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RECYCLING OF MINING AND METALLURGICAL WASTE MATERIALS
– Project Ris-Recover –
(The template for project promotion)

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1. INTRODUCTION

It is known that Europe is heavily dependent on mineral resources (the EU's annual share in global raw material production is only 5%), which is particularly true for certain elements of the periodic table and some other substances declared by the EU as critical raw materials. In the document titled Critical Raw Materials (CRMs) from 2017 (European Commission, 2017; last edition), 27 such substances are currently classified; from metals, such as, for example, antimony, cobalt and scandium, to coal for the production of coke and rubber. The purpose of this document is to periodically review the current status and to identify raw materials for which, from geopolitical reasons, there is a risk of supply and which are also very important for European industry and value chains within this industry. This document also serves as a basis for the current strategy (and, if necessary, its correction), which, on the one hand, establishes measures to improve the competitiveness and innovation of the European raw material sector and, on the other hand, provides funding for the implementation of this strategy. The most important programs in the field of raw materials are EIT RawMaterials and Horizon 2020; although the latter is more complex and covers other areas besides raw materials.

2. EIT RAW MATERIALS

The EIT is an abbreviation for the European Institute of Innovation and Technology, which was established in 2008 as an independent body of the European Union. Its main task is to promote cooperation between enterprises, educational and research institutes (the knowledge triangle), thus creating an appropriate environment for innovation and entrepreneurship in Europe. The Institute currently has 6 Knowledge and Innovation Communities (KICs) that focus on current social challenges: climate, digital technology, health, nutrition, innovative energy and raw materials. The Community for raw materials is an EIT RawMaterials, with an ambitious mission, to change the dependence on raw materials in Europe's strategic power. This should be achieved by fostering the competitiveness and growth of the European raw material sector, in particular through radical innovation and entrepreneurship. The most important areas are: (a) research and assessment of the potential of European raw materials, (b) mining in demanding environments and innovative, sustainable mines, (c) increased

material efficiency in mineral and metallurgical processes, (d) substitution of critical substances in products and their optimization, (e) the recycling and optimization of value chains for better products, and (f) the planning of circular economy products and services. The Slovenian partners in the EIT Raw Materials consortium are the Slovenian Institute of Civil Engineering and the Geological Survey of Slovenia. Institutions can also apply for financial resources. companies that are not partners of KIC EIT RawMaterials by joining one of the partners.

3. PROJECT RIS-RECOVER

Below is a brief presentation of one of the successful projects, RIS-RECOVER, with the full title "Regional innovation scheme for zero waste extraction of critical raw materials". It is a three-year project that started in 2018. The project involves six partners from Slovenia, Republic of Macedonia, Austria and Belgium. The coordinator is the Slovenian Civil Engineering Institute (ZAG), while partners are the Geological Survey of Slovenia (GeoZS), the Construction Institute of Macedonia (GIM), Goce Delčev University from Štip, Montanuniversität Leoben from Austria and the Flemish Institute for Technological Research (VITO) from Belgium. The value of the entire project, which is mainly financed by EIT RawMaterials, is about half a million euros.

The project addresses two general problems. The first relates to the fact that, as a result of the developed mining and metallurgical activities in the past, huge mining and metallurgical dumps are in the Western Balkans. Since the utilization of metals in the past has been relatively low, there are still many metals in these depots, including those on the list of already mentioned critical raw materials. On the other hand, these landfills represent a permanent source of metals release into the environment and consequently cause severe environmental problems in the local environment. Another problem addressed by the project is the general underdevelopment and lagging behind of the countries of the Western Balkans, migration (especially of young educators) and low innovation and political instability of the region.

The theme of the project is to identify the situation in selected mining and metallurgical depots (Pb, Zn, Cu, As, Cr, ...) in the Republic of Macedonia (Figures 1–3) and to check how metals can be technologically and cost-effective extracted from these depots, their quantity and which procedures are most appropriate for this. An important part of the project is the zero waste approach, which means that the material left after the extraction of metals is a raw material for applications in the construction industry. In order to make the proposed solutions realistically practical, it is necessary to establish a network and cooperation among stakeholders along the entire value chain (from the owners of mines, processors, end users of raw materials, equipment suppliers, educational and research institutions, as well as regulators and the public). This is also an important goal of the project.

Fig. 1. Metallurgical waste dumps after processing of lead and zinc concentrates in Veles, Republic of Macedonia (photo: R. Šajn)

Fig. 2. Metallurgical dump residues after processing of chrome ore in Jegunovci, Republic of Macedonia (photo: R. Šajn)

Fig. 3. Mining waste dump in the area of the Lojane mine, Republic of Macedonia (photo: R. Šajn)

REFERENCE

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