BBC Radio 4 The Scramble for Rare Earths - Full Transcript

BBC Investigative journalist Misha Glenny digs deep into the geopolitical tensions arising from China's dominance of magnet metal rare earths and the challenge being thrown down by the UK's Pensana and Less Common Metals.

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BBC Radio 4, The Scramble for Rare Earths ~ 3. The Super Magnets 28.09.22

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Misha Glenny
March 2020, the early days of lockdown for many of us. Boredom setting in, but nobody knowing how long it would last. The need for a new hobby, and in the US, one in particular gained popularity. Magnet fishing. People throwing powerful magnets on lines into seas, rivers and lakes and pulling out some quite extraordinary things. Warheads from World War One for example, and even a dead shark attached to a metal hook. And they could only do that thanks to the extraordinary rare earth metal used in the magnets, neodymium. It's this that gives the magnets their power. How strong, well, a magnet weighing half a pound can support metal the weight of a giant panda.

Dr. Julie Klinger
Neodymium is a silvery, softa white metallic element. And when it's combined with iron and boron to make magnetic alloys it becomes a super magnet.

Misha Glenny
Dr. Julie Klinger is author of Rare Earth Frontiers: From Terrestrial Subsoils to Lunar Landscapes.

Dr. Julie Klinger
And it's actually the crystalline structure of this alloy that makes a neodymium magnet a super magnet. And that's because the crystals or magnetic domains all line up in the same direction when they are exposed to an external magnetic field. So, when you're making a magnet, that's exactly what you want. The stronger the magnet the better the magnetic domains all line up the same direction.

Misha Glenny
And as entertaining as magnet fishing sounds, neodymium magnets have far more important uses than that.

Dr. Julie Klinger
In the 1960s and 1970s, scientists throughout the world on either side of the Iron Curtain were trying to develop really powerful magnets for nuclear applications. In the 1970s at Oak Ridge National Laboratory in the US, scientists developed an alloy which was a neodymium-praseodymium iron boron alloy, and they found that this alloy can store so much magnetic energy and so that means that you can use actually a fairly small magnet to do very powerful things. Now ever since then, that type of magnet has been developed to be used in very, very powerful motors such as those used in electric vehicles, or aboard aircraft generators and a different version of that same magnet is used for offshore wind turbines.

Misha Glenny
I'm Misha Glenny and you're listening to the Scramble for Rare Earths. In this series, I'm finding out why the battle for a small group of metals and critical raw materials is central to rising geopolitical tensions around the world. In previous programmes we've heard about how China became dominant in the rare earth industry and the neodymium story isn't really any different now. China mines 62% of the global supply and refines 84% of it. Relying on a sole supplier for critical materials is problematic as we've seen with Russian oil and gas, but even in the admittedly unlikely event the relations with China took a turn for the better, there's another potentially bigger problem.

Dr. Julie Klinger
There's a real possibility that if the major economies of the world are truly serious about achieving their climate goals that we could run into a bottleneck when it comes to rare earth elements. So, for example, President Xi Jinping has said that China aims to have its CO2 emissions peak before 2030 so that the country can hit carbon neutrality before 2060. Now, a number of countries and even a number of cities around the globe have similar goals. But in order for China to do that, and to continue on its current development path, it's going to have to make a lot of electric cars, it's going to have to electrify a lot of its transport, and it's going to need to deploy a lot of different forms of renewable energy. When it comes to wind turbines, that means it's going to need to use a lot of its rare earths, neodymium in particular, for its own purposes.

Misha Glenny
A shortage in the West isn't imminent, but sooner rather than later we need alternative sources. And I'm not just talking about mining the stuff. We need to refine and process it too. Getting an operation like that up and running takes a lot of time and a fair bit of cash too. But some companies outside China are doing just that. Paul Atherley is chairman of Pensana, which says it's creating the world's first sustainable rare earth hub.

Paul Atherley
We're looking to create an independent and sustainable supply of rare earths for the automotive industry, which as you know, in transitioning to electric vehicles, and for this amazing offshore wind industry.

Misha Glenny
Take a look around the coast of Britain. Enormous wind farms rising like daffodils in spring. 75 miles east of Hull, Hornsea Two to became the largest wind farm anywhere in the world last month, taking over pole position, by the way, from Hornsea One. The UK currently has offshore wind capacity of 10 gigawatts and the government aims to increase that to 50 gigawatts by 2030. This is massive.

Paul Atherley
50 gigawatts is roughly equivalent to the 65 gigawatts of installed electricity capacity in the UK at the moment. So, we're talking about a Saudi Arabia of wind.

Misha Glenny
To exploit that wind power we're going to need lots and lots of magnets. Neodymium magnets. Ian Higgins is the managing director of Less Common Metals based on the river Mersey near Liverpool. The company specialises in the processing of rare earth metals, so he knows a thing or two about magnets.

