

CLEARPATH

Critical Minerals Research at the Department of Energy December 19, 2016

In 2015, power production accounted for 93% of all U.S. coal consumption. The small remainder was used for heat-intensive industrial processes such as steel, cement, and paper manufacturing.¹

Coal companies are losing value and market share with the recent influx of cheap natural gas onto the market. From 2001 to 2015, coal's share of the US power mix fell 51% to 33% and natural gas production increased its share from 17% to 33%.²

The Department of Energy is currently conducting research to improve the long-term sustainability of coal and develop new revenue streams to the industry. One focus is to turn coal power waste into a valuable revenue stream. Over 100 million tons of coal ash are produced each year, some of which is ripe for recycling. This waste is already recycled and resold as commercial products including ready mix concrete, roofing shingles, agricultural supplements, and gypsum wallboards. In fact, half of manufactured wallboard in the US uses a repurposed coal byproduct.

One untapped opportunity is extracting rare earth elements and critical minerals from coal waste. These minerals are used in virtually every modern product, from refrigerators to cars to cell phones. The United States has no domestic production capability and China produces 80% of global supply. For this reason, a number of efforts have been started to 1) improve US economic security and 2) to establish a new revenue stream to the coal industry.

Coal by-products contain critical minerals in very small quantities (0.01-0.13%) relative to commercial ores (2 – 20%). The Department of Energy is focused on new methods to economically extract critical minerals from coal. The core concept has been proven³, and early stage research is underway to make it a commercial reality. The first large demonstration projects are scheduled to be piloted from early to mid-2020s. The economics are still being scoped out, but DOE's goal is to make it cost-competitive with conventional methods by 2025.

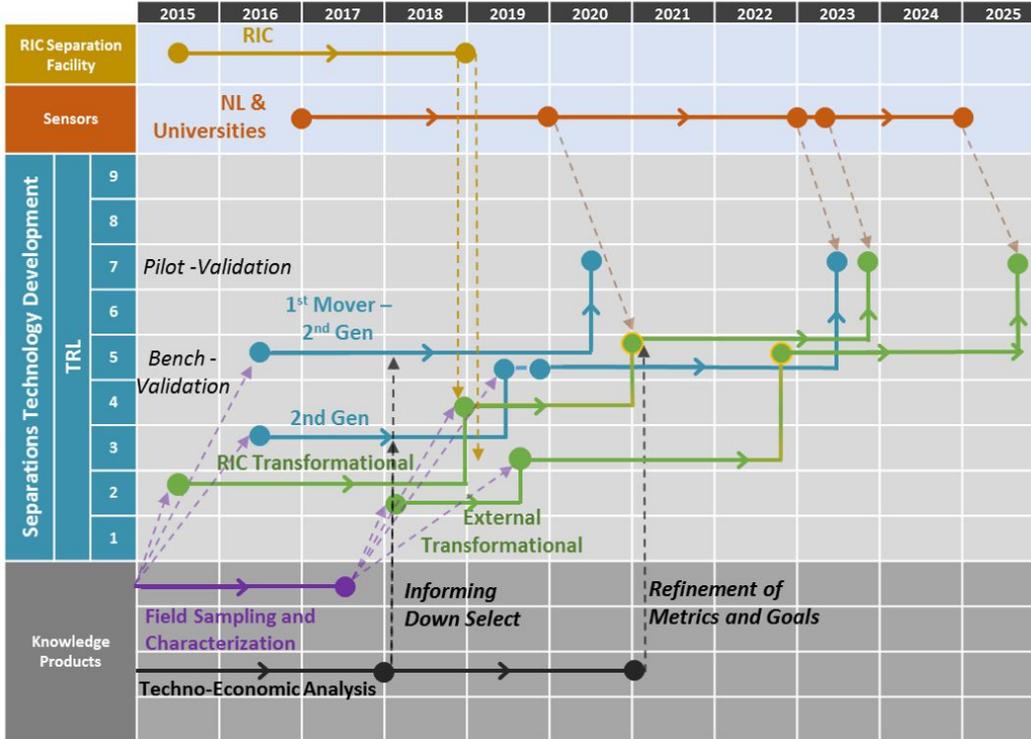
Department of Energy Critical Minerals Research Timeline

¹ [EIA: Annual Coal Report](#)

² [EIA: Electricity Data Browser](#)

³ [Department of Energy](#)

NETL – Industry – Universities – National Labs



KEY MILESTONES

- FY17:** Establish cost targets for REE separation
- FY18:** Identification of high coal-based resources for REE recovery
- FY19:** Laboratory sensor demonstration for in-field and process separation use
- FY19:** 2nd generation bench-scale FOA REE separation technologies demonstrated
- FY20:** 1st mover/2nd generation pilot-scale FOA REE separation technologies demonstrated
- FY20:** Laboratory transformational REE separation concept optimization completed
- FY20:** Demonstration of sensor capability at bench/pilot-scale facilities
- FY23:** Pilot-scale 2nd generation REE separation technologies demonstrated
- FY25:** Pilot-scale transformational REE separation technologies demonstrated