ROAD MAP
FOR THE SUSTAINABLE MANAGEMENT OF MINERAL RAW MATERIALS

GOBIERNO DE ESPAÑA
VICEPRESIDENCIA TERCERA DEL GOBIERNO
MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO

STRATEGIC ENERGY AND CLIMATE FRAMEWORK

The "Road Map for the Sustainable Management of Mineral Raw Materials" is the result of the contribution of various economic agents, administrations, and citizens. This process has been channeled through different consultations, open to the participation of the general public, which have allowed the identification of the different visions of agents and society as a whole. In this way, in the context of circular economy, the lines of action have been identified to guarantee the supply of mineral raw materials in Spain in a more sustainable way, maximizing the benefits along the value chain, thus contributing to the energy and digital transition, and European and Spanish industrial sovereignty.

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EXECUTIVE SUMMARY

In the process of ecological transition and change of the global economic paradigm in which we find ourselves, an in-depth review of all economic activities is necessary. Particularly those related to the extraction of the mineral resources available on the planet, to guarantee their social, environmental, and economic sustainability while promoting a sufficient degree of strategic autonomy that does not make European industrial production dependent on third parties and jeopardize the objectives set out in the European Green Deal[1].

This transition process and, in particular, the energy transition towards a generation model based on renewable energy sources, will reduce our economy's dependence on fossil fuels, but will also entail the appearance of new demands for materials and raw materials.

This transition is taking place in a complex international context, with challenges whose consequences were unthinkable a few years ago. The crisis caused by the COVID-19 pandemic has exposed vulnerabilities that affect national security and the well-being of citizens, such as dependence on foreign supplies and the fragility of international trade flows[2]. In addition, the current geopolitical context unleashed after the Russian war of aggression is characterized by considerable instability and increased strategic competition. This has led the European Union (EU) and its Member States to assume greater responsibility for our security and to adopt new decisive measures to build our European sovereignty, reduce our dependencies, and design a new model for growth and investment, particularly in the most sensitive areas, such as the Critical Raw Materials[3].

Therefore, as indicated by the European Union Parliament, the transition to climate neutrality must not involve replacing dependence [on third countries] on fossil fuels with dependence on other raw materials[4].

In this context, it should be borne in mind that the mineral deposits of strategic raw materials for a decarbonized and electrified economy are distributed all over the planet. It is therefore urgent to ensure their production in a sustainable and efficient manner, highlighting the benefits and employment potential of the green economy for both developed and developing countries, where the extraction and transformation of raw materials could become key-activities to support human rights, communities of interest and improve their governance.

Therefore, at national level and following the strategic approaches of the European Union, this Roadmap for the sustainable management of Mineral Raw Materials aims to establish the bases for the transformation of the Mineral Raw Materials industry in a circular economy context and to guarantee the supply of indigenous mineral raw materials in Spain in a more sustainable and efficient way, maximizing the benefits along the value chain[5], thereby contributing to European and Spanish industrial sovereignty.

The European Union's principles for sustainable raw materials in Europe[6] in social, environmental, and economic terms indicate the criteria to be applied in the value chain of mineral raw materials and their potential for the fulfillment of the Sustainable Development Goals (SDGs).

Likewise, at the European level, the approach to strategic and energy dependencies has been considerably reformulated. In this regard, critical raw materials have received renewed impetus, which has materialized, among others, in the approval by the European Commission of the Critical Raw Materials Action Plan in September 2020. The last was built based on the European Raw Materials Initiative (RMI[7]), launched in 2008 and still in force, and on a call in the REPowerEU[8] Plan to extend the concept of security of energy supply to incorporate the critical raw materials and intermediate products needed to strengthen Europe's strategic autonomy.

The EU Action Plan on Critical Raw Materials aims to secure the supply of raw materials to the European economy and sets out the EU's lines of action in the field of those raw materials considered critical for the double transition (Critical Raw Materials) to ensure resilience through a secure and sustainable supply as a crucial contribution to the recovery and long-term transformation of the economy[9].

In addition, several initiatives have recently been launched based on the European Green Pact, the New Industrial Strategy -COM (2020) 102 final10[10]- or the Communication on critical raw materials - including the fourth EU 2020 Critical

[1] COM/2019/640 final, https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=CELEX:52019DC0640
[2] https://www.congreso.es/public_oficiales/L14/CONG/BOCG/A/BOCG-14-A-91-1.PDF
[3] The Versailles declaration, 10 and 11 March 2022, https://www.consilium.europa.eu/media/54800/20220311-versailles-declaration-es.pdf
[4] European Parliament, A European strategy for critical raw materials, https://www.europarl.europa.eu/doceo/document/TA-9-2021-0468_EN.html.
[5] The mineral raw materials value chain is considered to be the reuse, repair, recycling, exploration, extraction, processing, and transformation of mineral raw materials.
[6] https://ec.europa.eu/growth/sectors/raw-materials/policy-and-strategy-raw-materials/sustainable-supply-raw-materials-eu-sources_en
[7] COM/2008/0699 final, https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=CELEX:52008DC0699
[8] COM(2022) 230 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A230%3AFIN&qid=1653033742483
[9] COM(2020) 474 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0474
[10] COM/2020/102 final, https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=COM:2020:102:FIN

Materials list, the Raw Materials Report for strategic sectors and technologies, or the European Raw Materials Alliance - COM (2020) 474 final[11]. In all of them, in the context of a green economy, reduction of consumption, efficiency and access to resources are recognized as strategic security issues necessary for Europe's ambition to become a competitive economy and a climate-neutral continent.

The present moment is critical for the EU and its Member States. As the EU strives to reach the goal of climate neutrality by 2050, the current situation calls for a thorough reassessment of how we ensure the security of our energy supply, and the development of a stronger economic base. This involves reducing our strategic dependence in the most sensitive areas, such as critical raw materials, through strategic partnerships, exploring strategic reserves and promoting the circular economy and resource efficiency[12].

As explained in detail in this document, the situation of critical raw materials is at a turning point. The convergence of supply and demand factors, the embryonic development of circular economy technologies, and limited reuse projections, are coming together in a recovering post-COVID and geopolitically unstable economic context. In these circumstances, primary raw materials will continue to play an essential role in the economy and industry.

It is therefore necessary to draw up this Roadmap, in line with EU initiatives on raw materials, sharing the vision of a greener and more digital Spain and European Union. The key now lies in taking advantage of this context to promote industrial sectors that guarantee essential resources, promote technological sovereignty, increase the resilience of the Spanish economy and position Spain as a strategic player in European sovereignty.

At the national level, in November 2020, the Council of Ministers approved the Long Term Decarbonization Strategy 2050[13] (ELP 2050) as part of Spain's commitments to the Paris Agreement[14] and as a member state of the European Union and set the path to achieve climate neutrality by 2050. Likewise, the National Integrated Energy and Climate Plan 2021-2030 and the objectives established in Law 7/2021, of May 20, on climate change and energy transition make up the new strategic and regulatory framework for the ecological transition.

The objectives set for 2050 make it necessary, first of all, to reduce and optimize the consumption of resources, identify strategic raw materials and establish the sustainability standards to be applied to the different phases of the life cycle of the minerals value chain. With this perspective, the ELP 2050 establishes the reuse and recycling of materials as the first option to be considered. It also points out the need for a supply of critical raw materials that improves Europe's independence and avoids unsustainable sources of supply for environmental or social reasons, promoting, as well, the use of domestic mineral resources under European environmental and sustainability standards.

Likewise, the ELP 2050 model indicates that Industry will play a central role in this transition, with a commitment to the use of alternative raw materials and promoting the circular economy, with special attention to achieving high levels of recycling not only of those materials used in decarbonization technologies but also of the most common materials used in manufacturing and construction in Spain.

On the other hand, in February 2022, the Council of Ministers approved the National Security Strategy (ESN 2021). The ESN 2021 points out that the evolution towards a decarbonized economy will increase competition for raw materials, such as rare earth, materials, and industrial processes related to digitalization and renewable technologies, as well as a greater dependence on the geographical regions supplying these technologies. Therefore, reducing strategic dependencies on raw materials and essential components of industrial value chains by diversifying production and supply, maintaining reserves, and boosting production and investment in Europe is key[15].

In this respect, the data and analysis conducted in this Roadmap highlight, in line with the EU Action Plan on critical raw materials, the need to develop resilient value chains for industrial ecosystems and reduce dependence on critical raw materials through a balanced transition between circular use of resources and innovation; the strengthening of sustainable and responsible internal supply; and the diversification of supply also through sustainable and responsible sourcing from third countries.

In particular, these value chains must take into account the extractive and processing industrial activity of metallic minerals, industrial minerals, and construction minerals and the need for sustainable extraction for three main reasons: (i) sustainable and local extraction reduces environmental and social impact given that it is regulated by

[11] COM/2020/474 final, https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=CELEX:52020DC0474
[12] The Versailles declaration, 10 and 11 March 2022, https://www.consilium.europa.eu/media/54800/20220311-versailles-declaration-es.pdf
[13] La Moncloa. 03/11/2020. Estrategia a largo plazo para una economía española moderna, competitiva y climáticamente neutra en 2050 [Consejo de Ministros]
[14] Paris Agreement 2015. United Nations, https://unfccc.int/sites/default/files/spanish_paris_agreement.pdf
[15] https://www.dsn.gob.es/es/documento/estrategia-seguridad-nacional-2021

demanding sustainability criteria; (ii) it increases our competitiveness, generates quality employment and enables the autonomy of our productive system as a whole by reducing our dependence and exposure to the volatility of the price of raw materials required by the different industrial processes and to the external geopolitical situation; and (iii) local extraction (with rigorous sustainability criteria) reduces the carbon footprint and emissions linked to transportation.

This Road Map, and the measures contained in it, form an interdepartmental country strategy for the Mineral Raw Materials industry as a whole, based on environmental, social, and economic sustainability, on the most innovative and efficient techniques to reduce both greenhouse gases and our dependence on imports. Consequently, it seeks the security of supply and contemplates the following types of instruments:

REGULATORY INSTRUMENTS

- view of mining regulations: Alignment with the circular economy, ensuring environmental protection, and boosting restoration with Best Available Techniques. Alignment with the EU Action Plan on critical raw materials.
- Mechanisms for transparency and traceability of the origin of mineral raw materials imported into Spanish territory.
- Review of industrial and mining bridging regulations: Promotion of integral strategic value chain projects.

SECTORAL INSTRUMENTS

- Circular economy: Use of tailings dumps, use of existing mine shafts, restoration of abandoned mining waste facilities.
- Sustainable management: Improving knowledge of mining resources in Spain, tools for biodiversity management, development of policies for (i) good governance, (ii) ethics, (iii) transparency, and (iv) regulatory compliance.
- Development of a list of strategic materials for the green and digital industry, consistent with EU initiatives on critical raw materials.

CROSS-CUTTING INSTRUMENTS

- Support for investment in more sustainable and efficient processes. Promoting public-private cooperation in the related industrial sector.
- Application of life cycle analysis, carbon footprint, and environmental product declarations.
- Clear contribution to policies to face the demographic challenge. Analysis of the social impact of these activities.
- Specific action plan to maximize sectoral contribution to the SDGs.
- Increased transparency and knowledge of the Mineral Raw Materials industry.
- Promotion of citizen and Local Entity participation.

BOOSTING R&D&I

- Specific program for technologies oriented to the circular economy.
- Support for digitalization and efficiency, mainly in the first transformation.
- Traceability systems for imported mineral raw materials.
- Promotion of integral innovative projects on the value chain (up to the final product).

The Road Map for the sustainable management of Mineral Raw Materials will be valid for the period up to 2050, although it will count on five-year plans to adjust it to the strategies, priorities, and evolution of the sector indicators. The magnitude and acceleration of the changes and challenges we face in the fight against climate change, the speed of technological and industrial evolution, as well as, the uncertainties regarding the geopolitics of international trade require the revision of the validity of the proposed measures every five years.

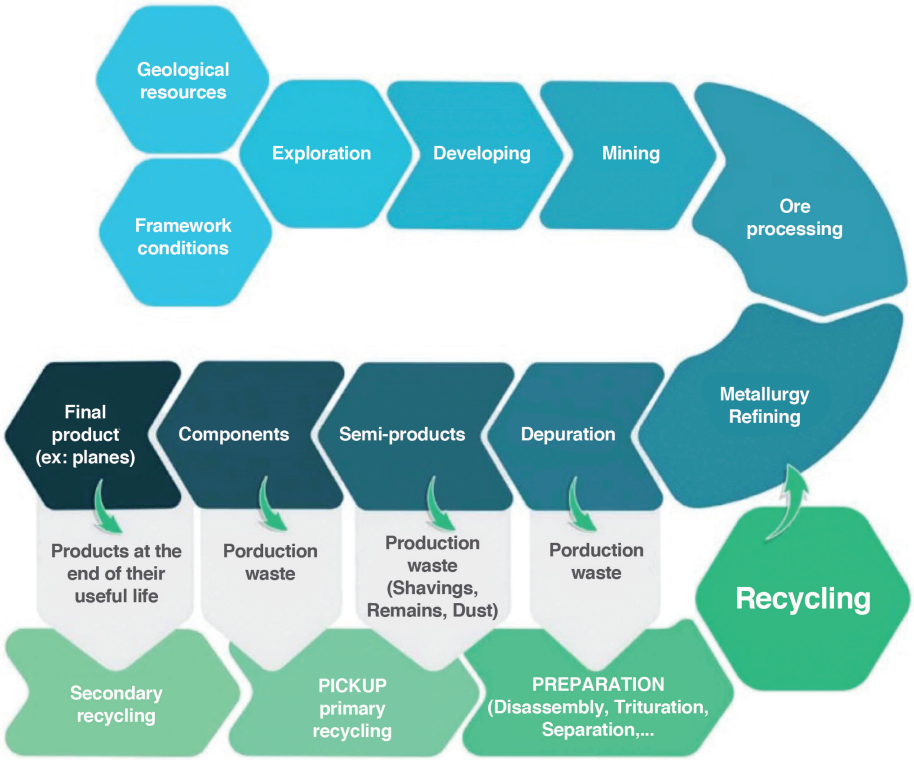
II

SUPPLY OF MINERAL RAW MATERIALS

2.1. THE IMPORTANCE OF THE MINERAL RAW MATERIALS

In the new industrial model for a decarbonized and digitalized economy carbon-neutral raw materials and production processes are required. Therefore, the Mineral Raw Materials industry plays a key-role as a supplier of both primary and secondary raw materials in the main sectors and activities for society, such as metallurgy and steel; mobility and automotive; electronics; chemicals, pharmaceuticals and healthcare; energy supply; paper manufacturing; construction materials[16]; agriculture and livestock; food in some of its processes; textiles and, in addition, environmental protection. The European Economic and Social Committee[17] estimates that 70% of European industry depends directly or indirectly on the activities of the Mineral Raw Materials industry.

