

# Peak Resources CEO on the economics of its rare earths project in Tanzania

March 23, 2018 – “But Tanzania is getting ready to start working the backlog of mining licenses and we get that from the mining minister, the deputy mining minister and the commissioner of mining” – said Rocky Smith, CEO of Peak Resources Ltd. (ASX: PEK), in an interview with InvestorIntel’s Peter Clausi.

**Peter Clausi:** The rare earths are an interesting market right now given the electric vehicle movement. Which rare earths does Peak Resources mine?

**Rocky Smith:** We mine all of the rare earths, but the primary rare earths in our operation are going to be NdPr – neodymium-praseodymium. They represent about 23% of our total rare earth composition.

**Peter Clausi:** What are the other ones?

**Rocky Smith:** Like most rare earth operations, you get about everything, everything comes. There is 15 rare earth elements. The primaries are always cerium and lanthanum, but you always get all of them. In our case the mids and heavies only represent about 1% of the total so they are really not worth that much to talk about.

**Peter Clausi:** Cerium is not really a rare earth. It is a rare earth, but it is not that rare. It is about as plentiful as copper.

**Rocky Smith:** Yes. Well, rare earths are really not that rare in the crust of the earth, but harder to find them in concentrations that you can actually recover them from.

**Peter Clausi:** The economics of mining. You have two projects underway right now.

**Rocky Smith:** We have an operation in Tanzania where the resource is. We are looking at starting that up and putting in a concentrator in Tanzania. Then taking the concentrate and moving it to Teesside in the U.K. and putting a refinery in there. We will basically crack the concentrate and then separate the impurities and then separate the rare earths from each other.

**Peter Clausi:** To my ear it sounds expensive to ship concentrate that far away. Why would you not just build on site?

**Rocky Smith:** The cost of shipping the reagents to the site would be about five times the cost to ship the concentrate to the reagents. So in this case the availability of a (inaudible) production and we actually do it as a by-product acid source. That is not available in Tanzania. If you were to try to process everything in Tanzania then you would have to ship five tons of reagents to Tanzania for every ton of concentrate that you would have shipped to the U.K. if you would have done it in the other direction.

**Peter Clausi:** Yeah, that is not very economic. Speaking of economic, you put out a project update in October of 2017 with some very impressive numbers. I saw pre-tax NPV of \$914 million U.S. dollars.

**Rocky Smith:** Yes. When we got done with the bankable we started really taking a hard look at the numbers and we noticed that we had some high reagent costs, particularly in the floatation areas in Tanzania. We went back and screened that particular area more diligently. We found that there were some opportunities there. We looked at different reagents that were less expensive, which was good, but we also found that the reagents that we were using actually performed so much

better than the one that we had in our BFS that we were able to bring more material through the same size plant. The effect of which was we had about a 15% increase in capacity through the plant, which of course affected the economics.

**Peter Clausi:** When do you think that plant will be constructed and operational?

**Rocky Smith:** All the construction is really pending, the permits coming through in Tanzania and the required financial raise, so whenever those happen we will start. That will take us about 15 to 18 months to build both these plants. It's a little bit difficult for me to say exactly when these other two things are going to happen. We're making some progress in Tanzania. It's been since July last year when they changed the mining law. Everyone kind of stopped their process. But Tanzania is getting ready to start working the backlog of mining licenses and we get that from the mining minister, the deputy mining minister and the commissioner of mining. Everyone is pretty much saying the same thing that they've got to set this commission, once that happens they will start working through this long list of mine projects that are there...to access the complete interview, [click here](#)

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## **Profiting from the Inevitable Price Increases of Rare**

# Earths in 2018

The rare earth market will have a tremendous 2018. Position yourself now to profit from that.

There are three key takeaways from this article. The first is that while rare earth elements aren't actually that rare (for example, cerium, #58 on the periodic table, is about as common as copper), REE's are extremely difficult to extract and process.

It is technically complicated to separate them from each other and from the host ore, increasing the cost and risk of mining REE's as compared to something more generic like gold or nickel. While they are easy to find, these metallurgic difficulties makes the REE supply response inelastic.

Second, something to compare it to, and for that we look at cobalt, the dominant element in the cathode of a lithium ion battery. For a primer on why cobalt spiked, please look here and here. In summary, Economics101 predicted the increased value in cobalt. It was clear that demand for cobalt was increasing as lithium ion batteries found their way into our toothbrushes, hedge trimmers, drones, cell phones and most importantly our electric vehicles. It was also clear that supply was at risk due to the concentration of cobalt production in the unfortunate Congo.