Ian Higgins
They allow you to generate electricity in a much wider range of wind speeds. So quite often when you look out into the Irish Sea or the North Sea and you see the wind turbines and they're standing stationary it is possibly the wind speed just isn't right. Whereas as long as they're based on rare earth permanent magnets they operate on a much wider range of wind speeds. So in that sense, you do get a much more efficient generation of electricity.

Misha Glenny
Less Common Metals and Pensana are part of a broader Western strategy to wrest control of the mining and processing of rare earths and critical raw materials from China. Mining and processing plants are appearing in Australia, Malaysia, Brazil, Greenland. Pensana's main extraction operation is in Africa.

Paul Atherley
Our mine at Longonjo in Angola, the mine is very very shallow, it's the near surface, we mine the top 25 to 30 metres. We process that and we process it to a high value raw material. Many miners in Africa simply extract raw materials and move them out of the African country at the lowest possible value. We're not doing that, we're investing in Angola, in the project and taking it as far as we can in the mineral processing. So, we're mining, concentrating and going to a mixed rare earth sulphate which is a very, very high value product and creates great opportunities in Angola, much higher fiscal take for the Angolan government.

Misha Glenny
Next stop Yorkshire, they send the sulphate onto, well, where else, Saltend.

Paul Atherley
Saltend is a chemical Park, it's the ex-BP chemicals park in an area where they've got chemical engineering in their DNA. So, we're putting in a rare earth separation facility, which is essentially a chemical process in this existing chemical park. So, Saltend is all about separation. It's all about chemistry.

Misha Glenny
And out comes neodymium, ready for sale to manufacturers, who can make magnets to go in the turbines. So, we can all ride off into a sparkly rare metal sunset, sustainable and geopolitically risk-free. Not so fast. Companies like Pensana and Less Common Metals have to compete on price. Put simply, China's rare earths are as cheap as chips.

Ian Higgins
Today, if you ask about what is the market price of, for example, neodymium, if you try to find any sort of indices that will give you that market price, they will all be based in China. And then there's even more complexity about that because within China there is a system of VAT rebates and local government rebates. For example, if we were to uplift this company from Ellesmere Port, northwest England, and put it into a rare earth enterprise zone in China, we would instantly see a discount on our raw materials of about 18%. And that really is the difference of us being competitive in both markets and us having to do what we do today, which is essentially focus on the niche, much more high value business.

Misha Glenny
But there's another factor; increasingly manufacturers and consumers want to know that material and final products are ethically sourced and environmentally friendly. China has reportedly started to clean up its mess. But in a recent report, the NGO Global Witness says that China has moved much of its production to Myanmar. Toxins from the mining operations seep into water supplies with devastating effects on local communities. Paul Atherley of Pensana insists that his customers want to know where materials come from.

Paul Atherley
The only way you can be absolutely sure that the raw materials going into the magnets for your cars, your offshore wind turbines are not coming from Myanmar, not coming from this ecological disaster, is to source them through fully traced sources. So in our case, we've be working with Cicero. Cicero is one of the leading bond agencies and they've done a complete review of all of our practices, and they've given us a high rating, they have given us a light-green rating and a good corporate governance.

Misha Glenny
The report gives Pensana for four rather than five stars. But Cicero points out that any company engaged in mining is likely to lose brownie points because the practice is inherently disruptive. China's virtual monopoly is bound up with other major economic and geopolitical issues. If Beijing was prepared to threaten Japan with a stop to rare earth supplies for the arrest of a trawler captain, as we learned in an earlier programme, just imagine how it might respond to an argy bargy over Taiwan. China's leadership is now well aware of the threat which climate change poses so it could legitimately decide to keep all its neodymium to itself. But what's the alternative?

Dr. Julie Klinger
So, the main challenge that we have is to diversify our global supply chains, not just of new sources of neodymium, but also building up the manufacturing capacity to produce these high power magnets at scale, all around the world. And of course, if we're truly making our green transition green, we won't just rely on digging new holes in the ground in order to get the neodymium that we need. Building a circular economy to make sure that the neodymium magnets that are otherwise lost in discarded vehicles, electronics, infrastructure can be reclaimed and reused so that we can meet the needs of the green transition without needing to dig new holes in the ground. And of course, there's always the question of substitution. Scientists in a number of countries have been working on finding alternatives to rare earth elements in some of the most important applications. Of course, what this means is that they substitute rare earths with some other element, like vanadium, for example. And while this does potentially reduce the pressure on the rare earth supply chain, it doesn't get us away from a material need.

Misha Glenny
There are a few voices who argue the first thing we should do is start reducing our dependency on rare earths and critical raw materials. And those voices are getting louder. Some car manufacturers like Toyota and General Motors are experimenting with motors less dependent on rare earths. Frankly, at the moment that is just a drop, maybe a magnet on the fishing line, in the ocean. The big Western consumers, the US and the European Union, and now getting serious about how to secure the strategic supplies of rare earths to insulate them against the risk of China. Next time we'll find out how they're doing that and whether it will work in during an era, which some have dubbed the age of uncertainty.