

EFFECTIVE MINERAL POLICY AS A KEY FACTOR FOR SUSTAINABLE ECONOMY

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Guenther
TIESS

Doctor of Geological
Science, Associate
Professor of Technical
University of Ostrava,
managing director
of MinPol GmbH

Iryna
SOKOLOVA

executive director
of MinPol GmbH,
member of the UAG

Serhii
KLOCHKOV

geological survey
advisor of MinPol
GmbH, member
of the UAG

The paper analyzes the changes in commodity market distortions, competing land use types, raw material demand for development, and rapid diffusion of key enabling technologies meeting the requirements of constant, dynamic development of major European industries. The author gives the relationship between the dynamics for mineral resources consumption growth, and changes in the conditions of production of these resources. Contains a critical review of methods for predicting the mineral resources dependency, including an estimated forecasting method based on guidelines for the evaluation of needs for natural resources and their substitutes.

One of the principles is comprehensive and integrated resource recovery. In a nutshell, this new approach argues that any operation should disturb a mine site only once and extract all useful materials using an optimised integrated flowsheet. This principle also requires that all by-products and residues are (re)used and that by-products and tailings at the end of life to be 'future-proofed', i.e. they should retain their ability to continue to be of value into the distant future where technology/economy may make feasible their use.

It is noted that access to and affordability of mineral raw materials are crucial for the sound functioning of the EU's economy. A new 2020 list of critical mineral raw materials is presented and ways to compensate for the CRM deficit are described in detail.

Separately noted that the mineral policy is needed to be meticulously treated to facilitate company investment security, streamline permitting and access to minerals in a line with the European Green Deal, the Circular Economy Action Plan, the Bioeconomy Strategy and the European Industrial Strategy. Concerning, the latest steps towards Europe economically resilient by a framework for raw materials and the Circular Economy – creation of European Raw Materials Alliance recognized as particularly effective.

Global Industry Standard on Tailings Management represented as a robust, fit-for-purpose international standard for the safer management of tailings storage facilities.

The argument is given that since the land issue is one of the most delicate in a densely populated areas heavily dependent on agriculture, housing, infrastructure or other non-mineral development, a fair and equitable distribution of land is important for a mineral perspective.

There is also the need for strategic and open network between political, industrial and local communities through the exchange of information to enhance knowledge, experience and skills between stakeholders. Social acceptance of that idea is a fundamental element that must be addressed to develop a conflict-free area for mineral development activities.

The conclusions indicate that we would like to emphasize that the main task of today is to create an effective system for monitoring the movement of raw materials along the entire added-value chain. The ability to quickly identify and respond to challenges in mineral policy will provide leadership in EU strategic technologies and industries. This process has already started with the creation of the European Raw Materials Alliance ERMA. State institutions, businesses, scientific institutions, and civil society in the close dialogue are able to ensure sustainable development and security of civilization as a whole.

Keywords: *mineral policy; critical raw materials; natural resources; circular economy; strategic sectors; strategic technologies; ERMA; price trend.*

ABSTRACT

As we move on in the 21st century, it is becoming more evident that current business processes are leading the planet towards irreversible climate change, accelerating the loss of biodiversity, pushing society towards unheard inequality levels and boosting social conflicts over access to resources (food, water, land, energy, minerals). The transformative 2030 Agenda for Sustainable Development has inaugurated a new narrative, expressed in a new business process language, of pursuing ‘economic, social and environmental’ gains in equal measure, with a commitment to meeting the needs of two key beneficiaries, ‘people’ and ‘planet’, through the common goal of sustainable ‘prosperity’ for all. The 17 Goals (fig. 1) were adopted by all UN Member States in 2015, as part of the 2030 Agenda for Sustainable Development which set out a 15-year plan to achieve the Goals. To achieve and share this prosperity equitably, the way natural resources are discovered, produced, consumed, recovered and re-consumed will define, more than any other activity, the attainment of the Sustainable Development Goals. Against this background, it is critical to support European enterprises in the adoption of new practices and transition to enhanced business models. A published paper by the United Nations in 2015 emphasises the need of innovation as a key pathway to achieving the objectives in the 2030 Agenda for Sustainable Development and makes an urgent call for new business models in the mineral extraction industry.