Risky supply + increased demand = price increases. When we called about cobalt about 20 months ago, it was trading on the LME at roughly USD\$10 per pound. Today, it's around \$27. We're calling for \$35 by year end.

We are calling for the same kind of reaction in the REE market, and for the same basic reasons.

Which brings us to the the third takeaway, namely, supply and demand. The REE market already had one major surge this

century, coming in 2010, but that was in response to China's state-managed cuts in production. Since 95% of the world's REE's come from China, those production cuts caused prices to jump through 2011, when China changed its mind and prices plummeted (a simplistic summary of a complicated situation). In that case, the supply side dictated pricing.

As with cobalt, and the third major takeaway here, is that the next run in REE pricing will be driven by the leveraged push-pull of global product shortage and increased demand.

The U.S. Department of Energy is anticipating a critical shortage of neodymium, europium, terbium, dysprosium and yttrium necessary for green technology development and construction. (US Dept of Energy, Technology Metal Research). With virtually no production outside of China and with the supply response being inelastic, it will take a considerable amount of time for new mines to come online and begin production.

Part of that shortage will be driven by new demand, with possibly the greatest new demand for REE's in electric vehicles. For proof, consider the thought experiment from UBS in May, 2017. UBS's thought experiment was, let's tear apart a Chevy Volt to see what it's made of, and then draw inferences as to pricing of the vehicles and the pricing of the minerals that go into making a Volt. (As an aside, note that UBS' cobalt conclusion was the same as ours, that cobalt will have a great run should the sale of EV's continue.)

One of UBS' many interesting conclusions was that the market for rare earths, neodymium in particular, could face demand shocks in case of a rapidly evolving EV market. The material is used in the e-motor magnets (see page 8 in the report).

There is one more less empiric measurement to consider here, and we acknowledge it is less scientific and more anecdotal. However, it has been a reliable gauge for us in the past.

That gauge is this: there are more REE deals passing through my inbox than ever before. Investors are asking me to find them to good REE companies, and good REE companies are confidently seeking growth capital rather than coming apologetically hat-in-hand. Those two things happening at the same time is a leading indicator that the REE market will be play within 12 months or so.

So our three takeaways and the anecdotal evidence result in one question: do you as an investor think there will be more appliances with lithium ion batteries sold next year, or fewer? If it's more, then load up on the REE companies. If it's fewer, then go long steel.

Our call is that 2018 will be a big year for REE's. Plan ahead to profit from that.

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## **Lynas defies market to become a super metal heavy weight**

It's hard to believe that only a year ago, the fate of Lynas Corporation (ASX: LYC | OTC: LYSDY) ("Lynas") hung in the balance; debts had mounted, Malaysian operations were troubled with opposition, and the market for rare-earth elements (REEs) had never been in worse shape. Today, the company proudly wears the crown of the largest producer outside of China, and as prices begin to recover amid the Chinese crackdown on illicit mining practices, Lynas now reports positive cash flow and record operating efficiency; talk about a turnaround!

The company has been busy undertaking three years of continuous operational improvements and cost management, positioning Lynas to take advantage of the upturn in the rare

earths market. This month, the company's quarterly activities report makes for delightful reading, having reached the level of largest supplier of NdPr to the free market with invoiced sales revenue of A\$75.6m for the quarter, and producing their neodymium and praseodymium products at above design rate, with 1,343 tonnes for the quarter, up 17.6% on the June 2016 quarter.

China's asking price for NdPr is being driven higher and higher by continued strong demand for magnetic materials and the effects of the China central government's initiatives to enforce stricter environmental controls. Lynas increased cash flows from operating and investing activities to A\$15.8m from A\$11.6m in the previous quarter, and given that the NdPr price trend is expected to continue in the near term, the company's position should only become stronger throughout 2017.

Neodymium and praseodymium are the company's primary focus. The magnetic elements are experiencing increasing demand due to the rise in the use of magnetic motors in modern technologies such as electric vehicles and wind turbines; two areas in which significant growth is expected over the next decade. In fact, since many scientific groups began warning that carbon emissions must become negative as a matter of global urgency, interest in wind farming has been fueled even further, and some have even predicted that all new vehicles manufactured will be electric by 2030. It seems that the only way really for Lynas is up.

