

The challenges of rare earths in the Energy Transition

Stéphane GOUTTE^{*}, Lisa DEPRAITER²

¹University Paris-Saclay, UVSQ, IRD, France and University of Calgary, Canada.

²University Paris-Saclay, UVSQ, IRD, France

The accelerated energy transition to mitigate climate change necessitates large-scale renewable energy development. Sifting from fossil energy to renewable energy entails an increase in demand for critical raw materials (CRM). Rare earth elements (REEs) are 17 chemically similar metallic elements considered critical raw minerals. This paper investigates the role of REEs in the clean energy transition focusing on four REEs, namely neodymium, praseodymium, dysprosium, and terbium. These minerals are elementary components in permanent magnets used in wind turbine generators and electric/hybrid vehicle motors. Future development of offshore wind turbines and EVs will increase the demand for REEs as manufacturers tend to prefer their chemical properties to other minerals. However, the paper shows that market conditions have limited the supply of REEs over the past decades and identifies four challenges to the future development of REEs supply. These challenges are the substitution of REEs in low-carbon technologies, the recycling of REEs from end-of-life technologies, the development of mining and processing plants outside China, and the environmental concerns regarding the exploitation of REEs.