

## **Critical minerals for the energy transition: an industrial review**

### **Context**

The energy transition together with the security of energy supply question raised by the Ukrainian conflict has accentuated the need to study the main risks regarding the sourcing of critical materials. This internship focuses on critical materials defined as all elements that participate in the value chain of wind turbines, solar panels, batteries, transmission and distribution of electricity and big magnets. Several scholars have tackled the geopolitical aspect of this problem: if critical materials come from outside Europe we may face security of supply issues in the near future.<sup>1</sup> Instead, the Industrial Economics aspect has not been properly studied yet, which is the main objective of this internship.<sup>2</sup> In particular, the sourcing strategies of European firms as well as the way contracts and vertical relations determine competition is yet to be modeled and its impact on pricing estimated. Differently from commodities traded in well-established international markets, these strategic minerals, as defined by the US Geological Survey<sup>3</sup>, merit specific modeling efforts.

### **Missions**

- Review the literature in the topic present in high impact journals discussing their contribution, importance and room for further research identifying, particularly, those papers dedicated to the industrial structure and pricing mechanisms, starting from the seminal papers by Zhang et al. (2022) and Islam et al. (2022).
- Review of the non-academic literature to identify price formation mechanisms, vertical relations and contract structure.
- Sketch a model to understand market structure for different critical materials.
- Identify data needs for a possible empirical calibration.
- **A deliverable taking the form of a Working Paper/ Policy brief written in English is expected**

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<sup>1</sup> See e.g.:

Hache, E. (2018). Do renewable energies improve energy security in the long run?. *International Economics*, 156, 127-135.  
Li, Z. Z., Meng, Q., Zhang, L., Lobont, O. R., & Shen, Y. (2023). How do rare earth prices respond to economic and geopolitical factors?. *Resources Policy*, 85, 103853.

Theodosopoulos, V. (2020). The Geopolitics of Supply: towards a new EU approach to the security of supply of critical raw materials?. *Institute for European Studies Policy Brief*.

<sup>2</sup> A first effort in this line can be found in:

Zhang, H., Wang, X., Tang, J., & Guo, Y. (2022). The impact of international rare earth trade competition on global value chain upgrading from the industrial chain perspective. *Ecological Economics*, 198, 107472.

Islam, M. M., Sohag, K., Hammoudeh, S., Mariev, O., & Samargandi, N. (2022). Minerals import demands and clean energy transitions: A disaggregated analysis. *Energy Economics*, 113, 106205.

<sup>3</sup> For a summary for the case of batteries see:

Sanin, M-E., Walter, M., Snyder, M-V., Balza, L. Del litio al vehículo eléctrico en América Latina y el Caribe, *Inter-American Development Bank* 2023.

## Profile

We look for master students/engineering students in the fields of economics-energy- environment. The candidate must have organizational ease, autonomy, proven writing skills and ability to work in relation with the various interlocutors of the Chair. Good skills applied econometrics are required. A personal interest in the areas of climate change economics and regulatory economics is expected.

*This internship can lead to a CEC thesis project.*

**Duration:** Starting March-April 2024 for a 6 month-period

**Location:** Chaire Economie du Climat, Palais Brongniart, 28 Place de la Bourse, 75002

**Salary:** 80% minimum wage + meal vouchers-face value 9€

**Contact and documents:** send CV, Cover letter **plus** Master 1 grades (and Master 2 grades available) in **only ONE PDF file** to [claire.berenger@chaireeconomieduclimat.org](mailto:claire.berenger@chaireeconomieduclimat.org) indicating the internship offer's **(only 2 applications maximum on all CEC internships offers)**

**Application closure:** January 9th, 2024

**Interviews** from January 10th, 2024

**Final response** to candidates: January 31st, 2024