On top of the critical NdPr product, Lynas also produces cerium and lanthanum products which complement its operations. Lanthanum remained in high demand outside China this year, especially for high performance ferrite magnets and NiMH batteries, and all lanthanum produced by Lynas in this quarter was sold. The company also made significant quality improvements to cerium products, allowing them to increase their share of the catalyst and UV cut glass markets. In addition, Lynas have started developing new customized grades

for niche applications in order to attract higher prices.

This continued refinement of practices and products is what has kept the company above water during the harsh times of the last half-decade, and there is nothing to suggest that Lynas will change tracks anytime soon. The company enjoys a rare position in that 100% of its assets are commissioned; nothing is sitting on the back burner. Given the hard-won top-dog status the company has achieved, shares are an absolute bargain right now at only A\$0.10, and looking forward, it appears that the next few years will be far more fortuitous than the last for this miraculous survivor of some the harshest market conditions we've ever witnessed.

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## Lynas Targets Multiple Rare Earth Supply Chains

Amanda Lacaze, Managing Director of Lynas Corporation Ltd. (ASX: LYC | OTC: LYSDY) in an interview with InvestorIntel Editor Peter Clausi discuss the Australian's rare earth plays. Being the largest rare earths producer outside China, Amanda tells us of their primary product, neodymium and praseodymium (NdPr): "it is not a commodity, it is actually a specified functional material; so it can't be sold into a pool and then sold out, and that's a very good thing for our business." Lynas also targets the mixed oxide supply chain with lanthanum and cerium, and they reported record-breaking positive cash flow last quarter of AUS\$11.6 million.

**Peter Clausi:** Lynas has had a great year so far.

**Amanda Lacaze:** We've been quite pleased with this year.



There's been a lot of heavy lifting in Lynas and I know that you have tracked Lynas' performance over time. We're pretty happy. We're in a good spot now. We've now got 100% of our assets commissioned. We've got one separation train yet that we're going to look at how we actually bring that into play, but we're operating at slightly above design rates for Nd Pr which is the most valuable of the materials we produce.

**Peter Clausi:** A year ago you came to the conference saying you had erased debt, you put the assets— getting them ready for production and you had said it was going to be a big, big year. Now a recent press release shows that you have positive cash flow.

**Amanda Lacaze:** Actually I'm not sure that I said we had erased it. We've taken it away as a continuing issue. In fact, in the year just passed we did do a further rescheduling of the debt. I think we may have some of the cheapest money in the world seeing we're secured at 2.5%. Our bond is now at 1.25% coupon. Both of those debts have been pushed out, so we have plenty of runway.

**Peter Clausi:** Is that with a bank or a private lender?

**Amanda Lacaze:** The senior secured is with a company called JARE, which is a special purpose vehicle combined from JOGMEC, which is a Japanese government instrumentality, and Sojitz. Our subsidiary convertible bond is actually with a group of hedge funds basically. Both of our lenders have been very supportive during the period of time that the business has been both ramping up and also dealing with the most unfavorable market conditions that most people can remember. We are very aligned. We're very aligned on making a strong and successful business that sees good returns to all stakeholders...to access the full interview, [click here](#)

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# Northern Minerals ramping up to be the next heavy rare earth supplier outside of China

Northern Minerals Limited (ASX: NTU) (“Northern Minerals”) is focused on the delivery of the heavy rare earth (HRE) element, dysprosium. The company owns a significant landholding in Western Australia and the Northern Territory that is highly prospective for this commodity. Through the development of its flagship project, the Browns Range Project (the Project), Northern Minerals aims to be the world’s first significant producer of dysprosium, or any heavy REEs for that matter, outside of China.

Per the Definitive Feasibility Study (DFS), the full scale operation will use a combination of open pit and underground mining methods to extract 585,000t @ 0.66% total rare earth oxides (“TREO”) per annum, which will be treated through a beneficiation and hydrometallurgical plant. The project’s current mineral resource supports an eleven-year mine life, and with significant scope to expand this through further exploration, the project’s future is indeed promising.

A hydrometallurgical process will then further treat the 16,700tpa of mineral concentrate to produce 279,000kg of dysprosium per annum. The pilot plant is to feature a modular design where possible; a common solution chosen by smart companies who want to scale their operations with less risk than having a full and permanent processing facility anchored to their property. A modular plant has the ability to be

scaled both up and down as needed, not to mention shipped off to other sites for additional benchmarking and such.

Stage one includes the construction of a three year, 60,000tpa pilot plant operation at the Browns Range site. It will consist of an open cut mining operation, with processing via a beneficiation and hydrometallurgical pilot plant to produce 49,000kg dysprosium per annum, this state is intended to fully de-risk the operation by testing the process over time; it is important to thoroughly understand and improve knowledge of grade control, and the project's specific geology, to ensure that full future production goes ahead as smoothly as possible.

