

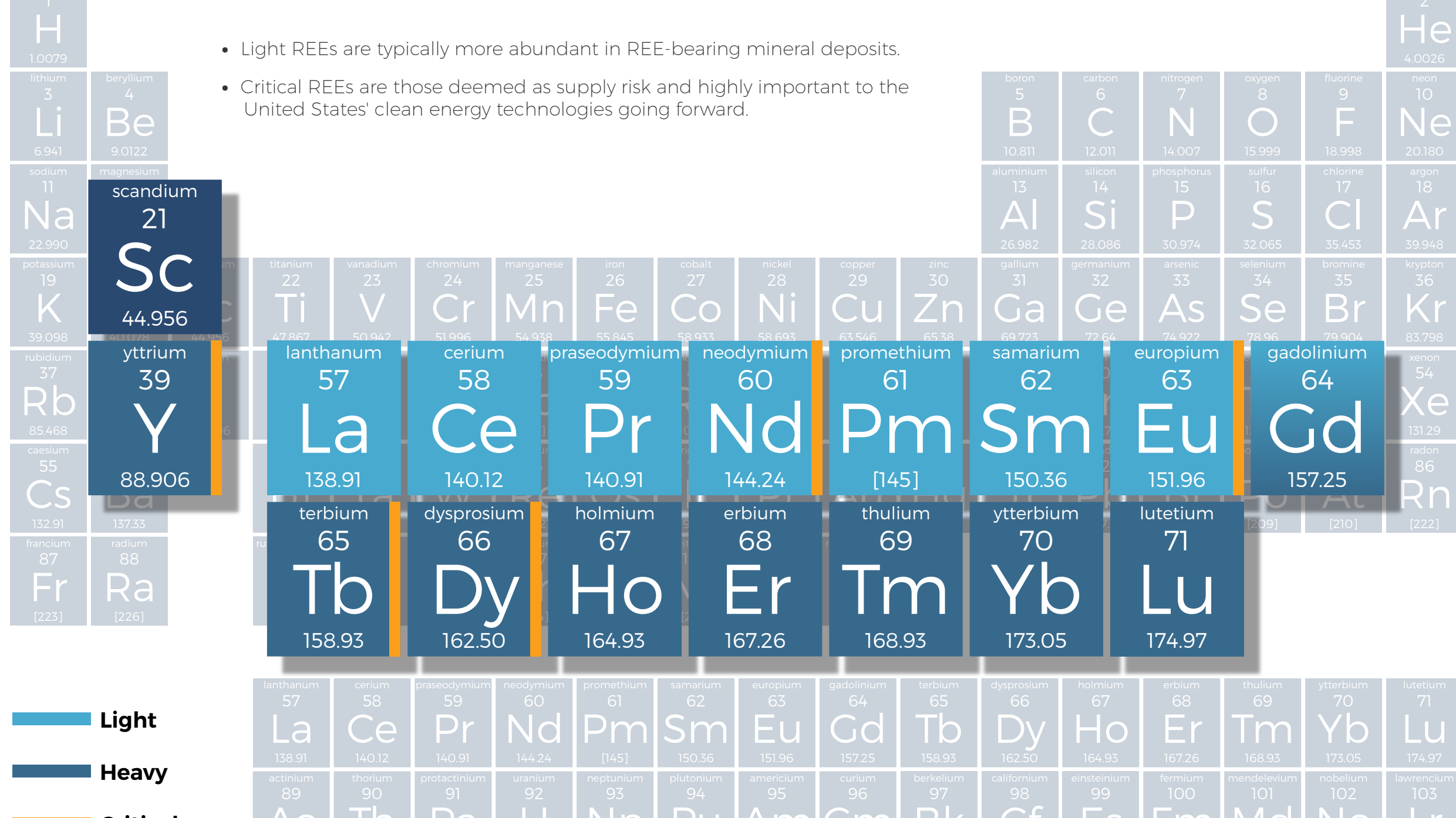
# Success in the Rare Earth Elements Program



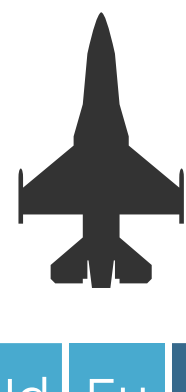

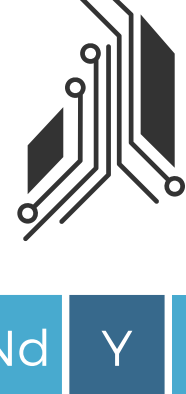




While comprising just 17 elements of the periodic table, the group known as rare earth elements (REEs) provides significant value to our national security, energy independence, environmental future, and economic growth.