FIGURE 1. Integrated view of raw materials. Source: International Resource Panel (IRP)[18]



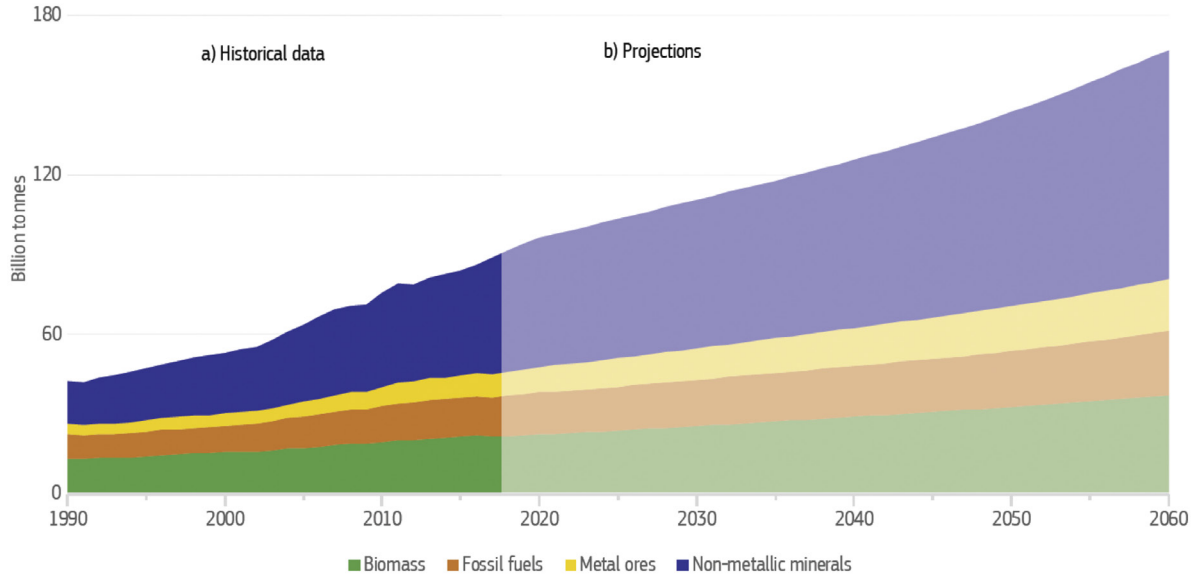
The growing demand for mineral raw materials

According to Eurostat data, in 2020, each European citizen consumed the equivalent of 13.5 tons per capita of raw materials, of which just over 0.7 tons corresponded to metals and 7.1 tons to non-metallic mineral raw materials[19].

The OECD forecasts that, despite greater efficiency in resource use, including the circular economy, the use of mineral raw materials will double by 2060 (+110%). In the case of metals, forecasts point to an increase of +150%, from 8 to 20 billion tons in 2060[20].

[16] Construction materials include aggregates, lime, cement, ceramics, bricks and tiles, ornamental rocks, plaster, etc.
[17] Opinion of the European Economic and Social Committee on the Non-energy mining industry in Europe https://eur-lex.europa.eu/legal-content/ ES/TXT/HTML/?uri=CELEX:52008IE1206&from=EN#ntr5-C_2009027ES.01008201-E0005
[18] IRP (2020), Mineral Resource Governance in the 21st Century: Gearing extractive industries towards sustainable developmen, https://www.resourcepanel.org/reports/mineral-resource-governance-21st-century
[19] Eurostat (2021), Material flow accounts and resource productivity, https://ec.europa.eu/eurostat/statistics-explained/index.php/Material_flow_accounts_and_resource_productivity#Resource_productivity
[20] OECD (2019), Global Material Resources Outlook to 2060: Economic Drivers and Environmental Consequences, https://www.oecd.org/publications/global-material-resources-outlook-to-2060-9789264307452-en.htm

FIGURE 2. Global extraction by type of resource: a) historical (global, 1990-2017) and b) projected data (global, 2018-2060). Source: Raw Materials Scoreboard[21]



Along the same lines, other forecasts22[22], such as those of the European Commission and other sources, project that global resource extraction will increase by nearly 90% between 2017 and 2060. This increase reflects a 28% increase in world population and a 72% increase in per capita resource use. According to these projections, for non-energy mineral raw materials, the extraction of metallic minerals will grow by 96% and that of non-metallic rocks and minerals by 168%.

The global implementation of resource efficiency measures and the increased potential for reuse and recycling of raw materials used in low-carbon energy technologies compared to fossil fuels may help to mitigate this growing trend, but according to the above data, resource extraction on our planet will continue to be necessary. In this context, the EU produces less than 5% of the world's production of mineral raw materials[23], while its industry consumes approximately 20% of the world's mineral raw materials[24].

The impact of decarbonization policies on the demand for raw materials

Indeed, according to the International Energy Agency (IEA)[25], the availability of the raw materials needed for the energy transition will pose new challenges for the security of supply of an energy system based on renewable energy sources.

[21] European Commission (2021), EIP on Raw Materials, Raw Materials Scoreboard 2021, https://op.europa.eu/en/publication-detail/-/publication/eb052a18-c1f3-11eb- a925-01aa75ed71a1. Projections based on the document of the OECD (2019), Global Material Resources Outlook to 2060: Economic Drivers and Environmental Consequences.

[22] World Bank (2017),The Growing Role of Minerals and Metals for a Low Carbon Future, http://documents1.worldbank.org/curated/en/207371500386458722/pdf/117581-WP-P159838-PUBLIC-ClimateSmartMiningJuly.pdf http://www.worldbank.org/en/topic/extractiveindustries/overview. https://rmis.jrc.ec.europa.eu/uploads/CRMs_for_Strategic_Technologies_and_Sectors_in_the_EU 2020.pdf

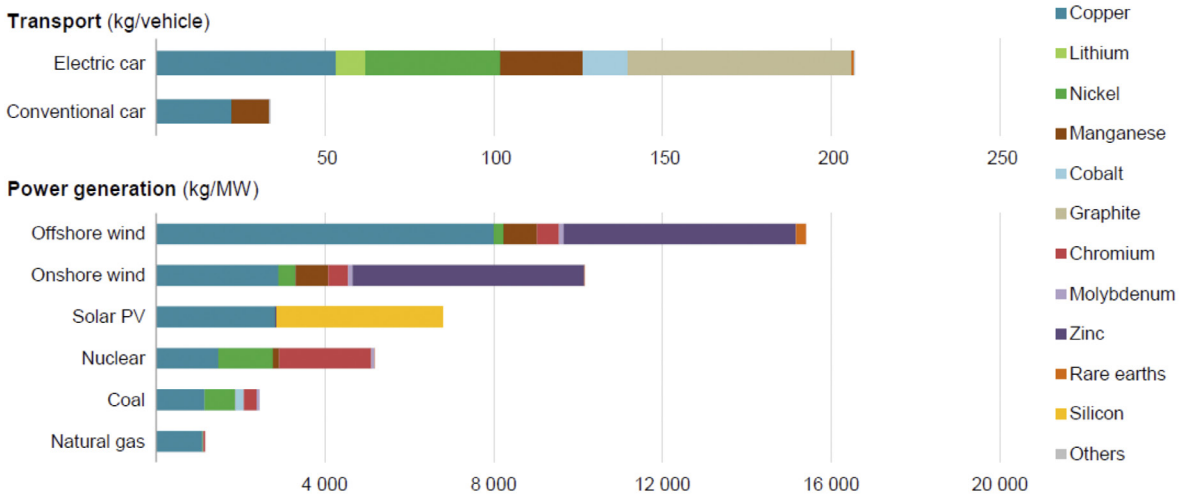
[23] Agricultural minerals (e.g. potash) and energy minerals (e.g. uranium and coal) are not included in this assessment.

[24] Eunomia, 2015. Study on the Competitiveness of the EU Primary and Secondary Mineral Raw Materials Sectors, http://www.euromines.org/files/news/ec-report-study-competitiveness-eu-primary-and-secondary-mineral-raw-materials-sectors/study-competitiveness-eu-primary-and-secondary-mrms-april2015.pdf y 2021, 3rd Materials Scoreboard, publicado por la Comisión Europea, https://op.europa.eu/en/publication-detail/-/publication/eb052a18-c1f3-11eb-a925-01aa75ed71a1/language-en/format-PDF/source-252070201

[25] IEA (2021), The Role of Critical Minerals in Clean Energy Transitions, https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/executive-summary

Additionally, in both qualitative and quantitative terms, the feedstock consumption of a clean energy-based system differs profoundly from a fossil fuel-driven one. Solar photovoltaic (PV) plants, wind farms, and electric vehicles (EVs) generally require more raw materials than equivalent fossil fuel-based technologies. A typical electric car requires six times more mineral resources than a conventional car, and an onshore wind plant requires nine times more mineral resources than a gas plant. Since 2010, the average amount of minerals required per unit of power generation has increased by 50% as the participation of renewables has increased.

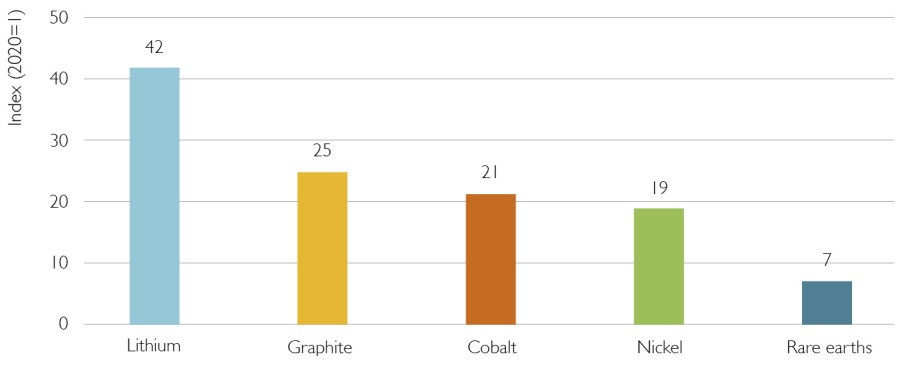
FIGURE 3. Minerals used in clean energy technologies. Source: IEA[26]



The types of mineral resources used vary by technology. Lithium, nickel, cobalt, manganese, and graphite are crucial to the performance, longevity, and energy density of batteries. Rare earths are essential for the permanent magnets used in wind turbines and electric vehicle motors. Power grids require a large amount of copper and aluminum, with copper being the cornerstone of all technologies related to electric power supply.

In scenarios driven by compliance with the Paris Agreement, demand for minerals for use in electric vehicles and battery storage is estimated to increase thirty-fold by 2040. Lithium will experience the fastest growth, with a demand increase of more than 40 times, followed by graphite, cobalt, nickel (between 20-25 times), and rare earths (seven times). Furthermore, the expansion of power grids means that demand for copper for grid lines will more than double over the same period.