Northern Minerals is already working alongside government regulators in relation to utilising current project approvals to execute stage one, and construction is expected to take around nine months once product offtake and funding is in place.

Stage two involves developing the project to Bankable Feasibility Study level based on the DFS completed in March 2015. The results of the studies, announced on 27 August 2015, are aimed at reducing mining costs, boosting production, producing a premium product and increasing the Ore Reserve. The final stage involves taking the project to full scale production based on the successful outcomes of stage one and two. Once at full scale, Browns Range will process 585,000tpa to produce 279,000kg of dysprosium, contained within 3,098,000kg TREO per annum, in a mixed RE carbonate, before going through a process of yttrium rejection.

The rejection of yttrium during the hydrometallurgical stage is intended to significantly reduce costs further downstream. Removing around 90% of the yttrium at this stage results in a less mixed carbonate. With current market signals indicating that sale of the yttrium oxide is likely to be limited for the foreseeable future, this step will increase the percentage of

the dysprosium in the mixed RE carbonate product from 9% to around 20%, creating a premium product and gaining the company a decent edge.

Completion of initial test work at ANSTO Minerals has indicated that removal of yttrium, lanthanum and cerium can be achieved through a relatively simple addition to the hydrometallurgical process. Further developmental studies will be completed subject to additional funding.

The pilot plant will be supported by a fly-in rota, and the workforce will be accommodated through an expansion of the existing twenty-person exploration camp to forty-room capacity. The plan to progress stage one to development is already well underway. Discussions are advancing nicely with several potential offtake partners and strategic investors, showing that it shouldn't be long at all before Australia adds another resource to its shipping roster. In addition to this, should Northern Minerals engagements with government regulators result in existing approvals for stage one being authorised, the Browns Range project will proceed very swiftly indeed.

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## **Lynas's Record Results – A Return to Rare Earth Confidence?**

Lynas Corporation (ASX: LYC | OTC: LYSDY) (“Lynas”) caused a stir in the Australian markets earlier yesterday, becoming one of the biggest movers with a 9% gain at morning trade. The shares of the rare-earth miner have bounced up twice this month, surrounding the release of the company's second quarter

update published on Tuesday; Lynas revealed record PrNd production of 1,331 tonnes, an impressive 13.2% increase on the previous quarter, beating their own projections.

Lynas commented that the production increases were the result of operational improvements made with the intention of boosting performance.

*“The changes to output volume are expected to be long-term and this seems to have boosted confidence in the team, in spite of a tough year for rare-earth prices. Saying that, this January has seen a slight boost to the RE market, with many claiming it to be the beginning of the end of the slump.”*

Additionally, the company noted that despite continued low prices for rare-earth products, its operating cash flow improved significantly, rising from A\$1.7m to A\$5m.

During the December quarter, planning was also finalised for the first mining campaign at the company’s Mount Weld Project in almost ten years. The Western-Australian volcano stabbing mission, which should provide one year of mill feed, is set to start this month at a cost of around A\$3m. The Mt Weld Central Lanthanide Deposit (CLD) is one of the highest grade rare-earth deposits known. Mt Weld also hosts a further three undeveloped sites rich in mantle-borne-treasures such as niobium, tantalum, titanium, zirconium and phosphate that present excellent future opportunity.

The Mt Weld deposits are concealed inside a two billion year old volcanic plug; An estimated 1.8km of which has been weathered during this time to form a high grade supergene rare-earth-oxide (REO) deposit. Lynas processes the ore on-site at the Mt Weld Concentration Plant, that concentrated product then finds its way to the Lynas Advanced Material Plant (LAMP) near Kuantan in Malaysia where it will be further refined into materials such as Neodymium/Praseodymium (Nd/Pr).

Despite being a rare-earth element and never being found in its free form in nature, neodymium is as prevalent in the Earth's crust as nickel, copper, and cobalt. It is used in a range of scientific and industrial applications and perhaps best known for creating super-strength magnets when combined with praseodymium.

The LAMP produces Nd/Pr oxide, cerium carbonate, cerium oxide, Lanthanum/Cerium carbonate and Lanthanum/Cerium oxide, and SEG oxide, as well as iron phosphogypsum and magnesium rich gypsum products which are stored on site in dedicated facilities. The company is well-advanced on developing commercial uses for these additional materials, further assisting with efficiency and financial performance. The plant is built on a 100 hectare site that is adjacent to established manufacturers of key chemical reagents, and has access to a skilled labour force and excellent infrastructure.

