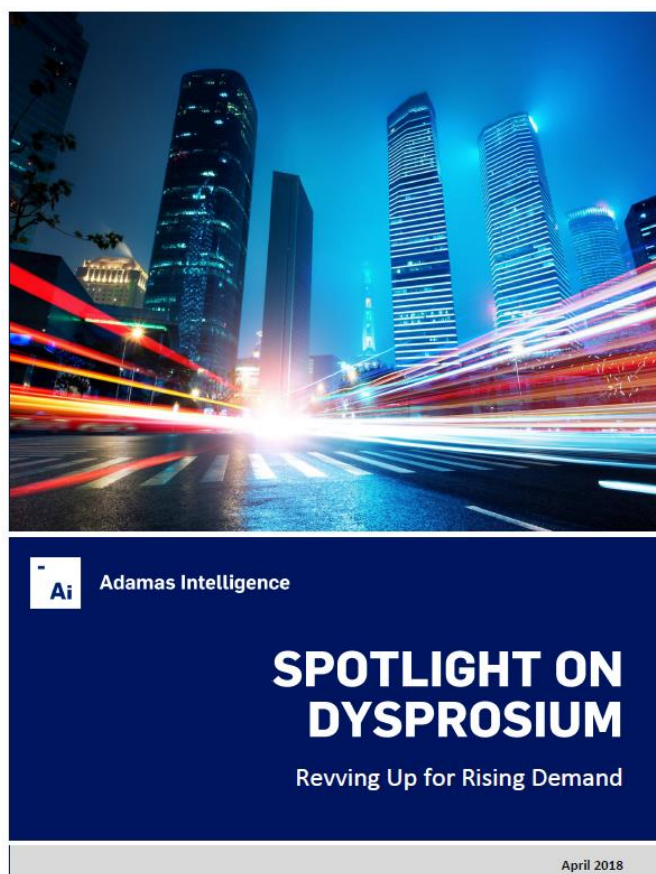


## Research confirms global dysprosium deficit

- 98% of global dysprosium production comes from China;
- Increased EV production is driving demand growth, even including efficiency gains;
- Chinese dysprosium production has decreased 34% since 2013 following crackdown on illegal miners;
- Browns Range is the only advanced dysprosium project globally that can address the supply gap.

Australian heavy rare earths developer, Northern Minerals Limited (ASX: NTU) (**the Company**) has commissioned a research report by independent consultancy Adamas Intelligence (**Adamas**) focussing on dysprosium and the global drivers of supply and demand for this critical element.

As Northern Minerals' Browns Range heavy rare earth project enters the commissioning phase (see ASX announcement 24 April 2018), this report highlights the pervasive global use of dysprosium in today's electronic driven lifestyles and how there are limited options for supply growth in the short term.

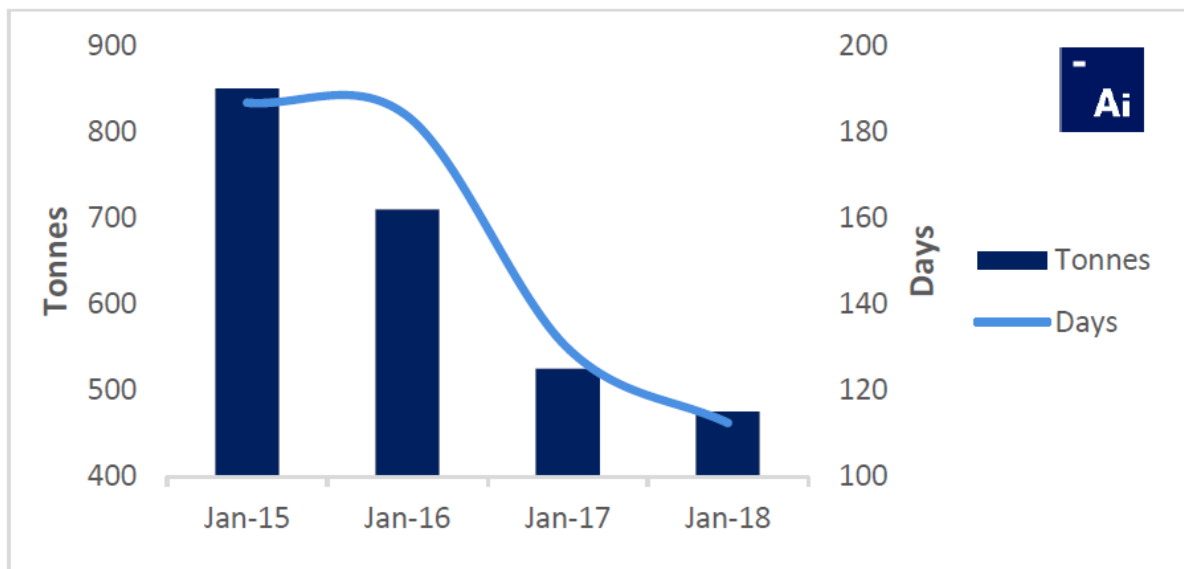


The full Adamas Intelligence report is available for [download](#) from the Northern Minerals' website under Investor Centre, Analyst Reports and 2018 titled Adamas Intelligence – Spotlight on Dysprosium – April 2018.