FIGURE 4. Estimated demand for minerals needed in clean energy between 2020 and 2040. Source: IEA

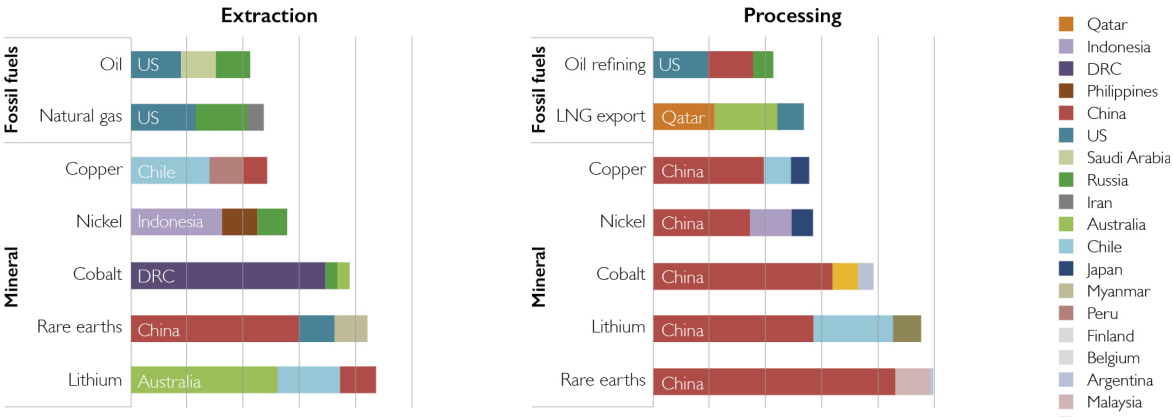


[26] IRENA (2022), Critical Materials for the Energy Transition: Rare Earth Elements, https://irena.org/events/2022/May/Critical-Materials-for-the-Energy-Transition-Rare-Earth-Elements

The supply problem

On the other hand, the production of many of the minerals needed for the energy transition is currently more concentrated than that of hydrocarbons. The world's top three producers control more than three-quarters of global production for elements such as lithium, cobalt, and rare earths. The level of concentration is even higher for processing operations, where China has a strong presence across the board. China's share in refining is 35% for nickel and 50% to 70% for lithium and cobalt. In the case of rare earths, according to the International Renewable Energy Agency (IRENA), more than 90% of the processing and refining of rare earths is carried out in China, and it is particularly complex to separate the elements individually[27].

FIGURE 5. Producción de determinadas materias primas minerales e hidrocarburos en 2019. Fuente: AIE



In this context, although Europe and Spain are self-sufficient in mineral raw materials for construction and most industrial minerals, both are highly dependent on other raw materials. Currently, Europe produces 60% of the metals it consumes and depends almost entirely on imports from third countries of raw materials considered fundamental for the European economy[28], with China being the world's leading producer of 19 of the 30 raw materials that are fundamental for the EU[29], despite having mineral resources, in some cases relevant, for some of them[30].

These new needs will lead to new geopolitics of raw materials that will replace the geopolitics of fossil resources marked by hydrocarbons, which structured the planet into two blocks: on the one hand, that of consumer countries with high levels of economic development and citizen welfare and, on the other, a small number of producer countries, developing countries, where resources were concentrated and where extractive processes sometimes did not meet the standards required to ensure compliance with the Sustainable Development Goals.

Access to resources is a matter of strategic security for Europe's ambition to move forward with the Green DeaL[31] The new industrial strategy for Europe proposes to strengthen its open strategic autonomy and warns that Europe's transition to climate neutrality could entail replacing the current dependence on fossil fuels with dependence on other raw materials, which we source largely from abroad and for which global competition is increasingly fierce. The EU's open strategic autonomy in these sectors must therefore continue to be based on diversified and undistorted access to global raw materials markets[32].

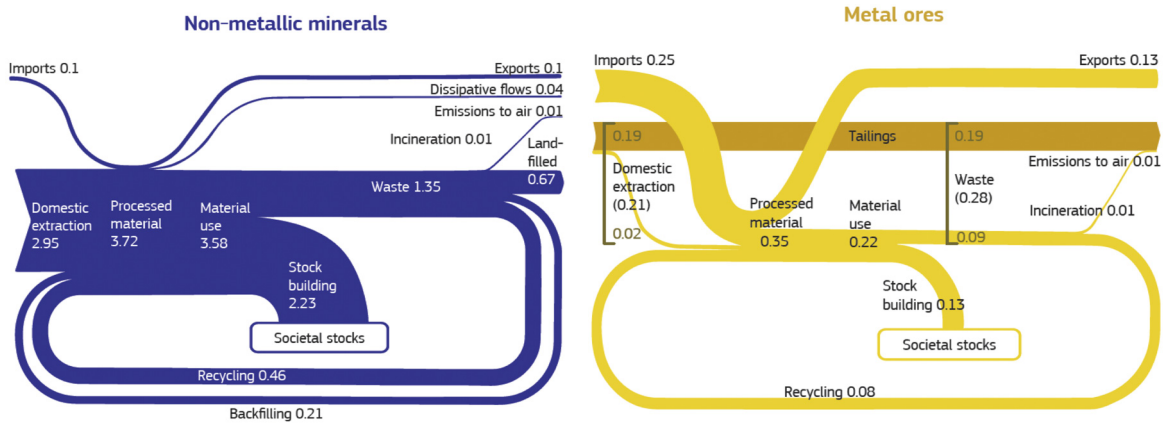
Therefore, in this transition process in which the foundations of a new green economy will be established in response to the global challenges we face, it is necessary to reflect on the lessons learned from the past and, in particular, in our country, on the need to reduce dependence on external supplies to ensure the security of supply of the system.

[27] IRENA (2022), Critical Materials for the Energy Transition: Rare Earth Elements, https://irena.org/events/2022/May/Critical-Materials-for-the-Energy-Transition-Rare-Earth-Elements
[28] European Commission ,EIP on Raw Materials, Raw Materials Scoreboard 2021, https://op.europa.eu/en/publication-detail/-/publication/eb052a18-c1f3-11eb-a925-01aa75ed71a1
[29] COM/2020/474 final, https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=CELEX:52020DC0474
[30] See Figure 13 "Exploration activities in the EU-27 (2019)"
[31] COM/2019/640 final, https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=CELEX:52019DC0640
[32] COM (2021) 350 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:350:FIN

Circular economy, recycling and recovery

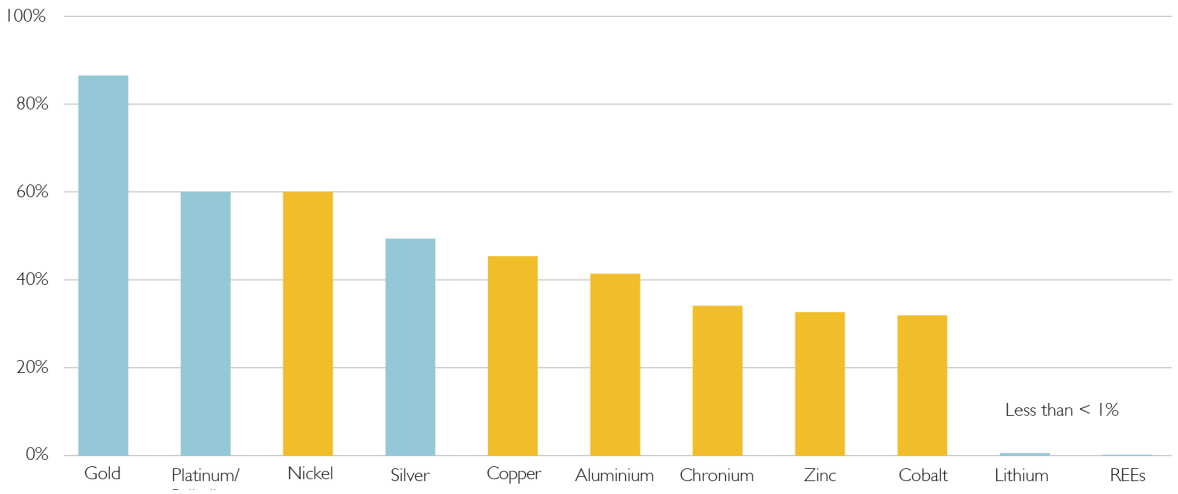
Increasing the circularity of the economy requires reducing the consumption of raw materials, increasing the use of secondary raw materials, reducing uses that do not allow their recovery, increasing the durability of products, reducing the generation of waste during the extraction, processing, manufacturing and use stages, and finally achieving more efficient recycling. The circular economy begins at the design stage and must be present throughout the entire value chain, requiring well-managed waste collection and treatment.

FIGURE 6. Sankey diagram of raw material flows for Europe (units in Gigatonnes). Source: European Commission, Raw Materials Scoreboard (2021).



In 2020, the circular use of raw materials in the EU economy as a whole stood at 12.8% (11.2% in Spain), 4.5% more than in 2004. In the case of non-metallic minerals, the circularity rate was 15%, while for metals it reached 25%[33];; more than 50% of metals such as iron, zinc, or platinum are recycled, thus covering more than 25% of EU consumption, while in the case of others -especially those required in renewable energy technologies or high-tech applications, such as rare earths, gallium or indium- the contribution of secondary production is very low[34].

FIGURE 7. Recycling rates for different metals. Source: IEA



[33] Eurostat (2021), Circular economy, material flows, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Circular_economy_-_material_flows
[34] European Commission (2021), EIP on Raw Materials, Raw Materials Scoreboard 2021, https://op.europa.eu/es/publication-detail/-/publication/eb052a18-c1f3-11eb-a925-01aa75ed71a1

The World Bank report "Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition"[35] demonstrates that optimizing waste management for mineral raw materials will fall short of demand. It further concludes that: "recycling brings environmental benefits in several areas, especially greenhouse gas emissions, with the carbon footprint of secondary mineral production, such as aluminum, being a fraction of primary production. However, for other minerals, recycling brings additional environmental challenges, such as energy use, greenhouse gas, and air pollutant emissions, water footprint, in addition to those derived from their transportation, so they should be evaluated with the environmental benefits."

Thus, the abovementioned projections establish that, in the hypothesis of 100% recovery, recycling, or reuse, this waste would only cover between 10% and 20% of the mineral raw material needs of European citizens in 2050. In the case of Europe, the University of Leuven's report "Metals for Clean Energy: Pathways to solving Europe's raw materials challenge"[36] points out that the increase in recycling in the period 2020-2050 in Europe will not replace mineral extraction but rather will smooth its growth. Thus, it is estimated that in 2050, compared to 2020, the annual increase in primary extraction, thanks to the contribution of recycling, will be[37]: for aluminum, +0.6% (instead of +1.4%); copper, -0.3% (instead of +1.0%); zinc, +0.0% (instead of +0.1%); silicon, +1.6% (instead of +2.3%); lithium, +8% (instead of +12%); or nickel, +1.0% (instead of +2.9%).

According to the Opinion of the European Economic and Social Committee, the EU faces technological, social, and environmental challenges related to the supply of mineral raw materials that underpin its industrial activity and the quality of life of its population. Technological advances, driving the efficient use of materials and resources, as well as waste reduction and recycling, in line with the EU's Circular Economy Action Plan[38],, are unfortunately insufficient to sustain societal needs and the growth of the world's population. Under these circumstances, primary raw materials will continue to play an essential role in the economy[39].

Therefore, to ensure the success of the transition, it will be necessary to have a sustainable extractive activity capable of generating quality employment in our country, minimizing vulnerability and dependence on external supplies from the energy system and industrial value chains.

Otherwise, in order to guarantee the security of supply of the industrial sectors as a whole, if there is no support for a national extractive industry that respects the principles of the European Union for the sustainability of raw materials and limits dependence on key industrial chains for the energy and digital transition, Spain will have to import raw materials from countries in which, as explained in the following point, legislation on environmental protection and the health and safety of people is not sufficient or is not adequately implemented.

Economic, social, and environmental sustainability

The United Nations Environment Assembly recognizes that the sustainable management of mineral resources contributes significantly to the achievement of the Sustainable Development Goals (SDGs), but their environmental impacts can sometimes be severe and long-lasting if they are not adequately managed[40], particularly in countries where environmental protection and human health and safety legislation is insufficient or not properly implemented. According to the United Nations International Resource Panel (IRP)[41], globally, the extraction of metals and non-metallic minerals is responsible (2017 data) for about 2% of the loss of bio-diversity related to land use (behind biomass with 85% and fossil fuels, 5%), 4% of water stress (biomass 85%, fossil fuels 5%) and 20% of impacts related to climate change (at the same level as biomass and fossil fuels).

Moreover, according to the IRP, revenue generation by the commodities industry presents great opportunities to support sustainable and inclusive development, with good governance being key to managing environmental and social impacts, as well as unlocking the sector's potential as a catalyst for sustainable growth and development. It also asserts that there is growing recognition that this sector, if well managed, can have a positive contribution in promoting broad-based and transformative development of economies.

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[35] World Bank (2020), Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition, https://pubdocs.worldbank.org/en/961711588875536384/Minerals-for-Climate-Action-The-Mineral-Intensity-of-the-Clean-Energy-Transition

[36] KU Leuven (2022), Metals for Clean Energy: Pathways to solving Europe's raw materials challenge, https://www.eurometaux.eu/media/jmxf2qm0/metals-for-clean-energy.pdf

[37] In parentheses, growth in mining extraction between 2020-2050 without the expected increase in recycling rates in 2050

[38] COM/2020/98, https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=CELEX%3A52020DC0098

[39] Opinion of the European Economic and Social Committee on 'Digital Mining in Europe: New solutions for the sustainable production of raw materials', https://eur-lex.europa.eu/legal-content/ES/TXT/HTML/?uri=CELEX:52020IE1559&from=ES

[40] IRP (2020), Mineral Resource Governance in the 21st Century: Gearing extractive industries towards sustainable development., https://www.resourcepanel.org/reports/mineral-resource-governance-21st-century

[41] IRP (2020), Building resilient societies after the COVID-19 pandemic (2020), https://www.resourcepanel.org/reports/building-resilient-societies-after-covid-19-pandemic

Finally, it concludes that, in the current context of the Global Agendas, the Mineral Commodities sector in Europe has a positive and direct impact on its 17 Sustainable Development Goals (SDGs)[42].

It is therefore necessary to carefully balance extractive activities with the management of other valuable natural resources (including ecosystems and biodiversity), as well as with regional development.