The company noted that their recent improved financial outcomes were underpinned by boosted production, but the second-quarter update had yet more to give, revealing that Lynas achieved record sales of A\$65m, up from A\$53.8m in the September quarter.

*"We expect demand to remain strong over the coming period and are hopeful the recent firming of lanthanum and cerium prices may also be reflected for other rare earth products."*

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## **Rare earths search picks up as focus back on need for new**

# supplies

Feel that? “That” is a sudden shift in the ground under the rare earths. In fact, Dudley Kingsnorth, speaking at the recently held 5th Annual Cleantech and Technology Metals Summit, hinted at one factor that might change the REE picture: the cheap price of cerium may lead to more applications using it.

But there are two main trends: one is a growing realization that, while we’ve been talking about lithium and other technology metals, a large chunk of electronics and technology still relies on various rare earth elements. Yes, lithium is going to be big, but future supply of that does not at this stage seem to be in doubt, what with all the contenders falling over each other to get into that business – and most particularly the fact that it can be sourced from a range of geological locations (Bolivia, Canada, Australia among them) rather than China having the whip hand.

In fact a writer in *The Irish Times* made this point recently when he wrote, after discussing lithium, **“what the world really needs now is cheaper and more reliable sources of the rare earth elements”**. While not quite making sense (the last thing the industry needs is cheaper REE as it can barely function with those prices now applying) you can see that his heart is in the right place. Yes, we do need more “reliable” sources of rare earths in the sense of having sources outside of China. But we have talked ourselves hoarse over the years about the long-term danger of depending on China without any resolution; perhaps, thanks to *The Irish Times*, we might focus our minds back on that.

The other trend is signaled by a number of news stories concerning the ability of the United States to get back into production of rare earths – something that has long been urged by those concerned about the resource securities issue.

The first item is the only one that has direct bearing on *mining* of rare earths in the US as opposed to *extraction* of them.

The Manchester, England, based advanced metals study group, AZOM, reports on work in the US concerning new aluminium-cerium alloys. The Oak Ridge National Laboratory is working with Eck Industries and the Lawrence Livermore National Laboratory on including cerium in these, making the alloy more workable and malleable.

This is the important point, according to AZOM: the most common REE-containing ore in the US, it says, has 500 times the amount of cerium than dysprosium (and a factor of three to neodymium). AZOM argues that if a market could be found for that cerium, then REE mining in the US becomes more attractive because adding 1% of cerium into aluminium alloys would provide a market for 3,000 tonnes of cerium a year.

*(An important aside: this is not InvestorIntel claiming this to be the case; we are just reporting what has been claimed.)*

This is what AZOM says: "if the new alloys are adapted for use in internal combustion engines, they could swiftly convert cerium from a problematic by-product of rare earth mining to an important product in itself. These aluminum-cerium alloys would allow engines to enhance fuel efficiency directly by operating hotter. They may also optimize fuel efficiency indirectly, and thereby leading the way for development of lighter engines that use small aluminum-based parts or use aluminum alloys to substitute cast iron parts such as transmission cases, cylinder blocks, and cylinder heads."

The second item comes from the Pratt School of Engineering at Duke University in Durham, North Carolina. They recently produced a study showing that ashes from coal mined from the Appalachian Mountains could be a source of some technology metals. University researchers have measured the content of



rare earth elements in samples of coal ash from every major coal source in the US. The results showed that coal from the Appalachians contained the most rare earths. Heileen Hsu-Kim, associate professor of civil and environmental engineering at Duke, concludes that “there’s literally billions of dollars worth of rare earths elements contained in our nation’s coal ash”.

The researchers used an extraction technique involving nitric acid and concluded that it would be possible to extract elements such as neodymium, europium, terbium, dysprosium, yttrium and erbium from the burned coal. Hsu-Kim said the next stage would be to look at the cost of extraction. “The trick will be exploring our options and developing technologies to drive the costs down.”

Thirdly, University of Wyoming researchers have joined those at the Idaho National Laboratory and the US Geological Survey to study retrieving REE from water produced in oil and gas production and geothermal projects.

How many of these will ever eventuate no one can guess.

And, true, investigations into extracting rather than mining do not help the mining companies that hope to get into producing these elements out of the ground.

But the take-home from this post is that the reliable supply of REE is still very much an issue. And that the development of new mines outside China is still much needed because, even with lithium flying high, much of our technology will still depend on REE.