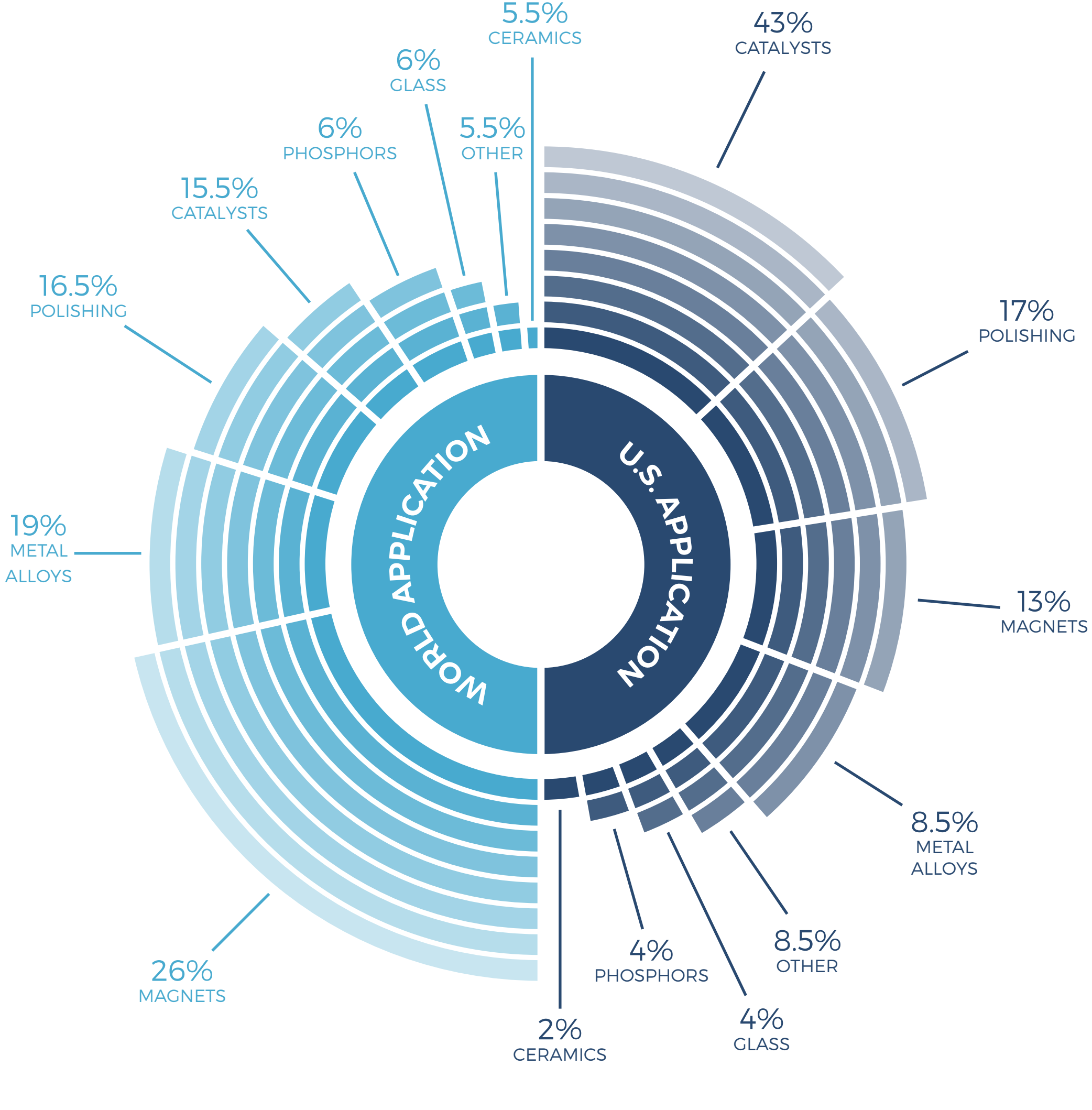
REEs can be divided into **light**, **heavy**, & **critical**.