The mineral extraction industry underpins the value chain of critical business sectors in the EU, such as defense, automotive, aerospace and medicine. And despite increases in resource efficiency, primary mineral resources are necessary to nourish the development of modern societies for the coming decades. For this reason, securing reliable, sustainable and undistorted access to mineral raw materials is a growing concern within the EU and the motive why the European Commission has defined a list of critical raw materials (CRM) for the EU economy.

One of the principles is comprehensive and integrated resource recovery. In a nutshell, this new approach argues that any operation should disturb a mine site only once and extract all useful materials using an optimised integrated flowsheet. This principle also requires that all by-products and residues are (re)used (closed system, available for successive life-cycles) and that by-products and tailings at the end of life to be ‘future-proofed’, i.e. they should retain their ability to continue to be of value into the distant future where technology/economy may make feasible their use. This is a big difference with the conventional logic as, while it may represent higher economic costs to a mining company, it provides a more comprehensive societal benefit, may help to gain social acceptance and reduces the risks of environmental pollution (waste streams are inexistent or highly reduced). The implementation of ‘comprehensive and integrated resource recovery’ advocated by UN requires a fundamental shift in traditional business models, because the extraction and maximisation of the value of all existing materials in a mineral deposit increases the number of interactions in downstream industries. This does not mean, necessarily, higher complexity of industrial processes. But it requires more sophisticated analysis and operational integration of many different value streams. And to make this transition efficient, it is critical the support of an innovative cluster approach where dialogues across industrial sectors maximise resource efficiency and boost the design of new flowsheets.

CRITICAL RAW MATERIALS PROBLEM

Mineral policies and strategies and need to be regularly revised and updated. An important point, which is extremely critical, is the fact that parts and/or the whole value-chain of several CRMs are moving to China and South-East Asia. For CRMs that are found in the EU or can be recovered, an industrial chain needs to be identified, developed and protected.

Sustainable Development Goals



Figure 1. Sustainable Development Goals

Antimony	Coking coal	Indium	Phosphorus	Titanium
Baryte	Fluorspar	Magnesium	Scandium	Bauxite
Beryllium	Gallium	Natural graphite	Silicon metal	Strontium
Bismuth	Germanium	Natural rubber	Tantalum	PGMs
Borate	Hafnium	Niobium	Tungsten	HREEs
Cobalt	Lithium	Phosphate rock	Vanadium	LREEs

Figure 2.
CRM list vs Ukrainian subsoil CRM, by light green – deposits, by dark green – prospects

Raw materials are essential for the sustainable functioning of modern societies. Access to and affordability of mineral raw materials are crucial for the sound functioning of the EU's economy. The increasing demand in raw materials raises growing concerns regarding the mineral resources and especially metals availability. Furthermore, many metals, metalloids or rare earth elements which had no application in the past are now used for the manufacture of high added value products especially in the domain of new and green technologies. Many of them are by-products of base metals production and their reserves are very limited. Therefore, a new list of critical raw materials was established by the European Commission in 2020.

The list of CRM has been extended to 30 from 27 in 2020, excluding Helium. Four new metals were added: Strontium, Titanium, Bauxite, Lithium. Bauxite – the main alumina ore. Titanium – aerospace industry. Strontium – medicine industry. Lithium – a valuable component of high energy-density rechargeable lithium-ion batteries. Ukraine can play a crucial role in ensuring economic security and strategic stability of the European industry by becoming an integral part of pan-European clusters, raw materials and production alliances at all stages of creating added value for raw materials. 23 from 30 CRMs are identified by MinPol in 2018 and expanded according to the 2020 list (fig. 2).

For the first time, the high CRM potential of Ukraine was revealed by the MinPol on December 11, 2018 before the high tribune of the European Commission within the SCRREEN project. Presently, the European Commission welcomes diplomatic actions with Ukraine to support the possibility of integrating Ukrainian potential into the EU's strategic industries and technologies taking. Ukraine is one of the leading mineral, and raw materials producing countries of the world. More than 5% of world mineral reserves are contained in the subsoil of Ukraine. At the same time, Ukraine occupies only 28th place in the world for the extraction of mineral raw materials. This testifies to the huge undiscovered mining potential. Ukraine possesses industrial capacities and technologies to produce high-purity rare-earth metals and their compounds and alloys of widely use with focus to capture added-value is inherently competitive. The key priority issue is reforms of the regulatory framework

are simplification and harmonization of the regulations. If such is achieved, Ukraine clearly will hold promising potential as a future source for Critical Raw Materials (CRMs) and the EU-UA stand to gain from developing a strong co-operation.

