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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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Terminology & Abbreviations

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<tr>
<th>Abbreviation</th>
<th>Terminology</th>
<th>Definition</th>
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<tr>
<td>REE</td>
<td>Rare Earth Element</td>
<td>The lanthanide series of chemical elements, plus yttrium</td>
</tr>
<tr>
<td>REO(s)</td>
<td>Rare Earth Oxide(s)</td>
<td>Chemical oxides of lanthanides and/or yttrium</td>
</tr>
<tr>
<td>TREQ</td>
<td>Total Rare Earth Oxide</td>
<td>The collective group of all rare earth oxides combined</td>
</tr>
<tr>
<td>LREO(s)</td>
<td>Light Rare Earth Oxide(s)</td>
<td>$\text{La}_2\text{O}_3$, $\text{CeO}_2$, $\text{Pr}<em>6\text{O}</em>{12}$, $\text{Nd}_2\text{O}_3$, $\text{Sm}_2\text{O}_3$, $\text{Eu}_2\text{O}_3$, $\text{Gd}_2\text{O}_3$</td>
</tr>
<tr>
<td>HREO(s)</td>
<td>Heavy Rare Earth Oxide(s)</td>
<td>$\text{ Tb}_2\text{O}_7$, $\text{ Dy}_2\text{O}_3$, $\text{ Ho}_2\text{O}_3$, $\text{ Er}_2\text{O}_3$, $\text{Lu}_2\text{O}_3$, $\text{Yb}_2\text{O}_3$, $\text{ Ym}_2\text{O}<em>3$, $\text{ Y}</em>{2}\text{O}_3$</td>
</tr>
<tr>
<td>neo-CREO(s)</td>
<td>New Critical Rare Earth Oxide(s)</td>
<td>$\text{La}_2\text{O}_3$, $\text{Nd}_2\text{O}_3$, $\text{Pr}<em>6\text{O}</em>{12}$, $\text{ Dy}_2\text{O}_3$, $\text{ Tb}_2\text{O}_7$ (see page 24 for more information)</td>
</tr>
<tr>
<td>mag-REO(s)</td>
<td>Magnet Rare Earth Oxide(s)</td>
<td>$\text{Nd}_2\text{O}_3$, $\text{Pr}<em>6\text{O}</em>{12}$, $\text{ Dy}_2\text{O}_3$, $\text{ Tb}_2\text{O}_7$ (see page 24 for more information)</td>
</tr>
<tr>
<td>add-REO(s)</td>
<td>Additive Rare Earth Oxide(s)</td>
<td>$\text{Gd}_2\text{O}_3$, $\text{ Tb}_2\text{O}_7$, $\text{ Dy}_2\text{O}_3$, $\text{ Ho}_2\text{O}_3$ (see page 24 for more information)</td>
</tr>
<tr>
<td>Mineral Resource</td>
<td>Mineral Resource</td>
<td>Concentration of mineralized material of economic interest for which there is a reasonable prospect that it could eventually be viably extracted</td>
</tr>
<tr>
<td>Mineral Reserve</td>
<td>Mineral Reserve (a.k.a. Ore Reserve)</td>
<td>Economically mineable part of mineral resource as demonstrated by a PFS or FS</td>
</tr>
<tr>
<td>Grade</td>
<td>Grade</td>
<td>Concentration (weight percent) of a material of economic interest in its host</td>
</tr>
<tr>
<td>NI 43-101</td>
<td>National Instrument for the Standards of Disclosure for Mineral Projects in Canada</td>
<td>Rules and guidelines for reporting information related to mineral properties owned by, or explored by, companies which report these results on stock exchanges within Canada; derived from Canada Securities Authorities</td>
</tr>
<tr>
<td>JORC Code</td>
<td>The Australasian Joint Ore Reserves Committee Code</td>
<td>Code for reporting the status of a mineral resource owned by companies that trade on the ASX; derived from an independent mineral industry body</td>
</tr>
<tr>
<td>SAMREC Code</td>
<td>South African Mineral Committee Code</td>
<td>Minimum standards, recommendations, and guidelines for the public reporting of exploration results, mineral resources, and mineral reserves</td>
</tr>
<tr>
<td>Relative Distribution</td>
<td>Relative Distribution</td>
<td>Relative concentration of an individual REO versus the concentration of all REOs combined; expressed as a percentage of TREQ</td>
</tr>
<tr>
<td>MLR</td>
<td>China’s Ministry of Land and Resources</td>
<td>Government authority responsible for issuing semi-annual REO production quotas in China</td>
</tr>
<tr>
<td>MOF</td>
<td>China’s Ministry of Finance</td>
<td>Government authority overseeing tax and tariff-related matters of China’s REO industry</td>
</tr>
<tr>
<td>MOFCOM</td>
<td>China’s Ministry of Commerce</td>
<td>Government authority overseeing tax and tariff-related matters of China’s REO industry, as well as issuance of rare earth export licenses</td>
</tr>
<tr>
<td>GAC</td>
<td>China’s General Administration of Customs</td>
<td>Government authority responsible for collection of taxes, customs duties, excise duties and other indirect taxes</td>
</tr>
<tr>
<td>MIIT</td>
<td>China’s Ministry of Industry and Information Technology</td>
<td>Government authority overseeing industry and information technology sectors, and responsible for promoting the national knowledge economy</td>
</tr>
<tr>
<td>FOB</td>
<td>Free on Board</td>
<td>Indicates that the seller pays for transportation of the goods to the port from which it will be shipped, plus pays any loading costs</td>
</tr>
<tr>
<td>PEA</td>
<td>Preliminary Economic Assessment</td>
<td>Technical study that evaluates a project’s economic potential following a Mineral Resource estimate</td>
</tr>
<tr>
<td>PFS</td>
<td>Preliminary Feasibility Study</td>
<td>Due diligence study to determine the viability of proceeding with development of a project</td>
</tr>
<tr>
<td>DFS</td>
<td>Definitive Feasibility Study</td>
<td>Final technical study to determine whether or not to proceed with development of a project</td>
</tr>
<tr>
<td>BFS</td>
<td>Bankable Feasibility Study</td>
<td>Includes a DFS complete with offtake agreements from prospective customers</td>
</tr>
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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.