- Light REEs are typically more abundant in REE-bearing mineral deposits.
- Critical REEs are those deemed as supply risk and highly important to the United States' clean energy technologies going forward.

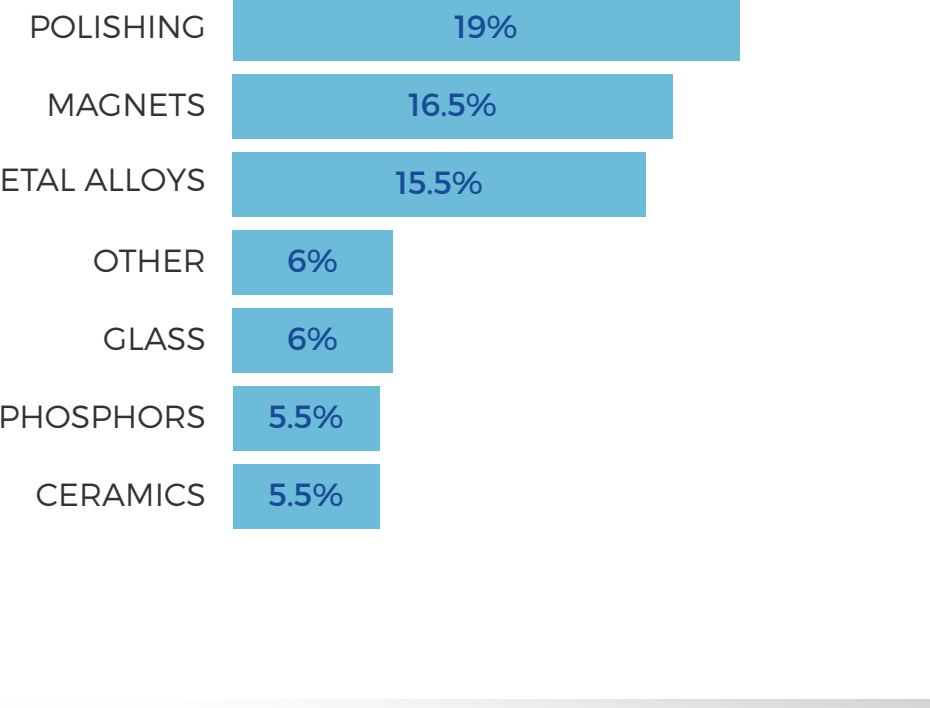


REEs are used in high technology products, such as **CATALYSTS, CELL PHONES, HARD DRIVES, HYBRID ENGINES, LASERS, MAGNETS, MEDICAL DEVICES, TELEVISIONS, AND OTHER APPLICATIONS.**

 <p><b>DEFENSE</b> Satellite Communications Guidance Systems Aircraft Structures Fly-by-Wire Smart Missiles</p> <p>Nd, Eu, Tb, Dy, Y, Lu, Sm, Pr, La</p>	 <p><b>METAL ALLOYS</b> NiMH Batteries Fuel Cells Steel Super Alloys Aluminium/Magnesium</p> <p>Nd, Y, La, Ce, Pr</p>
 <p><b>CERAMICS</b> Capacitors Sensors Colorants Scintillators Refractories</p> <p>Nd, Y, Eu, Dy, Lu, Gd, Ce, Pr</p>	 <p><b>CATALYSTS</b> Petroleum Refining Catalytic Converter Fuel Additives Chemical Processing Air Pollutions Controls</p> <p>Nd, La, Ce, Pr</p>
 <p><b>PHOSPHORS</b> Display Phosphors — CRT, LPD, LCD Fluorescents Medical Imaging Lasers Fiber Optics</p> <p>Nd, Eu, Tb, Y, Er, Gd, Ce, Pr</p>	 <p><b>MAGNETICS</b> Computer Hard Drives Disk Drive Motors Anti-Lock Brakes Automotive Parts Frictionless Bearings Magnetic Refrigeration Microwave Power Tubes Power Generation Microphones &amp; Speakers Communication Systems MRI</p> <p>Nd, Tb, Dy, Pr</p>
 <p><b>GLASS &amp; POLISHING</b> Polishing Compounds Pigments &amp; Coatings UV Resistant Glass Photo-Optical Glass X-Ray Imaging</p> <p>Nd, Gd, Er, Ho, La, Ce, Pr</p>	