ACTUAL TRENDS OF MINERAL POLICIES

Ukraine development is a pillar policy aiming to improve the well-being of people, economic growth. A phenomenon of national market productivity will make Ukraine the leader among advanced countries. Many steps have yet to be taken in this direction by Ukrainian society. We believe that there will be enough political will to implement all the initiatives initiated by MinPoL to achieve close integration of the pan-European strategic industries. The main task of the current moment, we see forcing the state of raw materials independence of the EU industry, creating new value chains with short logistics and optimal capital and operating costs. The current situation is unacceptable, namely: the dominance of China controlling rare earth needed for electronics, magnesium for car seats, laptops, wind turbine, including Germanium – 65%, Brasilia – Niobium for jet engines and other strategic technologies. Cobalt – comes from the Democratic Republic of Congo (DRC) for batteries, there is a lack of elements for battery production, renewable energy in the condition of Covid 19 that results in serious transport disruption and pressure between traders and consumers.

There is an urgent need for the EU vital market to follow a strategy of the US and Australia that have conducted strategic raw materials audit in order to make a safety caution for smooth mineral supply-chain to critical industries. Europe's dependency problems could be solved by facilitating cooperation between neighbor countries, where Ukraine has huge potential to become the major partner to close it lacks their abundant mineral deposits.

It is vital to promote recycling of critical elements and, to start using the EU's Copernicus earth observation satellite in order to identify and manage new and existing and sources.

The list of critical raw materials is economically and strategically important for the Europe an economy, having a high-risk associated with their supply. In the scenario, 'mitigating actions' need to be developed to reduce criticalities.

Therefore, the goal is to telegraph a degree of a CRM (critical raw materials) value that could potentially result in increased profitability for the EU strategic technology and industrial sectors (fig. 3). The mineral policy is needed to be meticulously treated (paradigm change) to facilitate company investment security, streamline permitting and access to minerals in a line with the European Green Deal, the Circular Economy Action Plan, the Bioeconomy Strategy and the European Industrial Strategy.

The aim of the European Commission is to provide a powerful and transparent analysis tool to develop future strategies in order to support mineral policy decisions.

There are also needs to include provisions which open a window for boost in sustainable mining practices through a more effective policy and to bring better regulation