FIGURE 8. SDGs in the extractive industry value chain. Source: European Commission

In this context, it should be noted that, according to the Global Risks 2022 report by the World Economic Forum (WEF)[43], five of the top ten global risks identified for the next ten years are climate or environment-related, one of them being the natural resource crisis: failure of climate action; extreme weather; biodiversity loss; environmental damage; natural resource crisis.

[42] European Commission, Raw Materials Information System, https://rmis.jrc.ec.europa.eu/?page=sdg-18f0ad
[43] https://es.weforum.org/reports/global-risks-report-2022

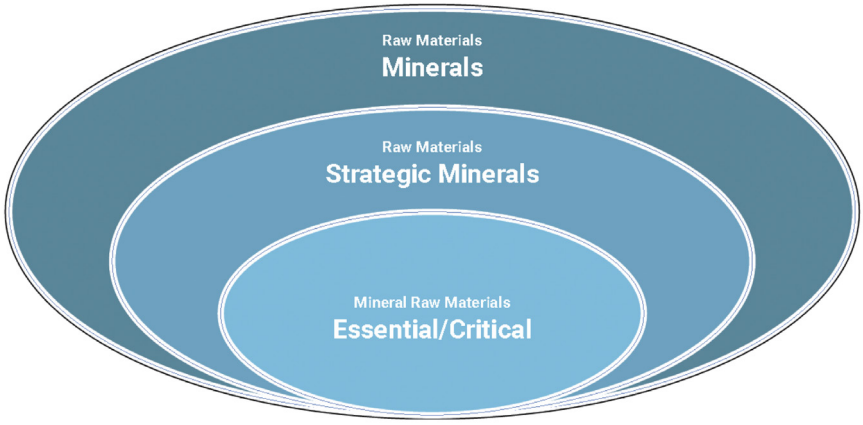
From priority to strategic raw materials. Critical or fundamental raw materials.

Starting from the classic definition given in the National Plan for the Supply of Mineral Raw Materials 1979-1987, priority minerals are considered to be those which constitute a challenge at a national level for the supply to the industry in conditions of adequate cost, quality and quantity, and for which it was necessary to define a program and objectives for internal and external supply. For this Road Map, the term strategic mineral can be defined by taking up the baton of the priority mineral and adapting it to the 21st century, extending the concept to a more global (European) challenge and directing it to the industry considered essential, in the European case, all those related to the ecological transition, and in particular, the energy transition to a new decarbonized and digital production model.

On the other hand, a critical or fundamental mineral can be defined as those raw materials that are economically important, in that they are essential for a given industrial process, and that have a high probability that their supply will be interrupted[44].

Both minerals groups are vital to a country's economy and the functioning of its industrial fabric, but the latter ones are encompassed within the former. It is, therefore, crucial to delimit both fields in order to be able to define policies for the protection or promotion of one or the other, which should be of greater intensity in the case of critical/critical minerals.

FIGURE 9. Diagram of strategic and fundamental raw materials



2.2. INTERNATIONAL AND EUROPEAN CONTEXT

Worldwide situation

According to the United Nations International Resource Panel[45], in 2016, an estimated 65 billion tons of mineral raw materials were extracted worldwide[46]. Ten countries were responsible for 70% of the world's production of non-energy minerals, metals, and mineral fuels. Among them, China was by far the largest producer with 37% of non-energy minerals, producing also 54% of aluminum, 50% of steel, 38% of cobalt, and 47% of primary and secondary zinc.

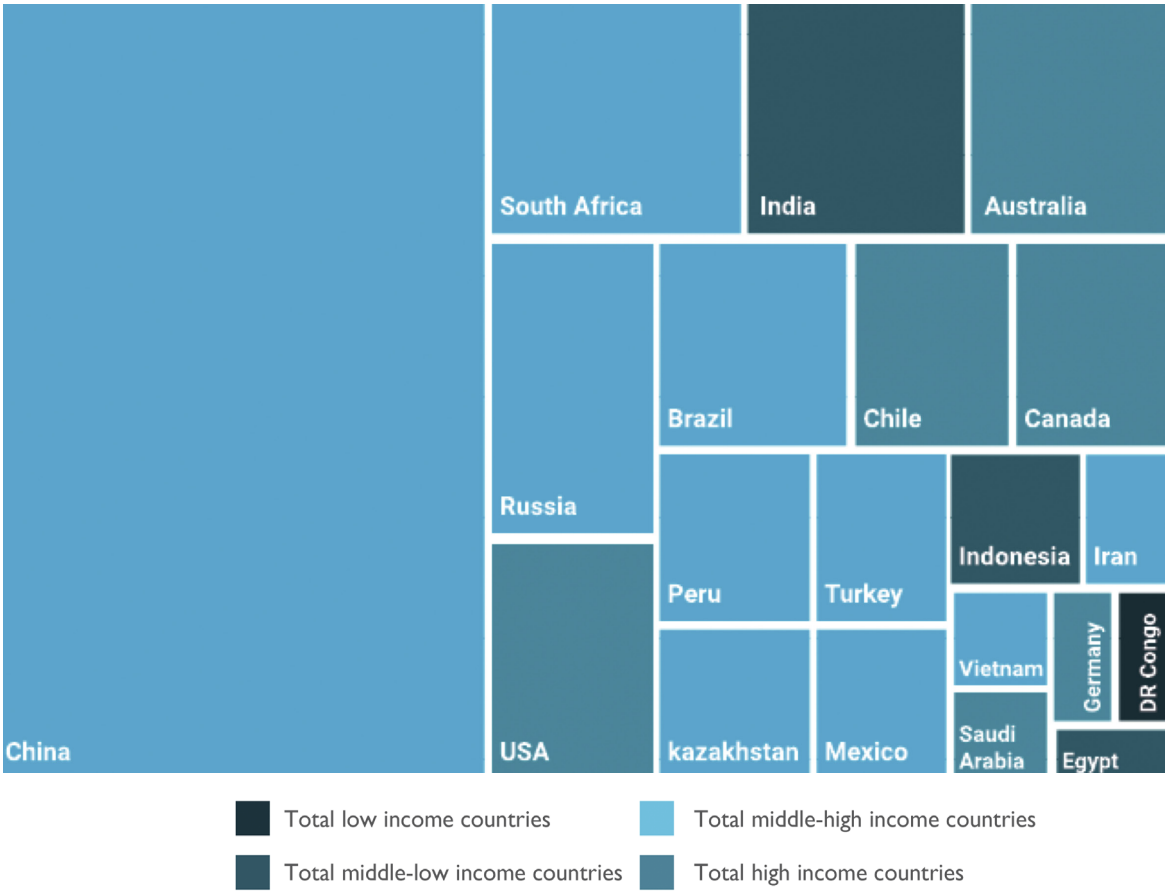
As for the origin of the production value, 90% came from upper-middle or high-income countries, with Germany being the only EU country among the top 20 producers, mainly due to its production of industrial and construction minerals.

[44] ESCRIBANO BOMBÍN M.; LÓPEZ JIMENO, C. Y MATAIX GONZÁLEZ (2019): «Manual de minerales críticos y estratégicos en la nueva economía» ISBN 978-84-96140-62-2, págs. 49-83

[45] IRP (2020), Mineral Resource Governance in the 21st Century: Gearing extractive industries towards sustainable development, https://www.resourcepanel.org/reports/mineral-resource-governance-21st-century

[46] Including raw materials with mineral content

FIGURE 10. Distribution of the top 20 producers of non-energy minerals and metals. Source: IRP



Regarding mineral exploration, essential in identifying areas where mineral resources may exist and in improving knowledge of deposits already identified, it is estimated that in 2017 spending on exploration for metallic minerals and certain industrial minerals amounted to US$7.95 billion[47], with Canada and the United States accounting for 21% of the total. Concerning Europe, despite consuming between 25% and 30% of metals globally, exploration spending was around 3%. Concerning the type of company, the largest share corresponded to large companies (49%), juniors (29%)[48],, and intermediate companies (13%), while mining exploration with public funds accounted for around 5%[49].

[47] IRP (2020), Mineral Resource Governance in the 21st Century: Gearing extractive industries towards sustainable development. Exploration of metallic and certain industrial minerals, https://www.resourcepanel.org/reports/mineral-resource-governance-21st-century
[48] The main source of financing for junior companies is funding rounds, issued according to the degree of maturity of the mineral resource and the project.
[49] There is currently no public expense in Spain. It is estimated that spending by junior companies is higher than the global trend.

FIGURE 11. Distribution of spending on mineral exploration. Source: IRP

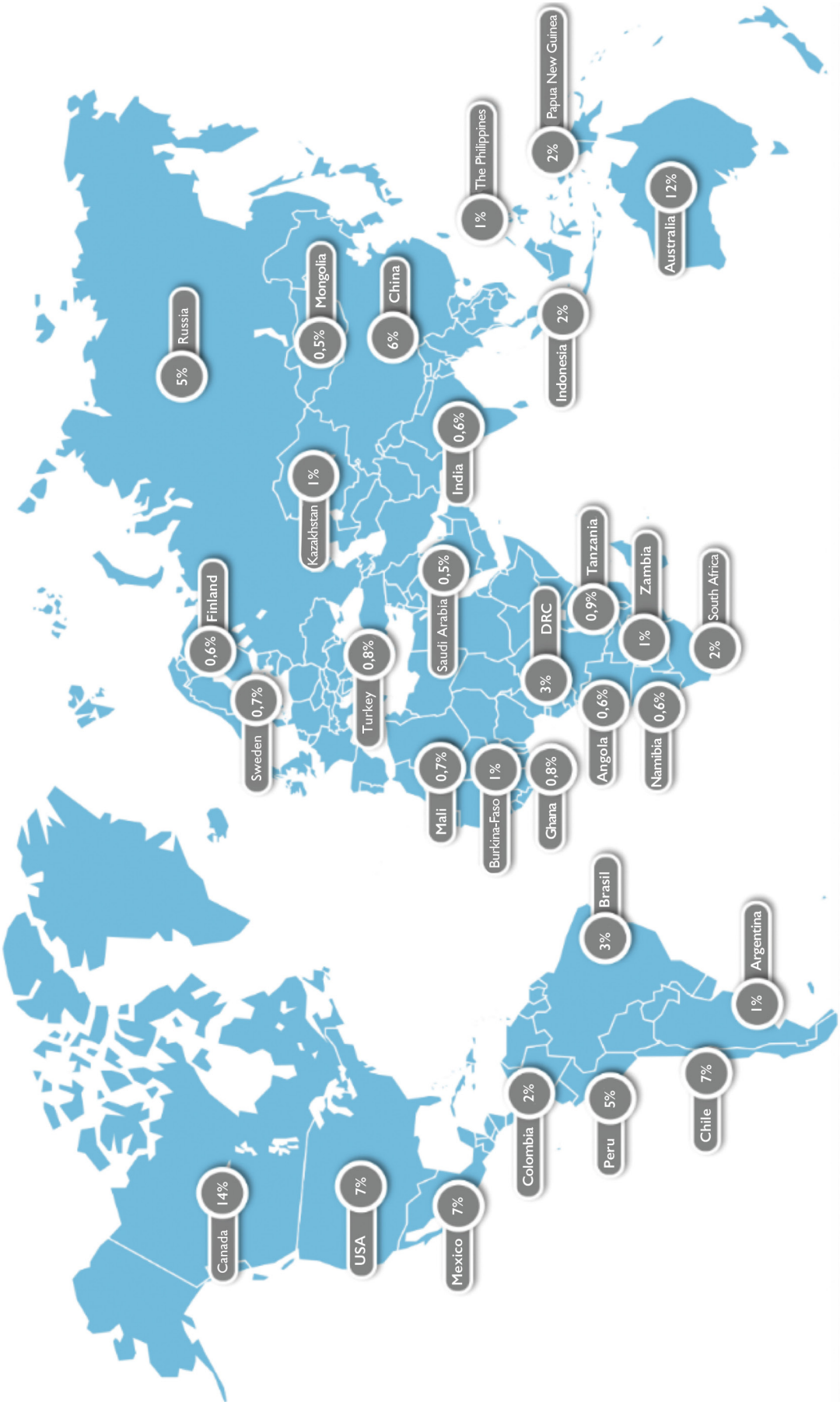
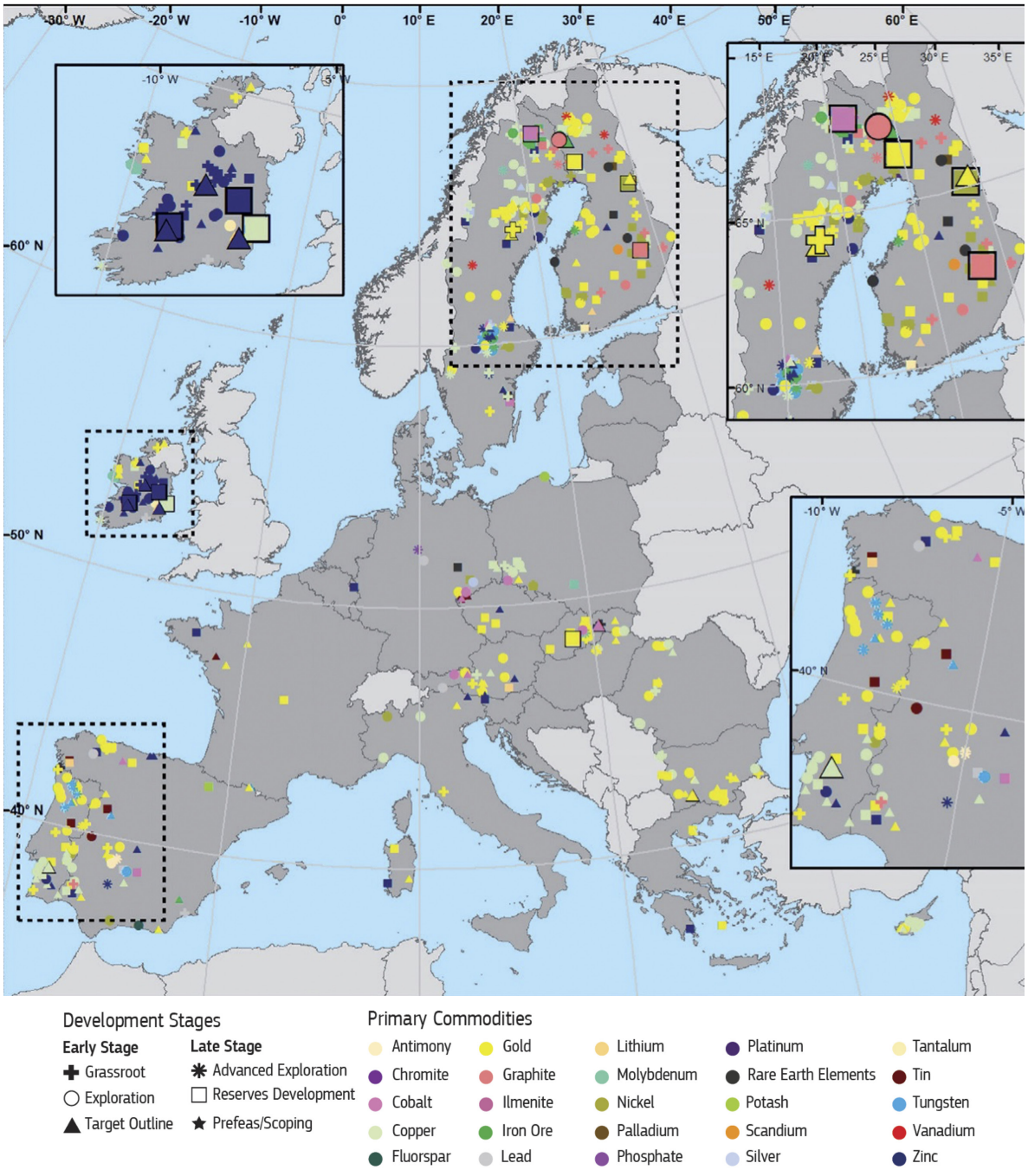