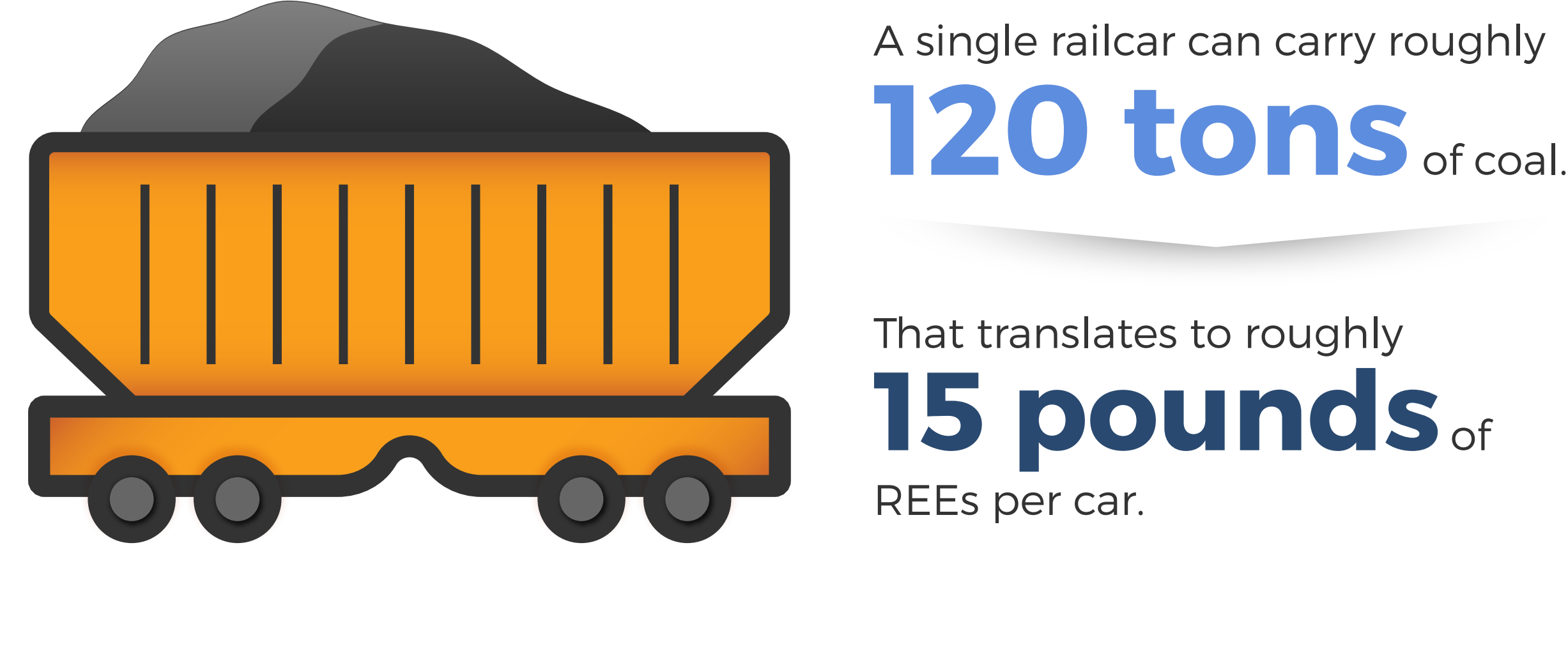
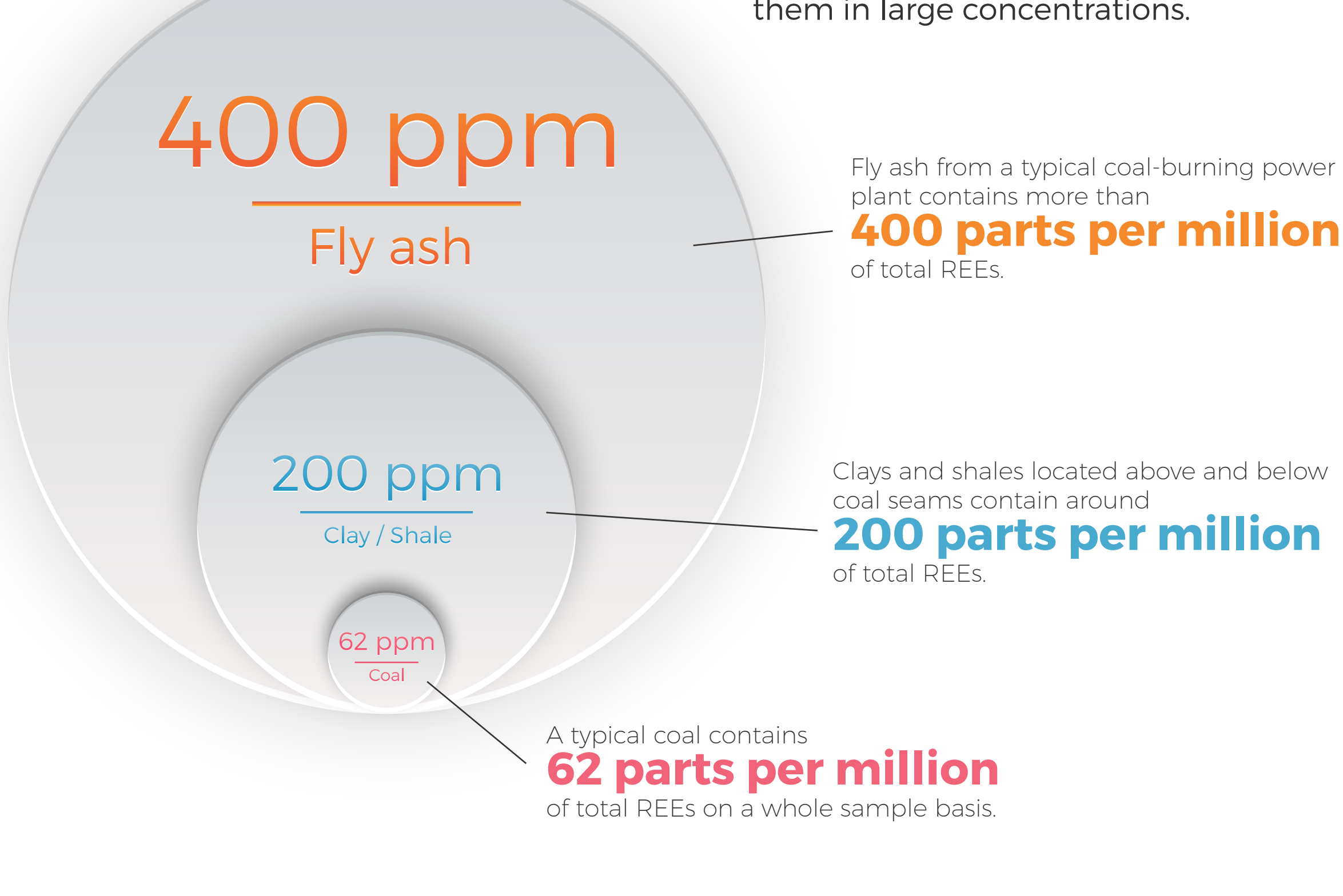
## WORLD APPLICATION



## DOE-NETL initiated the Rare Earth Elements Program

in 2014 to address the feasibility of separating and extracting REEs and other minerals from coal and coal by-products including **FLY ASH, COAL REFUSE & ACID MINE DRAINAGE.**

REEs are actually not that rare. However, it is unusual to find them in large concentrations.



With more than **275 billion tons of coal** reserves in the United States, **17 million tons of REEs** are present within the coal.