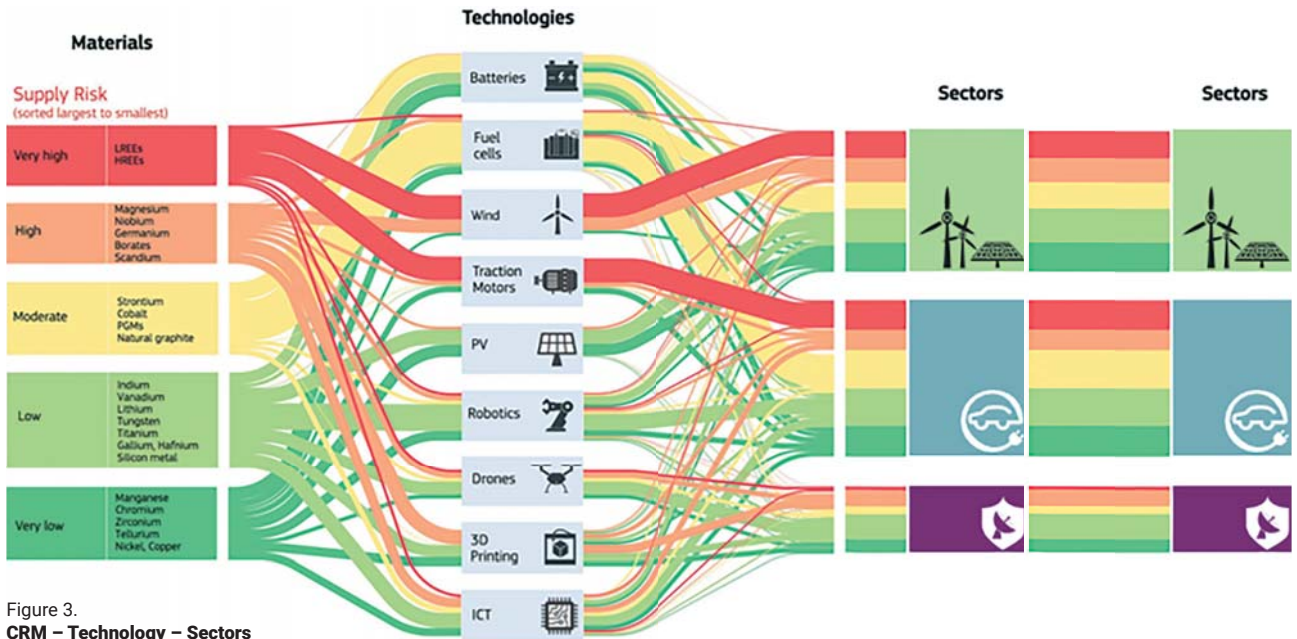


Figure 3. CRM – Technology – Sectors

and enforcement as well as to underpin growth-oriented balanced social and economic aspects.

The latest steps towards Europe economically resilient by a framework for raw materials and the Circular Economy– creation of ERMA’s (European Raw Materials Alliance). The activities will increase the production of raw and advanced materials and address Circular Economy by boosting the recovery and recycling of Critical Raw Materials by 2030, taking the lead also in the creation of pan-European standards for the characterization of the properties of secondary CRM waste (WEEE, EoL batteries, etc.). All organizations involved in promoting R&I for substitution in the EU would certainly welcome a specific substitution strategy for Europe.

Mineral Resources are the key to a growing economy. One of our key messages are to promote National Mineral Policy Frameworks which are based on the value chain. If we have a look more deeper, the value chain starts in the

moment when minerals (as a part of the earth crust) becomes an objective of economic interest. So first, there should be a demand for specific raw material which is determined by society needs, economic development and technological progress. Such process is, thus, very dynamic (CHANGES IN TIME). The ongoing monitoring of the European mineral needs, a dedicated database of critical raw materials, other minerals and market prices are setting up an overview assessment of the theoretical maximum value of the mineral economy

Contributions from all sectors of technical study could bring added value in the main pillars of Land Use Planning.

The protection of natural resources as a path to sustainable development of Human Life could not be forgotten. This concept concerns to any natural resources: water, forests, soil, land, while minerals should be treated more carefully. Take it into account that energy and non-energy mineral recourses are non-renewable. In that context,

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The official launch of the EUROPEAN RAW MATERIALS ALLIANCE

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29 September 2020



Figure 4. Start of ERMA (erma.eu source)



Figure 5.
Principal scheme of raw material maturity

the concept of a recycling economy, including agriculture and industrial production, can also help to conserve land and natural resources, significantly reducing waste and pollution.

MINING SECURITY ISSUES

Mining waste management takes a special position in environmental protection. Vale's Corrego do Feijão mine accident in Brumadinho, Brazil, on 25 January 2019 triggered an urgent revision of the Principles on mining infrastructure. This reflected the Global Industry Standard on Tailings Management represented by Dr. Bruno Oberle August 5, 2020. Co-convened by the International Council on Mining and Metals (ICMM), United Nations Environment Programme (UNEP) and Principles for Responsible Investment (PRI), the Global Tailings Review has established a robust, fit-for-purpose international standard for the safer management of tailings storage facilities, wherever they are and whoever operates them.



Figure 6.
Major principles of the Global Industry Standard on Tailings Management

Strengthening current practices in the mining industry by integrating social, environmental, local economic and technical considerations, the Standard covers the entire tailings facility lifecycle – from site selection, design and construction, through management and monitoring, to closure and post-closure.

With an ambition of zero harm to people and the environment, the Standard significantly raises the bar for the industry to achieve strong social, environmental and technical outcomes. It elevates accountability to the highest organisational levels and adds new requirements

for independent oversight. The Standard also establishes clear expectations around global transparency and disclosure requirements, helping to improve understanding by interested stakeholders.

The Standard was developed through an independent process – the Global Tailings Review (GTR) – which was co-convened in March 2019 by the United Nations Environment Programme (UNEP), Principles for Responsible Investment (PRI) and International Council on Mining and Metals (ICMM) following the tragic tailings facility collapse at Brumadinho, Brazil, on 25 January 2019.

