

Niron Magnetix' Clean Earth Magnet® Technology is The World's First Rare-Earth Free, Commercial, High-Performance Permanent Magnet



Jonathan Rowntree
CEO

Niron Magnetix

Interview conducted by:
Lynn Fosse, Senior Editor
CEOCFO Magazine

CEOCFO: Mr. Rowntree, what is the concept behind Niron Magnetix?

Mr. Rowntree: Our Clean Earth Magnet® technology is the world's first commercial, high-performance, rare-earth free permanent magnet. Over the last ten years, we have developed a new magnetic material, which is the first to be commercialized in the last 40 years. This material, called Iron Nitride, is the most powerful magnetic material known to man, boasting a strength approximately 50% greater than that of the most powerful magnets available today. Unlike conventional rare-earth magnets, which require mining and refining of scarce materials, our Iron Nitride is derived from the readily available raw materials iron and nitrogen.

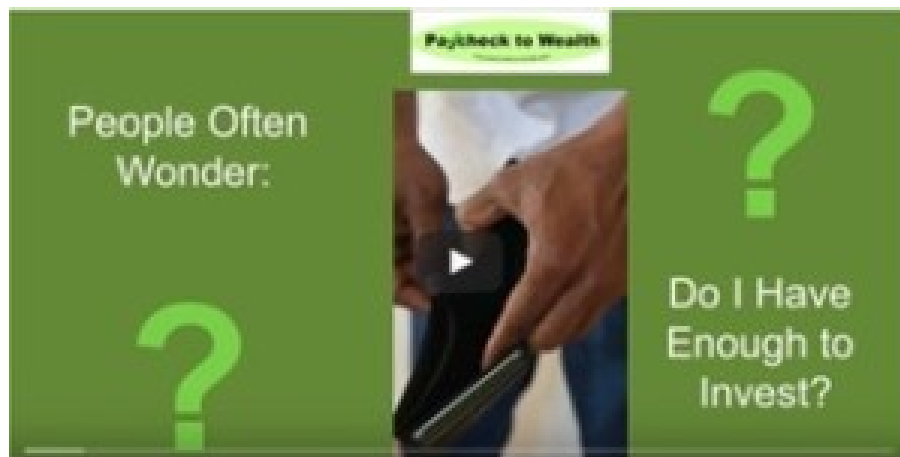
There are three key problems our technology addresses. The first one is rare earth minerals; because they are environmentally disruptive to mine, and they generate approximately 2,000 kilos of hazardous waste for every kilo produced, some of it even radioactive. Our technology solves this problem. The second issue is the supply of rare earths is controlled by China; whereas only about 60% of the world's rare earths are mined in China, over 90% of the world's rare earths are processed in China to make the alloy. Therefore, there is a risk to many companies for the supply and supply security of rare earths. The third and last point is that magnets are kind of the unsung heroes of many applications from speakers to industrial motors to EV drive trains to wind turbines.

With the energy transition that we are going through right now, the need for permanent magnets will triple over the next ten years, but there is only enough rare earth to double that, meaning there is going to be a big supply-demand imbalance. Because our technology solves environmental challenges, we can set up a plan and make magnets from highly recyclable materials of iron and nitrogen anywhere in the world and we can fill the gap in what is needed to enable and accelerate the energy transition.

With the ongoing energy transition, the demand for permanent magnets is expected to triple over the next decade, while rare earth supply can only double. This sets up a big supply-demand imbalance. Our environmentally friendly technology provides a solution to these challenges by enabling the production of magnets using highly recyclable materials anywhere in the world, while facilitating and accelerating the energy transition.

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CEOCFO: *Where did the idea to do this come about, what were some of the challenges, and have people tried to combine iron and nitrogen and come up with this in the past?*

Mr. Rowntree: Niron originated at the University of Minnesota. Back in 2010, there was a world rare earth crisis that started when the Chinese decided to go fishing in international Japanese waters. The Japanese impounded the Chinese fishing trawler and in response and retaliation to that, China decided to stop exporting rare earth to Japan. That triggered the rare earth pricing to go up by a factor of ten and highlighted the ubiquity of where rare earths are used in many different applications. This caught the attention of the Department of Energy in the US and they formed a program called R.E.A.C.T, which is a rare earth alternative R&D set of grants. Around twelve grants were given out, and the University of Minnesota and Professor Jian-Ping Wang were one of the recipients, receiving a grant for several million dollars. During this time, the Professor made Iron Nitride for the first time repeatedly and showed it had very high magnetic properties.

After that grant, we formed Niron Magnetics and over the next four or five years, developed the technology further. In 2017, we built our own lab outside of the University, which at that time was 8,000 square feet, and today it's 80,000 square feet where we are now commercializing the technology. It has taken us about ten years to finish the science and we celebrated our 10th birthday in October of 2023. Some of the challenges along the way were that Iron Nitride is not necessarily the most stable compound, because it wants to move back to being iron oxide or rust, so we perfected a way to synthesize nanoparticles of Iron Nitride and stabilize those. Our process today allows us to take that magnetic powder and press it into different shapes and sizes to make finished magnets.

"We are doing our bit to accelerate the energy transition and change the world with our magnet technology. Our Clean Earth Magnet offers significant environmental savings when compared to the magnets used today." Jonathan Rowntree

The science is now finished and for the last twelve months, we have been busy scaling the technology and commercializing the overall business. We have strong customer interest and investment from significant EV automotive customers as well as consumer electronics customers, and we expect we will have our first commercial sales later this year or early next year. We are also aggressively scaling the technology; last year, we operated at the gram scale, this year we're operating at tens of kilograms, and by the year's end, we aim to reach the scale of tons. We expect to build a manufacturing facility next year that will get us to the 100–500-ton scale, so we are ramping very quickly in terms of bringing this technology to market because we have overwhelming demand from our customers and a strong push to start buying our technology.

