Bloom and scandium

Last month (8 July), the short-seller affiliated Hunterbrook released a detailed report raising several questions about Bloom Energy, in particular questioning Bloom's reliance on China for scandium, its ability to secure sufficient scandium to meet announced sales goals, and the robustness of its sales and revenue pipeline. The report was preceded by a Bloom blog post in rather general terms talked about scandium and Bloom's products.

Bloom Energy is the US producer of solid oxide fuel cells, used for supplying on-site power storage that is crucial, for example, for ensuring uninterrupted power supply for data centres and reducing their burden on the energy grid. Rather than a liquid electrolyte, a solid oxide fuel cell uses a solid thin-film ceramic substrate, through which oxygen passes to react with fuel, which can be hydrogen or methane from natural gas or biogas. This substrate in a Bloom cell is made from ultra-pure zirconium oxide doped with scandium oxide to stabilise its structure and optimise its performance. This is the context in which Bloom came to talk about scandium in its 7 July blog post.

Since then, the still-tiny scandium market has been jolted by the 7 August announcement by the current US Administration of a conditional $400 million loan to Sunrise Energy Materials to build out its Syerston (Australia) scandium mine and construct refining facilities for scandium in the USA.

So, what does all this mean for scandium?

Let's start with Bloom and its demand (likely the majority of current global scandium consumption, though whether it is 60% or 80% is simply guesswork). We stress that we are not privy to Bloom's actual consumption (although we make what we believe to be reasonable estimates) and we are not going to comment on the robustness of Bloom's revenue pipeline.

Based on our reading of Bloom patents, third-party analysis, and past disclosures about system performance, OnG estimates Bloom will require a little over 40t of scandium oxide in 2026, of which 10-12t will be supplied from reclamation and recycling of scandium-bearing ceramics from older systems (we believe Bloom routinely recovers and reprocesses scandium-stabilised zirconia from its systems). Thus our net new demand roughly concurs with the Hunterbrook estimate, and the main difference appears to us to be modestly different assumptions about the geometry (thickness and total surface area) of each Bloom wafer. Close agreement doesn't mean we are right but at least we have company.

Next, where does this scandium come from? To the best of our knowledge, and leaving aside the Russian Federation's few tons per year of supply, the main sources of scandium include Rio Tinto's Sorel-Tracy plant in Quebec, Canada, Sumitomo's Taganito Bay plant in the Philippines, the Ramu Nickel operation in Papua New Guinea (although we believe scandium is not separated there), and sundry operations in China with Hunan Oriental, a division of the major titanium pigment company LB, leading the pack. We can see from this list maybe 10tpy of non-Chinese scandium oxide supply in 2026. We are not omniscient, and there may be small-scale production in India, Indonesia and perhaps Turkey but if operating (we think they are not) these candidates could account for another 3-5tpy.

What we do not see is large-scale supply from, for example, nickel laterite operations in Indonesia (where there is huge potential for scandium recovery) or from red mud deposits (where early work is proceeding in the USA and EU, with Rusal probably ahead in Siberia). Chinese production, as opposed to nameplate capacity, is perhaps 60-70t of oxide this year but with substantial error bars around our central estimate. So

from our perspective, we don't see how Bloom can source scandium without reliance on China, although we stress that our opinion rests on the intensity of scandium use per unit of power produced in Bloom's energy servers. And if Bloom's ceramic electrolyte wafers are 10-25 microns thick, rather than the 100-150 microns that informs our estimates, Bloom can likely manage today without any Chinese scandium.

We also don't know that it really matters if Bloom sources from China. China's export controls are burdensome, but Bloom's business is not a major military supplier, and China's controls bear most heavily on US defence-related materials. Despite current trade issues, our view is that supply chain concentration is a greater risk to Bloom (assuming we are right about Bloom's China scandium supply today) than Chinese export controls for fuel cells.

We believe Bloom needs to diversify its sourcing and will have to pay more for it (current Chinese prices for a suitable oxide are less than $1,000/kg, while US prices today are comfortably over $3,000/kg), but this is simply prudent supply chain risk management. At $3,000/kg and based on our assumptions, Bloom would spend around $300,000 per MW of power output, roughly 10% of the sales price of its energy servers as best we can judge. A substantial cost, but not ruinous, and surely manageable if selling to AI developers where the cost of power matters far less than the time to power.

What about the outlook? There are many variables that will influence Bloom's scandium needs, including ceramic gauge reduction, higher power per unit cell (although higher power tends to reduce lifetime), and perhaps changes in formulation (although a Zr-10Sc-1Ce ceramic offers probably the best long-term performance). Our view is that Bloom will continue to reduce its electrolyte thickness, but with the pressure to scale output rapidly, we believe that progress will be incremental to manage manufacturing risk.

Based on its pipeline (we do not address Hunterbrook's claims about Bloom's sales projections), Bloom may indeed need about 200t of scandium oxide per year by the early 2030s. Where could this come from, and how might Bloom get there, from here? This brings us back to Sunrise — and to its planned Syerston scandium mine in Australia.

Prior to the US' conditional loan offer, Sunrise was in need of either a bankable offtaker (in our judgement, Bloom is not bankable today) or a third-party guarantee. Sunrise has applied to the US EXIM Bank, and one of Bloom's much better capitalised partners (SK of Korea, or Brookfield of the USA) may have been willing to offer suitable guarantees, but a guarantee from some entity was needed. Today, unless the terms of the conditional loan are unacceptable to Sunrise, the issue of project finance now appears to have been resolved, and, subject to completion of the loan agreement, Sunrise should be able to move quickly into project execution.

By the early 2030s, we also believe, there is a high probability that NioCorp's niobium-scandium-titanium-REE Elk Creek project in Nebraska will be in production, thanks to its niobium supply potential. Thus Syerston and Elk Creek could by then be able to supply approaching 300t of scandium oxide annually. In addition, by the early 2030s there is a good likelihood of initial scandium recovery from red mud (ElementUSA in the USA and EU projects in Europe) plus early titanium waste recovery, e.g. in Greece. For the time being, while ownership is resolved, we discount further expansion at Rio Tinto's Sorel-Tracy.

Nonetheless, based on our assumptions about Bloom's scandium intensity per MW of output, we see Bloom continuing to need access to Chinese scandium oxide through the early 2030s.

We expect Sunrise to expand in stages and inevitably to suffer construction and commissioning delays. With the best will in the world, it is unlikely to deliver scandium to the market in volume before 2029. A major reduction in ceramic electrolyte thickness would alter the picture, but absent this or a large and abrupt increase in laterite supply, our view is that Bloom needs China through the end of this decade.

To sum up, we don't have a view on the quality of Bloom's order book, we believe Bloom needs Chinese scandium today, but we don't think Chinese supply is a fatal flaw, and we think Bloom's order book demand volumes are achievable and can incorporate over time a large share of non-Chinese scandium supply. Sunrise looks highly likely to proceed, with loan terms the major deal breaker in our view, and we see meaningful non-China scandium supply by the start of 2029.

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