

RARE EARTH MARKET OUTLOOK: SUPPLY, DEMAND, AND PRICING FROM 2016 THROUGH 2025

Adamas Intelligence: Critical Metals and Minerals Research

Following a lengthy, and at times painful, period of adjustment since the boom and bust of the rare earth market in 2011, the future will be marked by strong global demand growth for a number of rare earth elements, including neodymium, praseodymium, dysprosium, and lanthanum, and consequently, will see prices of most rare earth products return to levels that sustain the profitability and growth of today's dominant producers, and incentivize continued investment in exploration and resource development globally.

In this report, we analyze the rare earth market from 2005 through 2015, estimating production, consumption, prices, and the value of regional and global markets in each year. We provide a breakdown of REO consumption per end-use for over 200 individual end-uses and applications, and reveal insightful trends about the trajectory of the rare earth market.

With valuable hindsight in tow, we forecast supply, demand, prices, and the value of regional and global markets for each year from 2016 through 2025. We provide a detailed breakdown of forecasted REO demand per unit and per end-use for more than 200 individual end-uses and applications, and analyze three distinct future scenarios to forecast REO prices under different supply and demand conditions.

Essential reading for:

- Informed investors and financiers
- Technology, material, and chemical developers
- Exploration and mineral development companies
- Government agencies and advisory boards
- NGOs and global think-tanks
- Research organizations
- Advisory firms

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This report contains "forward-looking statements" – that is, statements related to future events. In this report, forward-looking statements address our expectations of future rare earth production, supply, demand, consumption, and pricing within parameters defined by stated scenarios, and often contain words such as "forecast", "project", "expect," "anticipate," "intend," "plan," "believe," "seek," "see," or "will." Forward-looking statements by their nature address matters that are, to different degrees, uncertain. A number of future uncertainties exist that could cause actual results to be materially different than those expressed in our forward-looking statements. Readers are responsible for assessing the relevance and accuracy of these forward-looking statements. Adamas Intelligence will not be liable for any loss, damage, cost, or expense incurred or arising by any reason of any person or business using or relying on forward-looking statements in this report.

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Executive Summary

Since the rare earth price spike of mid-2011, the market has endured a wealth of demand destruction. Over the past five years a significant amount of TREO demand, upwards of 30,000 tonnes per annum, has been lost on account of end-users' growing concerns over supply security, and a comparably significant amount of TREO demand, upwards of 20,000 tonnes per annum, has been lost as a result of the ongoing organic phase out of several mature technologies, such as fluorescent lamps, NiMH batteries, and HDDs, for example.

Looking back over the past five years, one can almost be forgiven for thinking that the global rare earth industry is on a terminal course. But, one can open this report to almost any page and see that this is simply not the case. Following a lengthy, and at times painful, period of adjustment since the boom and bust of the rare earth market in 2011, the future will be marked by strong global demand growth for a number of rare earth elements, such as neodymium, praseodymium, dysprosium, and lanthanum, and consequently, will see prices of most rare earth products return to levels that sustain the profitability and growth of today's dominant producers, and incentivize continued investment in exploration and resource development globally.

The outlook for rare earth demand from 2020 through 2025, and beyond, is exceptionally promising. This period reveals that for many of today's most highly publicized rare earth end-uses, such as electric vehicles, wind turbines, and many others, the rate of annual demand growth is poised to accelerate between 2020 and 2025, steering global rare earth demand to unfathomable new heights in the years thereafter.

In this report, we analyze the rare earth market from 2005 through 2015, estimating production, consumption, prices, and the value of regional and global markets in each year. We provide a breakdown of REO consumption per end-use for over 200 individual end-uses and applications, and reveal insightful trends about the trajectory of the rare earth market.

With valuable hindsight in tow, we forecast supply, demand, prices, and the value of regional and global markets for each year from 2016 through 2025. We provide a detailed breakdown of forecasted REO demand per unit and per end-use for more than 200 individual end-uses and applications, and analyze three distinct future scenarios to forecast REO prices under different supply and demand conditions.

This report builds on twelve months of primary research, including personal communication with hundreds of topical experts and rare earth industry stakeholders, and contains a wealth of current data and information covering all facets of the global rare earth industry.

Among the high-level findings of the report:

Government-led initiatives will fuel over half of all new demand growth through 2025

Global rare earth demand has become inextricably and inadvertently linked to government policies, regulations, mandates, and initiatives concerning electric mobility, clean power generation, energy efficiency, greenhouse gas emissions, urbanization, and industry modernization. Looking ahead, we forecast that over 50% of all new global rare earth demand growth over the coming ten years will be directly or indirectly driven by government-led actions.

China will become a net importer of certain rare earths by 2025

As China's insatiable demand for rare earth elements continues to grow over the coming ten years, China's domestic production will struggle to keep up in all scenarios examined herein, leading the nation to become a net importer of certain rare earths at the expense of the rest of the world's supply security. In fact, by 2025 China's domestic demand for neodymium oxide for permanent magnets alone is poised to exceed total global production of neodymium oxide by 9,000 tonnes in our base case scenario, highlighting the imminent need for additional sources of supply.

The market calls for development of a new mine every year by 2025

From 2016 through 2020 demand for neodymium, praseodymium, dysprosium, and lanthanum will grow relatively strongly, but, from 2020 through 2025 the rate of global demand growth for these rare earths will accelerate year-over-year, resulting in major annual demand increases by 2025 that can only be satisfied by the continuous and accelerated development of new mines.

In-lieu of conventional sources of capital, China will become a major investor in development of foreign rare earth resources

As the supply and demand sides of the global rare earth market continue to evolve on dichotomous paths, and China comes to terms with the fact that domestic demand will soon outgrow domestic production, we believe China's investments in development of foreign rare earth resources will rapidly accelerate should conventional sources of capital continue to ignore the rare earth industry. Evidence of this likely outcome is already emerging.