight a vehicle is to make the aluminium frame lighter weight by using scandium-aluminium alloy for the frame,” he said.

### Major growth area – solid oxide fuel cells (SOFCs)

Another major growth area for scandium is in solid oxide fuel cells (SOFCs) for utility and commercial scale applications. And here California-based [Bloom Energy](#) holds the majority, if not all, the market share.

SOFCs are one of many types of fuel cells but unlike the rest they produce electricity with natural gas, methane, or biofuel gas as input.

This type of power source is commonly used for data centres and hospitals as well as in niche products such as lasers and lighting for stadiums and studios.

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According to experts, scandium provides the highest known rate of transport of oxygen, and this permits the SOFC to operate at temperatures around 700C, much lower than the roughly 1000C of conventional yttrium-doped SOFCs.

This lower operating temperature makes the system much more mechanically robust, so Bloom's SOFCs essentially never stop working – making them the ultimate in uninterruptible power supply.

Bloom Energy is believed to use around 15kg of scandium oxide per 100kW fuel cell assembly.

### Hydrogen storage and transportation

Marty Weems, [American Rare Earths'](#) ([ASX:ARR](#)) president North America, says these cells could also be used in the storage and transportation of hydrogen.

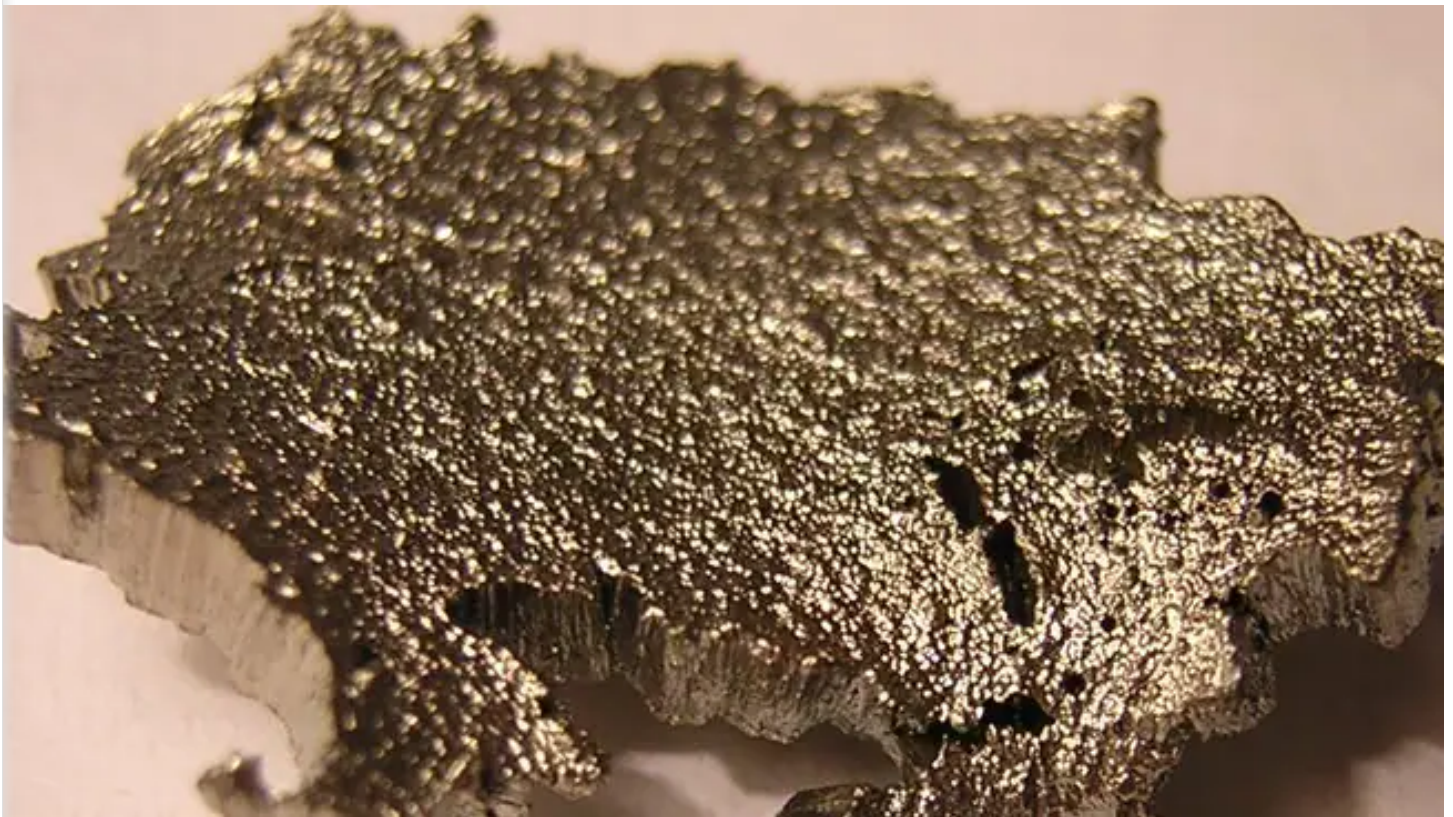
"Hydrogen storage in metal tanks is very corrosive to the metal, so companies have been looking at alloys that will resist the corrosion of the hydrogen," he explains.