CEOCFO: *How have you been scaling up and what have been the obstacles and what might have been easier than you thought to get to where you are today?*

Mr. Rowntree: I joined Niron in January last year, bringing with me thirty years of experience in the materials industry. I have brought new technology to market many times in my career, and while it is difficult to do, I love the challenge of it. I am particularly passionate about it when it is related to sustainability, and there is not a bigger sustainability story than Niron in terms of the benefits of our magnetic technology and how much more green and sustainable that is versus rare earth today.

Last year, we focused on developing a new material for the world. Instead of creating new equipment for this material, which would be risky and time-consuming, we optimized our existing processes. We used industrial-scale processes that were already proven, though we had to modify and tweak them to suit our needs. This approach helped reduce the risk of scaling our technology. In the front-end process, we operate much like a powder or chemical plant, utilizing large reactors to create our powder. For the back-end process, we employ commercially available presses, which are large magnetic presses that shape the powder into various sizes and shapes.

Last year, we found several commercial scale suppliers and we have several relationships with different suppliers here in the US and Europe to purchase and implement that equipment. In fact, over the last few weeks, we have received our first live scale production press that is being commissioned as we speak and we are excited to be able to manufacture much larger magnets than we have previously, which allows us to test them in several new larger applications. We are also excited about testing the technology in industrial motors and EV drive-train motors.

Niron Magnetics interview continued on page 5.

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CEOCFO: *When a manufacturer is going to use this to replace what they have been using, do they swap out new equipment and/or configurations to their current process?*

Mr. Rowntree: For some applications, it is a drop-in replacement. In audio applications, which is 25% of the speaker magnet market, the configuration process of an Iron Nitride magnet is not too different when compared to a neodymium magnet. We have taken commercial off-the-shelf speakers and replaced the magnets that were in them with our magnets, and proven that they have great sound.

For other applications like high-performance motors, the balance of properties of our materials is different from neodymium and other rare earth magnets used today. We are excited about that because we believe that our balance of properties will allow motor designers to optimize the motor design around our material which will allow the motor to have efficiency gains over the current design today. That means that we have to work with our customers as we redesign their motors together to make sure the materials work optimally in those applications.

We have hired motor experts with 40 years of experience in designing motors. We are helping customers to gain those efficiency improvements by redesigning their motors to be suitable for our material and we are excited about that.

CEOCFO: *Has the investment community been paying enough attention?*

Mr. Rowntree: Over the last few months, we have had huge investor interest in our technology, raising well over \$100 million for Niron. We have been successful at gaining private investment which has been a big part of our success. We have our seed investor in US private equity, and another investor in 2017 invested heavily in us, so those are our two leading investors today.

We have also been very well-supported locally. The University of Minnesota has continued to invest in our technology, as well as the local Shakopee Mdewakanton Sioux Community, so we have been fortunate to have a strong set of investors.

More recently, we have an investment that came late last year from two big automotive OEMs, GM and Stellantis. Just a few weeks ago, we announced the investment by Samsung Ventures, which validated our suitability for audio speaker applications, as well as automotive tier-one companies like Allison Transmission and Magna. We are excited about the partnership with these customers. They are investing in us and they are going to buy our magnets, so we are excited about them investing and validating our technology. We are working closer with them to bring those magnets to market.

CEOCFO: *What are you on the lookout for in terms of challenges?*

Mr. Rowntree: Hiring is going to be a challenge, but we have done a very good job so far. We have doubled the size of our business in the last twelve months and we just hired our 75th employee. We will double again in the next 12-18 months, so fortunately we have a very good value proposition and we are a very purpose-driven organization that wants to make a difference in the world. We are doing our bit to accelerate the energy transition and change the world with our magnet technology. Our Clean Earth Magnet offers significant environmental savings when compared to the magnets used today.

The other challenge is scaling. There is not a science problem; we have solved our science. This is just an engineering challenge as we look to make larger batch sizes and larger magnets to get the yields and the cost of material that we need to be commercially viable. We are very confident about our ability to do that. It just takes time and learning as you scale from the lab up to 10,000 magnet factories that will sit on acres of land and have very large reactors, all while making ten-ton batch sizes of material, which is very different from what is required in the lab. That is what we are working on.

Our plans will be the tons scale and towards the end of the year and next year, we are building our low volume manufacturing plant to get us to the 100-ton scale in the next several years. We have already started to do our site selection for a high-volume manufacturing plant where we plan to build a much bigger and probably around 10,000-ton factory some time in 2026 or 2027, which will be the largest factory in North America. We have already down-selected to 10 or 11 states that would be the best place for that large-scale factory.

CEOCFO: *In closing, what should people remember about Niron Magnetics?*

Mr. Rowntree: I think we have a very talented team in terms of technology and what we are doing. We are excited about the interest not only from customers but also from investors. One thing I have not talked about is that at the beginning of last year, we secured a SCALEUP grant from the Department of Energy's ARPA-E program, which was a \$17.5 million-dollar grant. We are in the middle of executing and spending this grant award to bring our commercial pilot scale into being, which we expect to be complete by the middle of the year.

We also attracted interest from the Department of Defense, and we plan to continue the public/private partnership of private investment as well as government investment, which has been a very good model of approach and we expect to continue to do this to scale our technology as we move forward.