## Key Findings

Key findings of the Adamas report include:

- *Dysprosium demand growth will be increasingly driven by global megatrends linked to electric mobility, clean energy, energy efficiency, and automation. These fast-growing policy-driven sectors will propel global dysprosium demand to new heights, requiring an unprecedented increase in global production to keep up.*
- *Over the past decade, China has been responsible for over 98% of global dysprosium oxide (or oxide equivalent) production each year. From 2005 through 2013 more than half of China's dysprosium oxide (or oxide equivalent) production each year was derived from unsanctioned/illegal mining activities. An ongoing government-led crackdown on illegal rare earth mining in China has led to a 34% reduction in global dysprosium oxide production since 2013.*
- *Inventory levels have decreased markedly since 2015, with an almost 50% drop in held stocks to a low of ~110 days at the start of 2018 (Figure 1).*



Source: Adamas Intelligence research, Asian Metal

Figure 1: Dysprosium inventory levels

- *Adamas believes that China's production alone will be insufficient to support global demand growth. In fact, by 2025 China's demand for dysprosium oxide for electric vehicle traction motors alone will amount to 70% of the nation's current legal production level, emphasizing the imminent need for new supplies. Outside of China, there are a handful of advanced rare earth development projects with potential to add significant quantities of dysprosium oxide production annually by 2025.*
- *If automakers, motor manufacturers, and other end-users of high-temperature NdFeB do not act today to secure long-term supplies, they will soon find themselves amidst a sellers' market scrambling for rare earth motor metals the same way many are scrambling today for battery metals.*

Rare earths comprise a series of 17 elements that are found in nature. Despite the term ‘rare’, these elements are quite abundant in the Earth’s crust, although seldom at levels that are concentrated enough to be economically produced.

In 2017, there were 138,900 tonnes of all 17 rare earth oxides (REOs) combined produced globally. This compares to 19,700,000 tonnes of copper, 4,700,000 tonnes of lead and 290,000 tonnes of tin during the same period.

Of the 138,900 tonnes of REOs produced, only 1.1% of this was comprised of dysprosium oxide, being 1,501 tonnes in 2017. This level is down 34% from 2013 levels at 2,265 tonnes due to a crackdown on illegal mining in China. Chinese production accounts for 98% of global production.

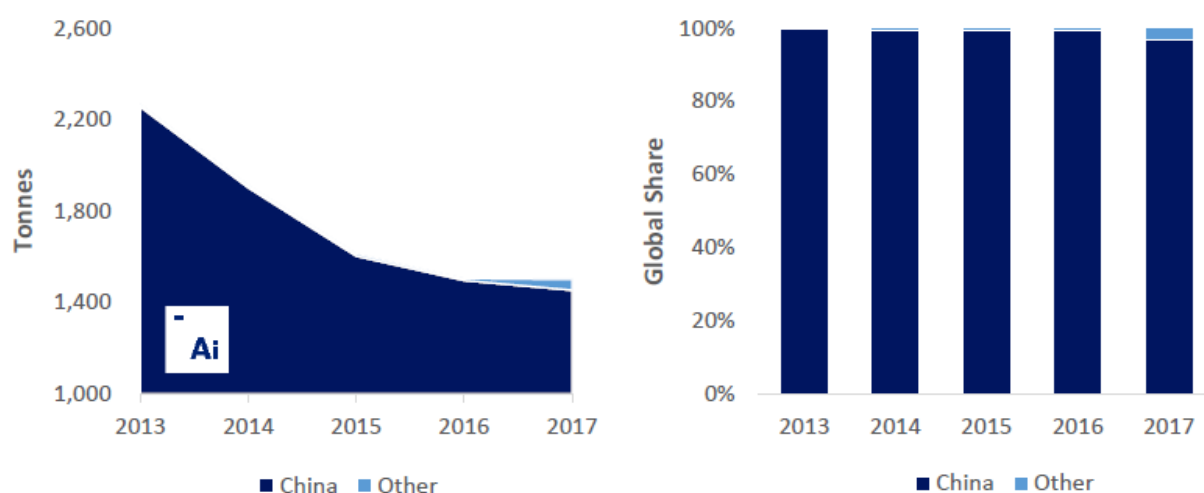


Figure 2: From 2013 through 2017 China was responsible for over 98% of global annual production

Adamas estimates that from 2013 through 2017, global annual consumption of dysprosium oxide (or oxide equivalent) decreased overall at a near-negligible CAGR of -1.3%, from 1,745 tonnes to 1,656 tonnes, putting it into a deficit.

There are two forces at play with regards to consumption. Firstly, there has been an efficiency drive by permanent magnet makers to reduce the amount of dysprosium used in certain grades of neodymium-iron-boron (“NdFeB”) magnets, primarily as a result of a price spike in 2011.

Despite a reduction in dysprosium concentrations used in certain grades of NdFeB, global demand for dysprosium oxide returned to growth in 2017 on the back of strong demand growth for magnets used in electric vehicle traction motors, wind power generators, and numerous other applications.