FIGURE 12. Exploration activities in the EU-27 (2019). The most advanced projects with larger symbols.
Source: Raw Materials Scoreboard (2021)



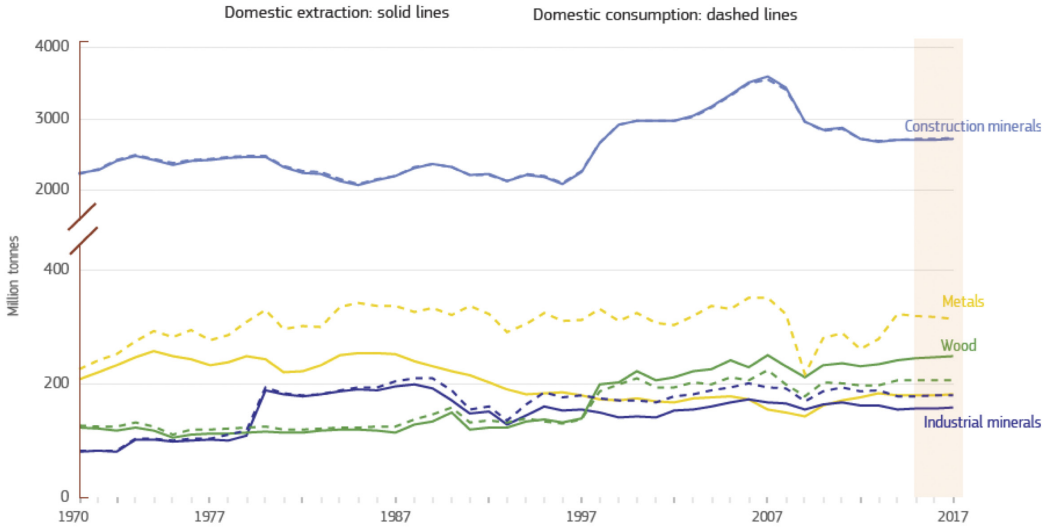
The European raw materials industry

Although the European raw materials industry has a long tradition and an important production of raw materials for construction and certain industrial and metallic minerals (mainly copper and zinc), its production, despite the availability of mineral resources, is scarce for other substances. Among the causes are, fundamentally, the lack of investment in exploration and mining, long and complex procedures for obtaining permits, or low levels of public acceptance[50].

[50] COM (2020) 474 final

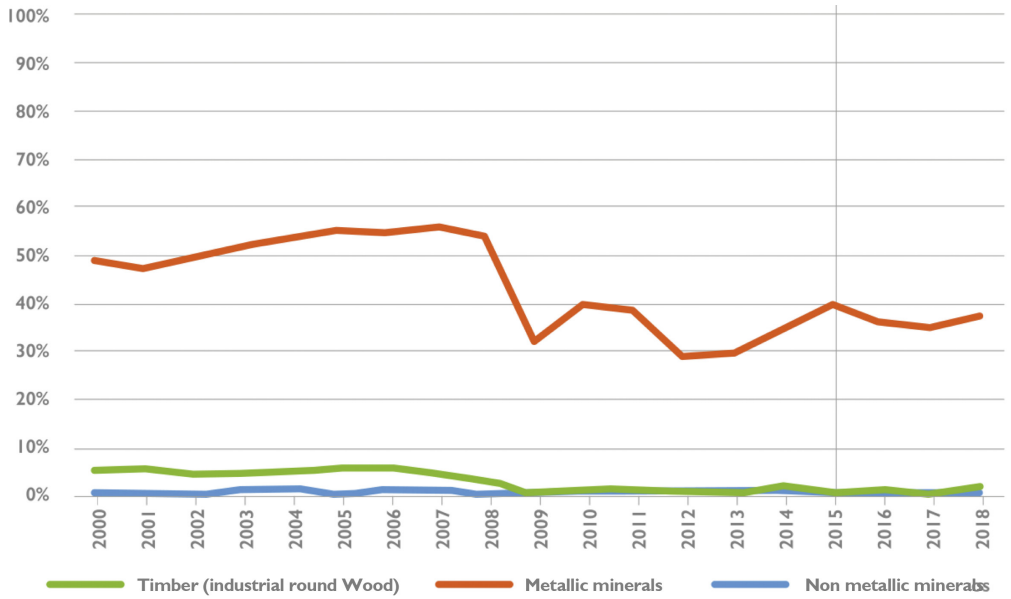
In Europe, around 3.35 billion tons of mineral raw materials are extracted each year, of which around 3 billion tons are construction materials, 0.2 billion tons are metallic minerals, and 0.15 billion are industrial minerals.

FIGURE 13. Extraction of raw materials in the EU-27 (1970-2017). Source: Raw Materials Scoreboard (2021)



Although Europe is globally the third largest producer of industrial minerals and produces most of the construction minerals needed, it is far from being self-sufficient in many of the raw materials required.

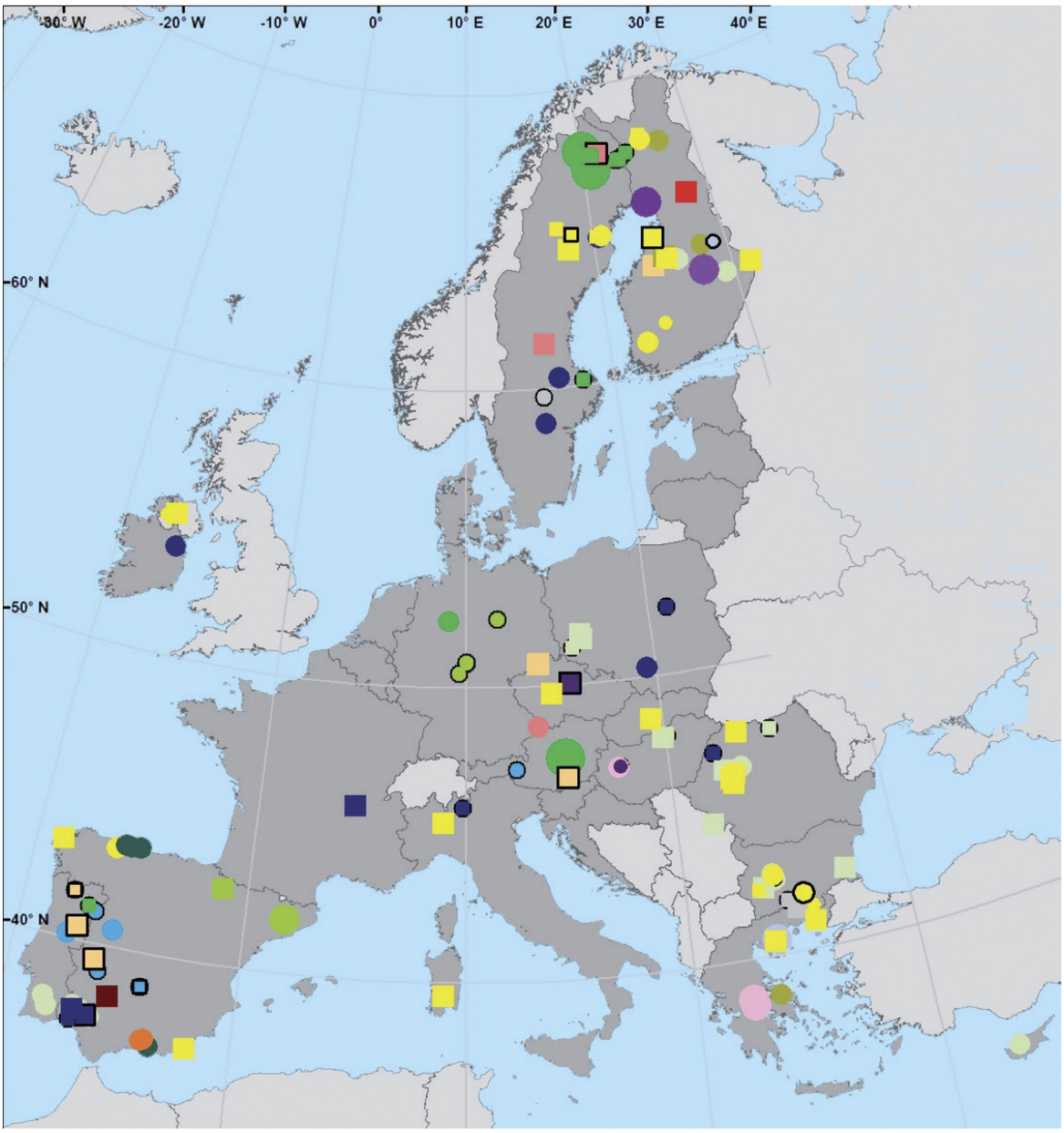
FIGURE 14. Dependence on imports for raw materials. Source: Raw Materials Scoreboard (2021)



According to Eurostat data (2018), the European Mineral Raw Materials industry consisted, in its extractive dimension, of about 18,300 companies extracting mineral resources in more than 32,000 mining operations, with direct employment of 398,000 jobs. The turnover is estimated at 105,000 M€ per year with a Value Added of about 35,000 M€ per year. In addition, there are some 2,000 companies providing support services[51] for mining activities.