The co-conveners have each endorsed it and call for its broad and effective implementation across the industry:

UNEP will support governments that wish to incorporate and build upon this Standard into their national or state legislation and policies.

PRI, representing USD 103.4 trillion in assets under management, will be developing investor expectations to support all mining companies in implementing the Standard.

ICMM member companies will implement the Standard as a commitment of membership, which includes robust site-level validation and third-party assessments.

RISKS OF STERILIZATION OF MINERAL RESOURCES

Since the land issue is one of the most delicate in a densely populated areas heavily dependent on agriculture, housing, infrastructure or other non-mineral development, a fair and equitable distribution of land is important for a mineral perspective. This argument is supported by the worldwide evidence suggesting that a more egalitarian distribution of land would generate significant productivity gains, avoiding a risk of STERILIZATION OF MINERAL RESOURCES.

Hence, currently policies and programs affecting the allocation of land, minerals and water among competing uses that have a profound impact on generation and distribution of economic benefits. The establishment of the rational system of urban and rural development as an instrument for equal competition over mineral and other natural resources is a basic mechanism.

There is the need for strategic and open network between political, industrial and local communities through the exchange of information to enhance knowledge, experience and skills between stakeholders. Social acceptance of that idea is a fundamental element that must be addressed to develop a conflict-free area for mineral development activities.

The policy should be built upon linkages between demand and supply, upstream and downstream industries, society needs and economy, etc. The access to land for mineral-based industry is the corner stone of this process and should become one of the policy priorities.

The connection between sustainable development goals and minerals extraction could play role in land use decision-making also at local level – especial in the economic sense. What is sometimes overlooked is that the extraction and use of mineral resources enables the knowledge growth and innovation for their more effective use.

The common ground:

- Treating mineral resources in parity with other natural resources based on understanding its;
- The value of mineral resources should be closely linked to their potential use (application of value chain approach);
- The sustainability of mineral land use should be represented by all dimensions: economic, environmental, social, not forgetting the knowledge growth and innovation potential;
- The relations between stakeholders should be at partnership level and in this way they should cooperate.

Supporting national framework is based on the 5C:

- Capacity (personal, technical, financial to work efficiently);
- Competence (the decisions on technical aspects is made by a person with an appropriate expertise);
- Cooperation (the authorities-industry-communities should work as partners in finding optimal solutions for all stakeholders);
- Compatibility (possibility to combine different functions and land uses which are not incompatible);
- Coherence (avoid or minimize the existence of conflicting policies);
- Finally – we should respect that other values and society needs might have priority in a specific situations;
- In addition to general principles just presented, we have identified three basic pillars which shape our approach:
 - Information and transparency – the support of knowledge base growth, the availability of information to relevant stakeholders, communication in the way they could be understood also to non-specialists;
 - Balancing of interests – the different stakeholders has different interests, these interests should be objectively valued to set balanced priorities; the partnership between authorities, industry and communities should be strengthened;
 - Permitting and legal framework – sustainable solutions for mineral-based economic activities could only work if the framework conditions including permitting are viable for the industry (not deteriorating), this includes the sufficient competence in decision-making.

CONCLUSION

Summing up, we would like to emphasize that the main task of today is to create an effective system for monitoring the movement of raw materials along the entire added-value chain. The ability to quickly identify and respond to challenges in mineral policy will provide leadership in EU strategic technologies and industries. This process has already started with the creation of the European Raw Materials Alliance ERMA. State institutions, businesses, scientific institutions, and civil society in the close dialogue are able to ensure sustainable development and security of civilization as a whole.

Based on the foregoing, an effective CRM policy is a major challenge for maintaining a stable EU economy today. New sources shall appear in the nearest future. The aim is to start working with sleeper prospective mining objects, consisting of CRM across the EU and associated countries. The community has already paid particular attention to the secondary enrichment of mining and tailing waste, as well as the secondary processing of WEEE.

Sleeper mining objects should get a second life primarily through a social license. Local communities and the general public can change the negative perception of mining activity into a potentially positive one through broad sociological projects to increase knowledge among civil society about modern mining and enrichment technologies. Small objects suitable for compact green mining technologies have the main prospect.