"An aluminium alloy with scandium would be very resistant to corrosion on that front so it could be a part of the fuel cell and as an alloy in the pipes as well as the tanks that store and transport hydrogen."

### Which stocks have exposure to scandium?

Hallgarten and Company, a New York investment bank dedicated to the natural resources space, says [scandium mining players are concentrated in Australia](#) while two others, Imperial Mining and Niocorp, are based in North America.

The most recent producer to enter the scene is mining giant **Rio Tinto (ASX:RIO)**, which recently started [producing scandium as a secondary stream](#) for the purpose of making alloy with aluminium at the Rio Tinto Fer et Titane (RTFT) metallurgical complex in Sorel-Tracy, Quebec, Canada.



Scandium unearthened in Queensland.

In January 2021, RIO invested US\$6m for the construction of a first module in the plant, with initial capacity to produce 3t of scandium oxide per year – or roughly 20% of the current global market.

In May 2022, the company produced its first batch of high-purity scandium oxide and is now focusing on production ramp-up to bring the plant to its nameplate capacity.

The company is considering near-term expansion options to increase production capacity in line with market demand.

Some reports suggest the global scandium market could reach US\$802m by 2027 at a compound annual growth rate (CAGR) of 7.6% during 2022–2027.

### SUNRISE ENERGY METALS ([ASX:SRI](#))

In December 2021, SRL's Sunrise Battery Materials Complex near Condobolin in regional NSW was awarded Major Project Status by the Commonwealth Government.

Anticipated to support a 50-year mine life, the project will produce high purity cobalt-nickel sulphates along with scandium, boasting robust economics.

These include Life of Mine (LOM) revenue of US\$16.3 billion, LOM EBITDA of US\$10.8 billion, average free cash flow (post-tax) of US\$308 million pa and NPV8 of US\$1.2 billion.

### **AMERICAN RARE EARTHS ([ASX:ARR](#))**

Back in August 2021, ARR achieved a [massive 216% increase in total rare earth elements](#) (TREE) grade and a 90% hike in scandium grade, along with a 76% drop in ore mass during preliminary test-work on La Paz samples and its flagship La Paz project in Arizona.

This was great economic outcome for ARR at the time, indicating La Paz ore can be processed using conventional methods and at a lower cost.

This news drove shares up over 10%, thanks to continued success at La Paz and several positive moves by the US, which is looking to secure its rare earth supply chain.

The La Paz project has a current exploration tonnage in the range of approximately 742.5 to 928.1 million tonnes with an average TREE grade of 350 to 400ppm and a scandium oxide grade of 20 to 24.5ppm, which is in addition to the existing and upgraded 170.6Mt resource in the northwest of the La Paz project area.

### **AUSTRALIAN MINES ([ASX:AUZ](#))**

This former market darling fell off the map when a comprehensive nickel-cobalt supply deal with South Korean battery maker SK Innovation was terminated late 2019.

Off-take was — and still is — crucial to AUZ finalising a very large, very complex financing package for the +\$1 billion Sconi nickel-cobalt-scandium development in north Queensland.

Sconi, if fully developed, will be one of the lowest cost battery materials producers in the world with a project life of more than 30 years.

But the company hit another bump in May when ASIC filed proceedings against it and its managing director Ben Bell, [alleging misleading claims](#) around project funding and off-take agreements in 2018.

“The Originating Process claims various declarations, a civil pecuniary penalty against the company and managing director to be fixed by the Court and a disqualification order against the managing director for such period as the Court considers appropriate,” AUZ says.

“The company intends to defend the proceedings.”

### **PLATINA RESOURCES ([ASX:PGM](#))**

Platina's Scandium Project (PSP), previously known as the Owendale Project, is about 350km west of Sydney.

Backed by former analyst and previous chief executive officer of [Sayona Mining \(ASX:SYA\)](#) Corey Nolan, the Platina's Scandium Project underwent a definitive feasibility study in December 2018, demonstrating a 30-year mine life that would generate an after-tax NPV of US\$166m (\$233m).

Platina's payback period at the time was 5.3 years, with its DFS financial model factoring in a scandium oxide price of about US\$1550 per kilogram over the life of the project.

While attention has been more recently focused on the company's gold portfolio, the company said it was implementing a range of initiatives to unlock value in the project back in September 2021.

At the time, Nolan said new pure play scandium projects such as the PSP, which offer stable sources of non-by-product supply, would be needed to stimulate demand growth.

Platina's new development strategy contemplates development of master alloy production intellectual property (IP) and a two-phase market entry strategy based on the development of a commercial scale master alloy production facility initially using third party purchased scandium oxide feedstock until such time that the market size or security of oxide supply warrants the PSP development.

The expected capital and operating costs are expected to be modest and will be defined by a feasibility study once the IP and market development strategies are completed.

### SCANDIUM INTERNATIONAL MINING (TSE:SCY)

Scandium International is focused on developing its Nyngan Scandium Project, about 500km northwest of Sydney, as the world's first scandium-only producing mine.

The company says exploration at the site has defined a measured and indicated resource significantly larger (about seven times) than the currently planned 20-year mine life outlined in the feasibility study.

At this stage, the project requires suitable short to medium term offtake agreements with customers for a meaningful portion of phase one product output, to take final investment decision and finance/construct.

SCY continues to pursue off-takes at this time.

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