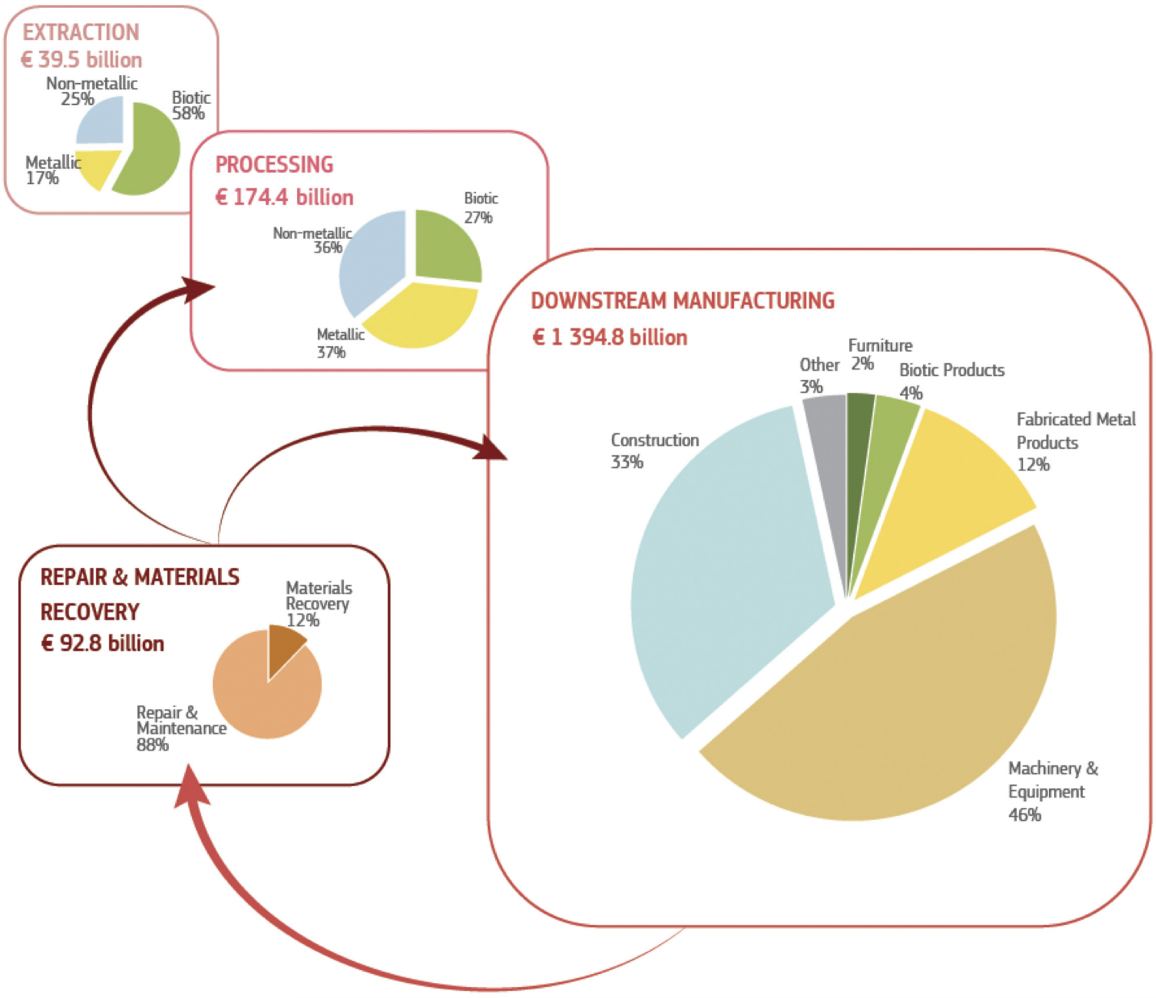
[51] https://ec.europa.eu/eurostat

FIGURE 15. Main EU countries producing metallic and industrial minerals.
Source: Raw Materials Scoreboard (2021)



If the first and second transformation stages are included, the value added is around €127 billion per year (2017), four times more than the extractive activity. However, the economic and strategic importance of the raw materials sector goes far beyond the economic activities strictly related to the extractive and processing industries. The secure supply of raw materials is essential for many sectors which, as a whole, including the construction sector, generate an Added Value of around €1.300 billion (2017). In this regard, it is interesting to note that the repair and material recovery sectors continue to grow, generating an Added Value of close to €100 billion (2017)[52].

FIGURE 16. Value chain of the Mineral Commodities industry in economic terms.
Source: European Commission



European Raw Materials Initiative

At the European level, the European Raw Materials Initiative (RMI[53]), launched in 2008 and revised in 2011 and 2014, aimed to secure the supply of raw materials needed for industrial value chains and the well-being of society. It envisaged a balanced approach based on the fair and sustainable sourcing of raw materials from international markets, enhancing the sustainable supply of raw materials from European sources, and resource efficiency and substitution.

[52] European Commission, EIP on Raw Materials, Raw Materials Scoreboard 2021, https://op.europa.eu/en/publication-detail/-/publication/eb052a18-c1f3-11eb-a925-01aa75ed71a1
[53] COM/2008/0699 final, https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=CELEX:52008DC0699

Based on the European Raw Materials Initiative, the Commission's September 2020 communication[54],urged national and regional authorities and companies to increase their agility and efficiency concerning the sustainable supply of critical raw materials. It proposed ten priority actions, including the creation of a European Raw Materials Alliance (ERMA)[55] covering the entire value chain, the promotion of research activities for the exploitation and treatment of fundamental raw materials (including mining waste), the use of earth observation and remote sensing programs for environmental management during exploitation and decommissioning, and the promotion of responsible mining practices.

The European Raw Materials Alliance (ERMA) involves the creation of an industrial alliance dedicated to ensuring a sustainable supply of raw materials in Europe. By bringing together all relevant stakeholders along strategic value chains and industrial ecosystems, the ERMA will initially focus on the most urgent needs, specifically increasing the EU's resilience in rare earth elements and permanent magnet value chains. This is vital for key EU industrial ecosystems such as automotive, renewables, defense, and aerospace. Subsequently, the ERMA will be expanded to address other critical raw material and base metal needs, including projects that support the circular economy and address the EU Green Pact. There will be an industry-driven process, led by EIT RawMaterials, tasked with identifying opportunities and barriers and building relevant investment cases with stakeholders and industry partners[56].

EU PRINCIPLES FOR SUSTAINABLE RAW MATERIALS

In May 2021, the European Commission adopted a set of principles for the sustainable extraction and processing of raw materials in Europe, based on social, environmental, and economic aspects[57]. These principles will help to achieve the SDGs, as well as contribute to consistency between emerging certification and labeling schemes in the field of sustainable raw materials.

Furthermore, they should enable better communication with the public about the conditions under which raw material extraction and processing is carried out in Europe. The principles will be based on existing EU legislation on sustainability and will refer to internationally agreed sustainable raw material extraction and processing initiatives. The principles do not impose any obligations on member states or the industry.

ACCESS TO RAW MATERIALS IN THE GLOBAL CONTEXT

The EU's action plan on fundamental raw materials indicates that social and environmental standards, as well as the traceability of supply and trade chains, must be safeguarded through the signing of international agreements. Thus, in the global context, the Commission is addressing access to raw materials through free trade agreements[58] [59]. These agreements propose measures such as the reduction of export restrictions on raw materials, reduction of tariffs, as well as the introduction of chapters dedicated to energy and raw materials, following a more systemic approach to remove existing barriers. Furthermore, these agreements oblige trading partners, among other issues, to effectively implement international labor conventions and environmental agreements; enforce their environmental and labor legislation; trade sustainably in natural resources; cooperate to move to a circular and resource-efficient economy; promote practices such as corporate social responsibility.

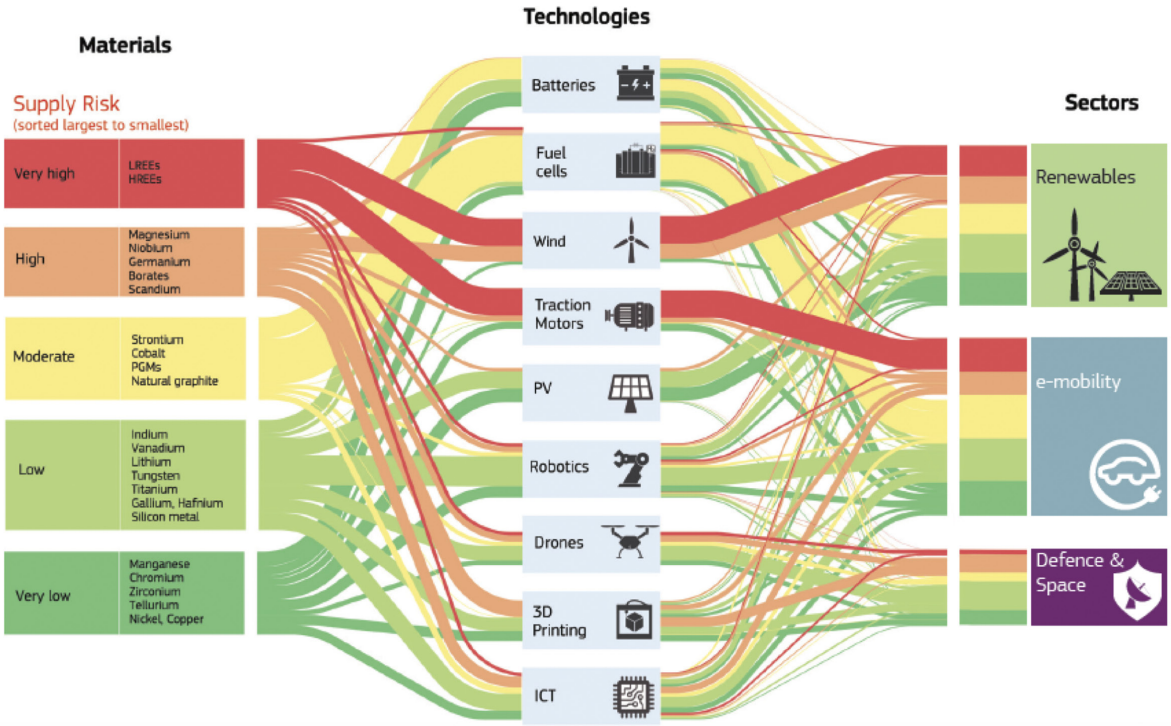
Furthermore, on the import of goods into the customs territory of the Union, the EU itself has Regulation (EU) 2017/821 of the European Parliament and of the Council of 17 May 2017 laying down supply chain due diligence obligations as regards importers into the Union of tin, tantalum and tungsten, their concentrates, and gold, originating in conflict or high-risk areas. There is also a proposal for a Directive on corporate due diligence of 23 February 2022[60], which aims to promote sustainable and responsible business behavior (environment and human rights) along global supply chains.

[54] COM/2020/474 final, https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=CELEX:52020DC0474
[55] European Raw Materials Alliance, ERMA, https://erma.eu/
[56] https://eitrawmaterials.eu/
[57] EU principles for sustainable raw materials, https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1/language-en
[58] COM(2021) 66 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021DC0066&qid=1614007663855
[59] Los acuerdos comerciales de la UE en vigor con los siguientes países incluyen normas sobre comercio y desarrollo sostenible: Canadá; América Central; Colombia, Perú y Ecuador; Georgia; Japón; Moldavia; Singapur; Corea del Sur; Ucrania; Reino Unido; Vietnam.
[60] https://ec.europa.eu/info/publications/proposal-directive-corporate-sustainable-due-diligence-and-annex

Fundamental raw materials for the European Union

As part of the raw materials initiative, the European Commission has been publishing the list of raw materials considered to be fundamental for the European Union every three years since 2011. Economic importance and supply risk are the two main parameters used. To assess the economic importance, the destination of raw materials is analyzed according to the consuming sectors.

FIGURE 17. Correspondence between the flow of mineral raw materials and their supply risk in relation to nine technologies and three strategic sectors. Source JRC (European Commission)[61]

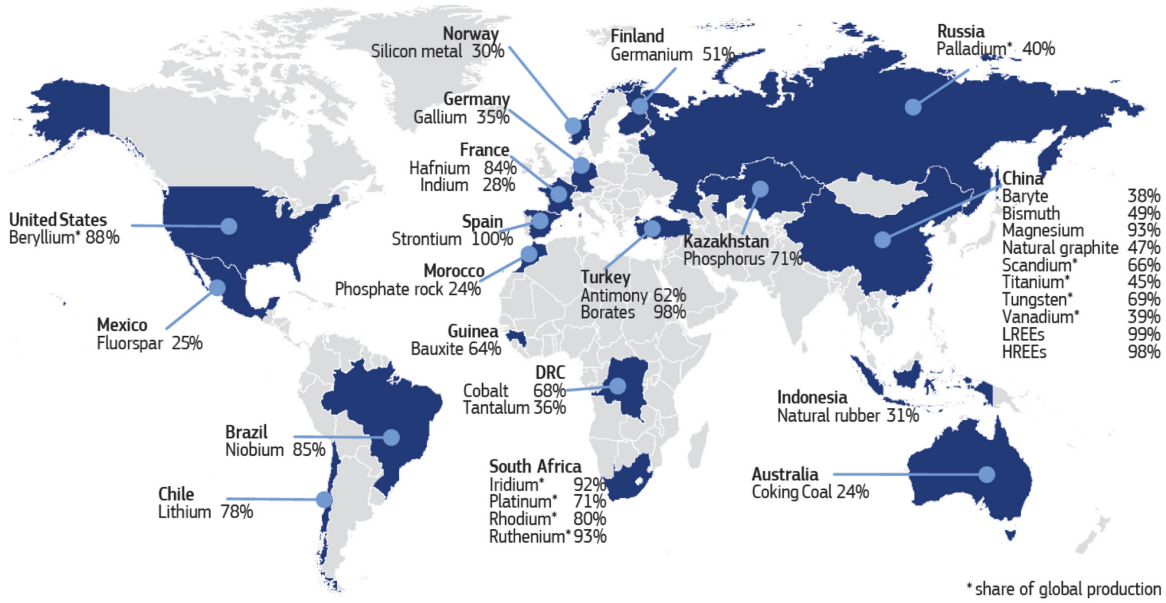


In terms of supply risk, the Commission examines the governance of supplier countries, the contribution of recycling, the potential for substitution, or trade restrictions in third countries. The EU 2020 list contains thirty raw materials compared to fourteen in 2011, twenty in 2014, and twenty-seven in 2017.

As can be seen in Figure 19, the supply of many fundamental raw materials shows a high degree of concentration. For example, 98% of the rare earths that the EU imports come from China, 98 % of borate comes from Turkey, and South Africa supplies 71 % of the platinum needed by the EU and an even higher percentage of the platinum group metals iridium, rhodium, and ruthenium.

[61] Rare earths are usually divided into two major groups: Light Rare Earths (LRR), to which La, Ce, Pr, Nd, Sm belong; Heavy Rare Earths (HRR), to which Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y, Sc belong.

