THE ROLE OF CIRCULAR ECONOMY IN THE EU'S STRATEGY FOR CRITICAL RAW MATERIALS

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1 INTRODUCTION

Since the adoption of the first circular economy action plan in the European Union (EU) in 2015, this subject has become even more important by the years passing on. In 2019 the EU's Commission implemented the European Green Deal as it's flagship initiative, as a growth strategy which set the EU on the path to a green transition, with the ultimate goal of reaching climate neutrality by 2050.[1] However, amidst of recent geopolitics turmoil besides climate neutrality, green transition has been seen more and more as a tool for energy security by its contribution to energy diversification, a connection clearly stated out by the EU's so called REPowerEU Plan published after the break out of the Russian-Ukrainian war. Meanwhile, accelerating green transition means growing demand for some distinguished technologies like solar panels, wind turbines or accumulators, just like for a set of raw materials which are essential building blocks of these technologies. Nevertheless, the overall value chain network of these technologies in the EU tends to be heavily import dependent[2] for example because there is a general lack of availability for many of these raw materials within its territory.[3] The EU itself realised both the economic and geopolitical consequences of this situation and brought up its master plan the so called Critical Raw Materials Act (CRM Act) in 2024 to mitigate it by improving capacities all along the supply chains. Taking into account the lack of raw materials just like the occasionally strong but eventually a small global industrial share in the vast majority of cases, recycling as part of the wider circular economy concept could be a key feature to improve availability of these important scarce elements.

2 MATERIAL AND METHODS

In this paper the authors' aims are threefold. First, they would like to outline the evolution of the EU's circular economy policy, focusing on raw materials. Second, besides the general lack of raw materials in the EU, they would present the different devices and their respective raw materials needs as well as their recycling tendencies. During this process, a special focus will be put onto rare earth elements (REEs) and permanent magnets. The reason behind this choice is the fact that these permanent magnets (PMs) have a wide range of applications including industry, energy and defence sectors. This means that PMs are in the very heart of the

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most pressing questions of the EU like green transition, competitiveness, reindustrialisation and rearmament. Finally, authors would like to present the current state of the act of recycling which encompasses some future prospects. For all of these, official EU documents will be analysed in depth. Besides, a special attention will put on some implementation of the PMs in depth as well. The first set of so-called Strategic Projects [4] related to strategic raw materials will be also discussed from the angle of recycling.

3 RESULTS

The main results are the followings:

- REEs and PMs are at the core of some current, essential economic and geopolitical questions.
- REEs are extremely hard to recycle compared to other elements, and so are the PMs, which is certainly a limiting factor in the scale up process of future circularity throughout the sector. It can be seen already taking into account the current low percentage of end-of-life recycling rate (EOL-RR) and the end-of-life recycling input rate (EOL-RIR) of REEs, which range between 0–10 % compared to some other critical raw materials.
- Future demand is difficult to predict, as well as to organise the respective European policies.

4 CONCLUSIONS

Circular economy is becoming an increasingly important part of the EU's strategy related to critical raw materials, because the green transition has become an increasingly important geopolitical factor. Meanwhile, the EU is lacking some critical raw materials which are indispensable to produce the devices enabling the green transition. In this case recycling could emerge as a key tool to enable higher availability of these elements as secondary raw materials. The problem is however, that many of these elements currently have a very low end-of-life recycling ratios. This is especially true regarding rare earth elements, with one of their particularly important field of use, the permanent magnets. Finally, future demands which are hard to be predicted only make planning even more difficult.

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