Therefore, despite efficiency gains by permanent magnet makers, the rate of growth of EV use has outpaced this leading to an increase in demand overall. On the supply side, with China continuing to crack down on illegal mining, there is an increasing supply shortage looming with Browns Range as the only new producer likely for several years.

The above-mentioned trends can be seen in Figure 3 below, which shows the impact of increased demand coupled with efficiency gains by magnet makers

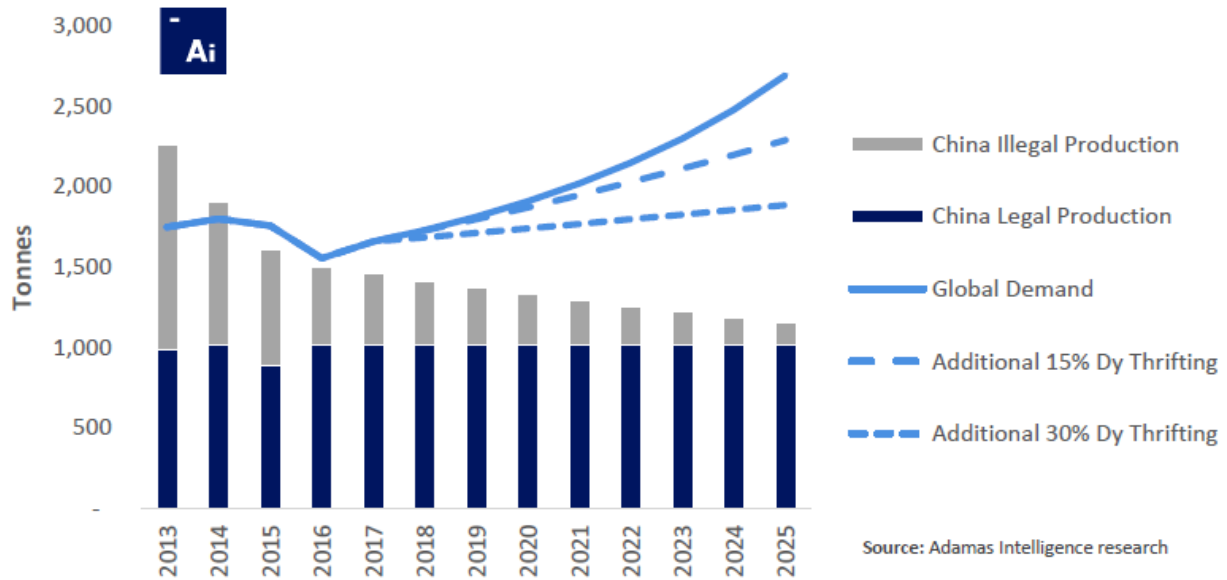


Figure 3: Increasing supply deficit

Outside of China there are eight advanced rare earth projects at various stages of pre-production development with potential to add significant quantities of dysprosium oxide supply annually by 2025.

These eight projects are in six nations on five continents and collectively have potential to add upwards of 1,200 tonnes of dysprosium oxide (or oxide equivalent) supply annually over the coming eight years.

Of these, four have a completed feasibility study, although dysprosium is not the primary commodity for most of these, meaning their development will hinge on other considerations.

Only Browns Range is advanced enough to commence production in the near-term, with commissioning recently started for the Pilot Plant Project.

If the Pilot Plant Project confirms the economic and technical feasibility of the full-scale project, this has the potential to add approximately 280 tonnes of dysprosium oxide per annum. At full-scale, Browns Range dysprosium production would be sufficient to supply the traction motors of approximately 2.7 million electric vehicles annually.

Northern Minerals' Managing Director, George Bauk commented *"This research confirms that despite its relatively small size, the dysprosium industry is critically important to future EV growth."*

*"Northern Minerals' position as the only dysprosium producer outside of China highlights the significant first mover advantage that we have, with heightened levels of interest in the Browns Range project globally."*

## ASX ANNOUNCEMENT

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### About Northern Minerals:

Northern Minerals Limited (ASX: NTU; Northern Minerals or the Company) has commenced commissioning of the Browns Range Heavy Rare Earth Pilot Plant Project in northern Western Australia.

Through the development of its flagship project, the Browns Range Project (the Project), Northern Minerals aims to be the first significant world producer of dysprosium outside of China.

The Project is 100% owned by Northern Minerals and has several deposits and prospects containing high value dysprosium and other HREs, hosted in xenotime mineralisation.

Dysprosium is an essential ingredient in the production of DyNdFeB (dysprosium neodymium iron-boron) magnets used in clean energy and high technology solutions.

The three-year R&D pilot plant project will commence first production of heavy rare earth carbonate in H1 2018. The pilot plant development provides the opportunity to gain production experience, surety of supply for our offtake partner and assess the economic and technical feasibility of the larger full-scale development.

For more information: [northernminerals.com.au](http://northernminerals.com.au).



ASX Code:	NTU	Market Capitalisation:	A\$94m
Issued Shares:	1,100m	Cash (as at 31 March 2018):	A\$14.9m