Prospective objects in associated countries are of interest as new sources of CRM for strategic technologies and industries. The focus will be primarily on the countries of the Balkan region and Ukraine.

In this direction, attention should be focused on harmonizing the legislation of these regions with the best European and world practices of subsoil use and the policy of mineral raw materials. The first steps have already been taken by the European Commission on the MinPol initiative presented in the SCRREEN report (screen.eu) in 2020.

The secondary enrichment of mining wastes will allow solving two main tasks - reducing the man-made load on the environment and creating new CRM sources for strategic technologies and industries. The main benefit of secondary mining is the reduction in CAPEX&OPEX – since the ore is already at the surface and the mining infrastructure is in place. The same factors apply to the recycling of finished products that have completed their life cycle.

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ЕФЕКТИВНА МІНЕРАЛЬНА ПОЛІТИКА ЯК КЛЮЧОВИЙ ФАКТОР СТАЛОЇ ЕКОНОМІКИ

Гюнтер
ТІСС

доктор геологічних
наук, доцент
Технічного
університету Острави,
керівний директор
MinPol GmbH

Ірина
СОКОЛОВА

виконавчий директор
MinPol GmbH, член
Спілки геологів
України

Сергій
КЛОЧКОВ

радник з геологічної
розвідки MinPol GmbH,
член Спілки геологів
України

У статті проаналізовано зміни в попиті на сировину для розвитку і швидкого поширення ключових технологій, що відповідають вимогам постійного, динамічного розвитку основних європейських галузей промисловості. Розглянуто взаємозв'язок між динамікою зростання споживання мінеральних ресурсів і зміною умов видобутку цих ресурсів. Здійснено критичний огляд методів прогнозування залежності від мінеральної сировини, зокрема, оцінний метод прогнозування, заснований на рекомендаціях з оцінювання потреб у природних ресурсах та їхніх заміників.

Представлений новий підхід демонструє, що будь-яка операція повинна бути проведена під час видобутку тільки один раз і привести до вилучення всіх корисних компонентів з використанням оптимізованої інтегрованої технологічної схеми.

Цей принцип також передбачає, щоб всі побічні продукти й залишки використовувалися повторно і щоб побічні продукти в кінці життєвого циклу були «орієнтовані на майбутнє».

Вказано, що доступ до мінеральної сировини має вирішальне значення для нормального функціонування економіки ЄС. Представлено новий список критичної мінеральної сировини (CRM) 2020 року і докладно обґрунтовано способи компенсації дефіциту CRM.

Окремо наголошено, що до політики в галузі мінеральної сировини необхідно ставитися відповідально, щоб забезпечити безпеку інвестицій. Що стосується останніх кроків в напрямі економічної стійкості Європи, то створення Європейського сировинного альянсу (ERMA) визнано особливо ефективним. Глобальний галузевий стандарт з управління хвостосховищами представлено як надійний універсальний міжнародний інструмент з безпечного управління відходами видобування.

Наведено аргумент, що, оскільки земельне питання є одним найбільш делікатних в густонаселених районах, то егалітарний (справедливий) розподіл землі є запорукою уникнення ризиків стерилізації мінеральних ресурсів.

Зазначено, що є нагальна потреба у функціонуванні стратегічної та відкритої мережі між політичними, промисловими й місцевими громадами шляхом обміну інформацією для розширення знань, досвіду і навичок між зацікавленими сторонами. Прийняття цієї ідеї суспільством є фундаментальним завданням, яке необхідно виконати для створення безконфліктного простору освоєння мінеральних ресурсів.

Висновки свідчать, що головне завдання на сьогодні – це створення ефективної системи моніторингу руху сировини ланцюжком створення доданої вартості. Здатність швидко виявляти проблеми мінеральної політики та реагувати на них забезпечить лідерство ЄС в стратегічних технологіях і галузях. Цей процес вже почався зі створення ERMA. Державні інститути, бізнес, наукові установи й громадянське суспільство в тісному діалозі здатні забезпечити сталий розвиток і безпеку цивілізації загалом.

Ключові слова: мінеральна політика; критична сировина; природні ресурси; циркулярна економіка; стратегічні сектори; стратегічні технології; ERMA; цінові тенденції.