FIGURE 18. Principales países proveedores de materias primas fundamentales a la UE.
Fuente: Raw Materials Scoreboard (2021)



Finally, the Commission also notes that "all raw materials, whether or not they are classified as critical, are important to the European economy; therefore, it is not appropriate to neglect a particular raw material or its availability to the European economy just because it is not considered a critical raw material"[62].

EUROPEAN ECONOMIC AND SOCIAL COMMITTEE EXPERT OPINION ON RAW MATERIALS

In 2009, the European Economic and Social Committee issued an opinion[63] on the raw materials initiative recommending that: "Member States should review their raw materials supply policies to determine their degree of importance for each EU Member State and the EU as a whole. The degree of importance of each raw material should be reviewed regularly, possibly every two or three years, in order to monitor possible changes." It further called for "developing a comprehensive approach to tackling the effects of climate change by improving energy-efficient technologies, promoting responsible use of natural resources and encouraging a greener orientation of its industry," as well as "the strategic importance of securing the supply of non-energy minerals in parallel with the European Energy Policy, focusing on the interdependence of these sectors due to technological factors."

EUROPEAN COMMITTEE OF THE REGIONS' OPINION ON RAW MATERIALS

At the beginning of 2021, the European Committee of the Regions welcomed the fact that the European Commission presented an Action Plan on critical raw materials to develop resilient industrial value chains in the EU. The opinion stressed that the EU should, as far as possible, source European raw materials in the long term, develop forward-looking development strategies, reduce dependence on critical raw materials through circular use of resources, sustainable products, and innovation, and diversify sourcing from third countries. It also stressed that recycled materials should be used to a greater extent to reduce the use of primary raw materials and critical raw materials; it also asked the European Commission to examine the competitive criteria according to which new products should, as far as possible, include a significant percentage of recycled material.

[62] COM(2014) 297 final, https://eur-lex.europa.eu/legal-content/ES/TXT/PDF/?uri=CELEX:52014DC0297&from=MT
[63] Opinion of the European Economic and Social Committee on the 'Communication from the Commission to the European Parliament and the Council: The raw materials initiative — meeting our critical needs for growth and jobs in Europe' (2009/C 277/19), https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2009:277:0092:0097:ES:PDF

European Framework Strategies

At the European level, in addition to the tensions caused by COVID-19 in the supply of mineral raw materials and their associated value chains, there is the impact of the Russian war of aggression. According to the Florence School of Regulation[64], the Russian invasion of Ukraine has come to transform the European energy crisis that began in the summer of 2021 into a structural situation, making it all the more necessary to accelerate the transition to a low-carbon economy by extending the concept of energy supply security to incorporate the critical raw materials and intermediate products needed for the transition.

To address these new challenges, in May 2022, the European Commission launched the REPowerEU Plan,[65] which comes in addition to other recent initiatives, such as the Green Pact (2019), the European Circular Economy Strategy (2015, 2020), or the New Industrial Strategy (2020), which also recognize access to resources as "strategic" to achieve climate neutrality by 2050 and ensure the supply of raw materials to European industry.

PLAN REPowerEU

The Plan has the dual objective of putting an end to the dependence on Russian fossil fuels and the climate crisis, establishing energy diversification and energy saving, and accelerating the introduction of renewable energies in the European Union as priorities.

Concerning mineral raw materials, it notes that "achieving the objectives of the REPowerEU plan will require diversifying the supply of renewable energy equipment and critical raw materials, reducing sectoral dependencies, overcoming bottlenecks in supply chains, and expanding the EU's manufacturing capacity for clean energy technologies."

It also states, "Beyond ensuring supplier diversification, strengthening circular economy models must be a priority. Research and innovation will be supported, also through Horizon Europe, to reduce material consumption, improve the recyclability of renewable energy equipment and replace critical raw materials."

To this end, the Plan notes, that the Commission will "intensify work on the supply of critical raw materials and prepare a legislative proposal," leveraging ongoing EU policies and actions, with the aim of "strengthening the European value chain by identifying mineral resources and critical raw materials projects in the European strategic interest, while ensuring a high level of environmental protection, including projects promoting a circular economy and resource efficiency."

EUROPEAN GREEN PACT

In 2019, the European Commission published the European Green Pact[66] which set out the EU Roadmap toward climate neutrality by 2050, zero pollution, and increased CO_2 reduction targets for 2030 to 55%.

The European Commission states that "Access to resources is also a strategic security issue for Europe's ambition to realize the Green Deal. Securing the supply of sustainable raw materials, in particular critical raw materials needed for clean technologies and digital, space and defense applications, by diversifying the supply from primary and secondary sources, is, therefore, one of the pre-requisites for making this transition a reality." The Commission will also "consider legal requirements to boost the market for secondary raw materials with mandatory recycled content (e.g. for packaging, vehicles, construction materials, and batteries)", as it has already done in the first instance through the Single-Use Plastics Directive[67], which mandates a minimum recycled plastic content in single-use beverage bottles.

These ambitions are based on the 2018 Communication "A Clean Planet for All[68]," which analyzed different scenarios for achieving the Paris Agreement targets. For the Commission, "Raw materials are indispensable enablers of carbon neutral solutions in all sectors of the economy. Given the scale of the rapidly growing demand for materials, primary raw materials will continue to meet much of the demand. However, reducing material input through reuse and recycling will improve competitiveness, generate business and employment opportunities, and require less energy, in turn reducing pollution and greenhouse gas emissions.

[64] Florence School of Regulation (2022), Between crises and decarbonisation: realigning EU climate and energy policy for the new «State of the World» https://fsr.eui.eu/wp-content/uploads/2022/06/Manifesto.pdf
[65] COM(2022) 230 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A230%3AFIN&qid=1653033742483
[66] COM/2019/640 final, https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=COM:2019:640:FIN
[67] Directive (EU) 2019/904, https://www.boe.es/doue/2019/155/L00001-00019.pdf
[68] COM/2018/773 final, https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=CELEX:52018DC0773

The recovery and recycling of raw materials will be particularly important in those sectors and technologies where new dependencies could emerge, such as dependence on essential materials like cobalt, rare earths, or graphite, whose production is concentrated in a few countries outside Europe. (...) With the transition to clean energy, new types of assets and resources are becoming strategic, such as the essential raw materials needed for renewable energy, electromobility, digital devices, and patents".

EUROPEAN STRATEGIES ON CIRCULAR ECONOMY

In 2015, the Commission launched the Circular Economy Action Plan (CEAP)[69] with a set of measures aimed at increasing the circularity of the European economy and the maintenance of raw materials within EU value chains. The CEAP 2015 included a strategy for a more circular use of plastics, better utilization of critical raw materials, and a framework for monitoring the plan.

Building on the work done since 2015, the Commission adopted in March 2020 a New Action Plan for the Circular Economy[70], being one of the main elements of the Green Deal for Europe. The new plan considers specifically the ecodesign, the analysis of the product life cycle, the promotion of more sustainable products through a greater contribution of recycled material, the reduction of hazardous substances and substances of very high concern, as well as, the improvement of the recyclability, durability, reusability, upgradability, and reparability of products, informing and raising consumer awareness of this. The Plan also focuses on the sectors with the greatest potential to contribute to the circular economy (electrical and electronic equipment, batteries, packaging, construction, buildings, etc.).

NEW EU INDUSTRIAL POLICY

In early 2020, the European Commission adopted a New Industrial Policy for the EU[71], to help the industry lead the digital transition, address the path to climate neutrality, and improve its competitiveness and self-sufficiency, all at a time of increasing global competition.

The strategy states that "To become more competitive as it becomes greener and more circular, the industry will need a secure supply of clean and affordable energy and raw materials." It further notes that "as European industry transitions to climate neutrality, dependence on available fossil fuels could be replaced by dependence on non-energy raw materials, many of which are sourced from abroad." Finally, it concludes that "boosting recycling and using secondary raw materials will help to reduce this dependence. Demand for raw materials is expected to double between now and 2050, making diversified sourcing essential to increase Europe's security of supply."

The COVID-19 crisis and the new geopolitical situation have further aggravated this analysis[72], exposing the global dependencies of the EU economy on both raw materials and technologies, and highlighting international supply vulnerabilities.

Therefore, in the current context, the need to ensure the self-sufficiency of strategic industrial value chains, both in the European Union as a whole and at the national level, with sustainable management of mineral raw materials to guarantee sustainable global economic development, is even more evident.

2.3. CURRENT SITUATION IN SPAIN

Situation of the mineral raw materials sector in Spain

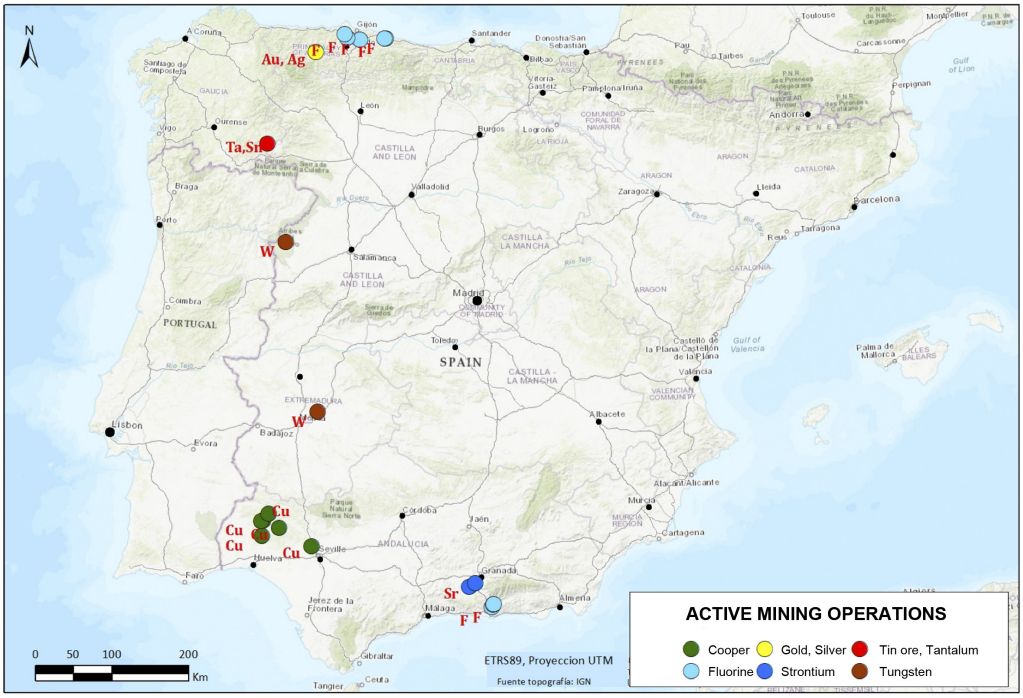
The extractive industry in our country has around 2,700 active exploitations, of which 10 are metal mining, 165 industrial minerals, 439 ornamental rock quarries, and around 2,100 aggregates[73]. The sector employs around 29,000 people and has an annual turnover of around €3.5 billion, making an important contribution to the local economy. Direct and indirect employment associated with the extraction and first transformation is estimated at 90,000 workers. Considering the activity as a whole (extraction, first and second transformation) - the total figure rises to 3,750 companies, 4,650 mining operations, and factories, and 320,000 workers, including direct, indirect, induced, and transport employment, with a turnover of around €26.6 billion and an export value of €11.8 billion. In total, the sector adds value annually, to about 210 million tons.

[69] COM/2015/0614 final, EUR-Lex - 52015DC0614 - EN - EUR-Lex (europa.eu)
[70] COM/2020/98 final, https://eur-lex.europa.eu/legal-content/ES/TXT/HTML/?uri=CELEX:52020DC0098
[71] COM/2020/102 final, https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=CELEX:52020DC0102
[72] COM/2020/474 final, https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=CELEX:52020DC0474
[73] Spanish Mining Statistics Data (2020) - MITECO, National Institute of Statistics - INE, ICEX Spain Export and Investment, https://energia.gob.es/mineria/Estadistica/Paginas/Consulta.aspx

FIGURE 19. Percentage distribution of the value of mining production by Autonomous Communities and main minerals obtained. Source: Mining Statistics of Spain (MITERD)

As far as critical raw materials are concerned, Spain currently has production of critical raw materials as: strontium, fluorspar, tantalum, silicon, and wolfram[74] as well as identified deposits of antimony, barite, bismuth, cobalt, lithium, and rare earths[75]. A significant number of these resources were identified during exploration campaigns carried out in the 1970s/80s or are associated with historical mining.

FIGURE 20. Active holdings of critical raw materials and other metallic raw materials. Source: Own elaboration



[74] COM/2020/474 final, https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=CELEX:52020DC0474.
[75] Spain's mining panorama, IGME (2016), (http://www.igme.es/PanoramaMinero/PANORAMA_MINERO_2016.pdf)

Background on raw materials strategies in Spain

Spain has had different plans and strategies related to mineral raw materials, such have been:

- National Mining Research Program[76] (1969).
- Basic guidelines for planning the supply of mineral raw materials (1974).
- National Plan for the Supply of Mineral Raw Materials (1979-1987).

In this sense, by agreement of the Council of Ministers on February 7, 1975, the National Plan for the Supply of Mineral Raw Materials (non-energy) was approved, which, among other aspects, specified the mineral raw materials and the activities related to them which were considered a priority and, at the same time, established the guidelines for action, both inside and outside the national territory.

Subsequently, through Law 6/1977, of January 4, 1977, on the Promotion of Mining, it was established that the Ministry of Industry, having heard the interested producing and processing sectors, would draw up (update) the National Plan for the Supply of Mineral Raw Materials, which would be submitted to the Government for approval and revision at least every two years. Thus, a minimum content of the Plan was established, with the obligation to establish the priority mineral substances. Specific investment lines were also created for the mining sector (LEIM) or specific mining research programs financed with State budgets, such as the so-called SISTEMINER (Systematic Exploration of Mineral Resources).

In practice, the last revision of the Mineral Raw Materials Supply Plan dates back to 1987, and since then, there has been no planning for the mining sector in Spain; only the list of priority mineral raw materials in force since 2002[77] remains.

Therefore, it is necessary for Spain to have a roadmap that allows configuring, at a national level, a harmonized framework that guarantees access to mineral raw materials, in coherence with the measures in the EU Action Plan on critical raw materials, as well as with the new sustainability principles that affect the extractive industry sector, approved within the framework of Law 7/2021, of May 20, on climate change and energy transition, in particular those detailed in the following epigraph.

Spanish Framework Strategies

At the national level, initiatives such as the Spain Circular Strategy 2030 (España Circular 2030), the State Framework Plan for Waste Management (PEMAR) (2016-2022), the Integrated National Energy and Climate Plan (2021-2030), or the Just Transition Strategy (2020) recognize the importance of a sustainable supply of raw materials. Likewise, the National Strategy on Green Infrastructure and Ecological Connectivity and Restoration (2021) highlights the need to promote the restoration and connectivity of the space affected by mining activity.

SPAIN CIRCULAR STRATEGY 2030 (ESPAÑA CIRCULAR 2030)

The Spanish Circular Economy Strategy, "España Circular 2030" (Spain Circular 2030), proposes a 30% reduction in the national consumption of materials concerning GDP by 2030, a 15% reduction in waste generation, and an increase in reuse to 10% of municipal waste. For this reason, it addresses raw materials as a central issue: "economy and environment are two interdependent realities, insofar as our society needs a constant flow of raw materials for their transformation into products, goods, and services, which provide us with everything from food, infrastructure, water, energy, housing or clothing, to mobility devices, communications or systems for sharing information." It takes up the priorities of the European Action Plan for the Circular Economy, specifically critical raw materials and construction and demolition waste, seeking to strengthen the markets for secondary raw materials, as a way to make more sustainable use of natural resources and advance along the lines of integrated use of raw materials and efficiency in the use of resources.

It also points out that: "In this context of increasing demand, together with increasingly reduced access to resources, a significant increase in the cost of raw materials, energy sources and materials can be expected, which could lead to serious instability in the socioeconomic system. It is, therefore, essential to have tools and mechanisms to guarantee supply provisions, correct consumption patterns, and facilitate the transition to a new sustainable production model that is in solidarity with future generations."[78] One of the indicators that will be used to evaluate the implementation of this Strategy is the

[76] National Mining Research Program (Programa Nacional de Investigación Minera), http://info.igme.es/ConsultaSID/presentacion.asp?Id=21892
[77] Royal Decree 647/2002, of July 5th, https://www.boe.es/eli/es/rd/2002/07/05/647
[78] Spanish Circular Economy Strategy, «España Circular 2030», https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/economia-circular/estrategia/

"self-sufficiency in raw materials (...) which shows the degree of dependence on external markets for the supply of raw materials, being especially significant in the case of critical [fundamental] raw materials; materials that due to their use in the economy, their application in technological devices, their natural disposition in geopolitically unstable environments and their deficit as a natural resource in the European territory, causes a structural weakness of the European economy." It also highlights the "Contribution of recycled materials to the demand for raw materials: The object of recycling is their introduction into secondary markets. Without its incorporation into the production process, any separation and recovery operation of materials from waste is meaningless. Determining the degree of participation in the raw materials market makes it possible to perfect a set of instruments to encourage their use, thus closing the circle" and "Trade in recyclable raw materials: This parameter complements the previous one by visualizing the import and export trade of raw materials."

España Circular 2030 is materialized through three-year action plans[79]. The first of these, for the period 2021-2023, proposes 116 measures that revolve around five axes and three lines of action specific to the circular economy, providing a joint and orderly response from the General State Administration. The plan includes mineral raw materials with specific actions for the fundamental ones.

SPANISH STATE WASTE FRAMEWORK PLAN (PEMAR) 2016-2022

Previously, in the State Waste Management Framework Plan (PEMAR) 2016-2022[80], which dedicates chapter 17 to waste from extractive industries, the ultimate goal, as with the EU waste policy, is to turn Spain into a resource-efficient society, moving towards a circular economy. In other words, to replace a linear economy based on produce, consume and throw away with a circular economy in which the materials contained in the waste are reincorporated into the production process over and over again for the production of new products or raw materials.

On the other hand, it points out that: "the application of Royal Decree 975/2009, of June 12, has meant a significant improvement in the protection of the environment and the management of waste from the extractive industries". Among the guidelines included are: reducing the need for waste facilities in the extractive industries by applying available technical improvements in prevention, the recovery of waste in new uses or applications when possible, the filling of mining voids (backfilling) or the restoration of degraded areas of the extractive industry under the provisions of the applicable regulations. Also, to encourage recycling and valorization, promoting the study of new uses when environmentally and technically possible and also their demand.

NATIONAL ENERGY AND CLIMATE PLAN 2021-2030

Similarly, the Integrated National Energy and Climate Plan 2021-2030[81] includes, in measure 5.1 Strategic Action on Energy and Climate, "the implementation of a sustainable and climate change resilient development model (...) that encourages (...) the promotion of efficiency and sustainability in the supply of raw materials for new technologies (...)". Likewise, in measure 5.7. New instruments to support research and innovation in energy and climate, it is stated that: "in the context of the new priorities and actions on energy and climate, the industrial policy will be affected by the new demand profiles for raw materials that will change significantly, so it must be ensured that innovations in the field of advanced technologies will not be hindered by the lack of availability or volatility of mineral raw materials on the market (...) [so it must] (...) Promote the development and financing of projects to promote R&D&I activities in the management of natural resources, raw materials, and adaptation to climate change". Among the new instruments and mechanisms for action, it includes "Raw materials: research projects aimed at updating information on raw material reserves in Spain and their future demand based on technological needs."

ENERGY STORAGE STRATEGY

For its part, the Energy Storage Strategy[82] *states that: "One of the challenges to be taken into account in the energy transition is precisely the scarcity of so-called critical raw materials (CRM) and strategic materials. These elements are necessary for some of the technologies that are essential for the transition to a climate-neutral energy system since clean energy technologies*

[79] https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/economia-circular/estrategia/
[80] Spanish State Waste Framework Plan (PEMAR) 2016-2022, https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/planes-y-estrategias/pemara-probado6noviembrecondae_tcm30-170428.pdf
[81] Integrated National Energy and Climate Plan, https://www.miteco.gob.es/images/es/pnieccompleto_tcm30-508410.pdf
[82] Energy Storage Strategy, https://www.miteco.gob.es/es/prensa/estrategiaalmacenamiento_tcm30-522655.pdf

require a greater quantity of materials than conventional ones". It also cites the World Bank[83] that analyzes the consumption of minerals needed to meet the demand for technologies associated with the energy transition with a time horizon of 2050, including energy storage technologies, which will have a significant demand for materials such as cobalt, lithium or graphite in the case of batteries. In conclusion, it will be necessary to pay attention to the needs for mineral substances, taking into account the reduction in the use of materials for the same performance as technology evolves and innovative applications are commercialized, as well as the reuse and recycling of these components.

Thus, it includes the need to promote national self-supply of raw materials or basic components, stating that "In order to promote sustainable self-supply, the aim will be to enhance the value of the country's rock and mineral resources, reducing dependence on third countries, contributing to the maintenance of the population and activity in rural areas with depopulation problems and favoring a rational use of land, mainly in rural areas." It also proposes a mechanism for the "traceability of the origin of suppliers and end of life of waste, to ensure compliance with environmental, geostrategic and social justice requirements." It also highlights that: "Spain has the challenge of researching, developing and promoting the battery industry and that of the mineral raw materials essential for their manufacture, promoting, in particular, its own resources (e.g. lithium, vanadium, nickel, cobalt, graphite, and rare earths), as well as researching new materials and improving the performance of existing ones."

He concludes by highlighting that "Taking advantage of the momentum of the energy transition will strengthen the national industry around energy storage technologies and boost the leadership of Spanish companies at the international level. It is essential to have national manufacturers and suppliers that generate high added value along the entire industrial value chain: from the supply of raw materials and basic components..."

NATIONAL STRATEGY ON GREEN INFRASTRUCTURE AND ECOLOGICAL CONNECTIVITY AND RESTORATION

The National Strategy On Green Infrastructure And Ecological Connectivity And Restoration[84] proposes recommendations for the ecological restoration of mining areas and areas affected by spills, pointing out, among other things, that: "mining voids offer very interesting opportunities for experimentation in ecological restoration or for the creation of custody agreements between the mining company and conservation NGOs to guide the restoration processes, while at the same time safeguarding their results and offering opportunities for environmental education". It also proposes the realization of "analysis of the distribution of mining voids that can help to establish a management of biodiversity enhancement actions, facilitating connectivity for some species through the creation of habitats that favor them in the quarry rehabilitation processes".

Finally, he indicates that: "There is a lot of information about good practices in the restoration of areas affected by mining activities. There is a need to develop standards for mining restoration to ensure that such practices are incorporated into mining management and to evaluate restoration projects, and to put in place the means to ensure that they are implemented."

JUST TRANSITION STRATEGY

The Just Transition Strategy[85] promoted by MITERD states that the keys to a greener economy "would be the promotion of green growth through business development linked to the optimal use of raw materials; and increased competitiveness."

SUSTAINABLE DEVELOPMENT STRATEGY 2030

The Sustainable Development Strategy 2030, approved by the Council of Ministers in June 2021, and presented to the United Nations, represents the Road Map for the fulfillment of the 2030 Agenda in Spain and raises among its accelerating policies the need to implement a green, fair, and digital model aligned with the SDG[86].

[83] World Bank (2020), Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition, https://pubdocs.worldbank.org/en/961711588875536384/Minerals-for-Climate-Action-The-Mineral-Intensity-of-the-Clean-Energy-Transition.pdf
[84] National Strategy On Green Infrastructure and Ecological Connectivity and Restoration https://www.miteco.gob.es/es/biodiversidad/temas/ecosistemas-y-conectividad/eniv_2021_tcm30-515864.pdf
[85] https://www.miteco.gob.es/eu/transicion-justa/documentoetj_tcm35-514300.pdf
[86] Sustainable Development Strategy 2030, https://www.mdsocialesa2030.gob.es/agenda2030/documentos/eds-cast-acce.pdf.

Environmental aspects of the production of primary raw materials in Spain

The exploitation of primary raw materials requires prior exploration to identify their presence. Such exploration can be in areas where no other extractive activity is taking place or has taken place (greenfield) or in areas where there is or has been mining activity (brownfield), which indicates the availability of certain raw materials. Both efforts require geological and socio-environmental knowledge, as well as, a financial investment.

Once the material is extracted, it is first separated by mechanical methods, and in certain types of minerals, it is further concentrated or refined through chemical and physical processes. All these processes are called beneficiation, and their use depends on the type and quality of the raw material. Sometimes, considerable quantities of material must be extracted, to produce a small number of pure minerals, and sometimes less common minerals are extracted as by-products. The residues from the extraction and refining process are commonly referred to as mining residues and can be rich in other materials and serve as a source of secondary raw materials. Semi-finished products are produced from concentrated and refined ores, which are then used for the final product.

Until a few decades ago, it was common to extract only one or two mineral substances in each mining operation, which, together with technological limitations or the price of raw materials, meant that valuable materials were often discarded, as mining waste. In many European countries, including Spain, mining waste from historic mines, and steel by-products, are a potential resource, mainly for metals and semi-metals. In this regard, the European Commission's Joint Research Centre estimates, for example, that the chromium, niobium, or vanadium content of slag could reduce dependence on imports of these materials by 12%, 6%, and 7%, respectively[87].

For exploration activities, and for any subsequent steps in the process, there is a legal framework that establishes the environmental protection and land use compatibility requirements under which these activities are permitted[88]. In Spain, before granting new permits for the extraction of mineral resources, compliance with environmental legislation must be ensured[89]. In particular, the environmental impact assessment, which is mandatory and binding in the authorization of each work, establishes the necessary conditions, limitations and prohibitions in order to guarantee safety and environmental protection.

In the past, accidents such as Stava (1985), Aznalcóllar (1998), Baia Mare, and Baia Rosa (2000) have had very serious environmental consequences, which is why, in 2006, Directive 2006/21/EC on mining waste was published, transposed by Royal Decree 975/2009, of June 12, 2009, which established additional requirements to improve the management of this type of facilities. This royal decree also includes provisions relating to the restoration plan and improves the financial guarantee scheme in order to ensure environmental restoration once mining ceases, a requirement established for the first time in the Spanish legislation of 1982[90].

Thus, the extraction of mineral raw materials extracted and processed in Spain are subject to strict environmental protection, human health and safety, human rights, and transparency requirements. According to data from the United Nations Protected Planet report, 15% of the planet's total land area has some form of environmental protection[91]. In Spain, the protected area represents more than 28% of the total land area.

[87] JRC (2019), Recovery of critical and other raw materials from mining waste and landfills: State of play on existing practices, https://publications.jrc.ec.europa.eu/repository/handle/JRC116131

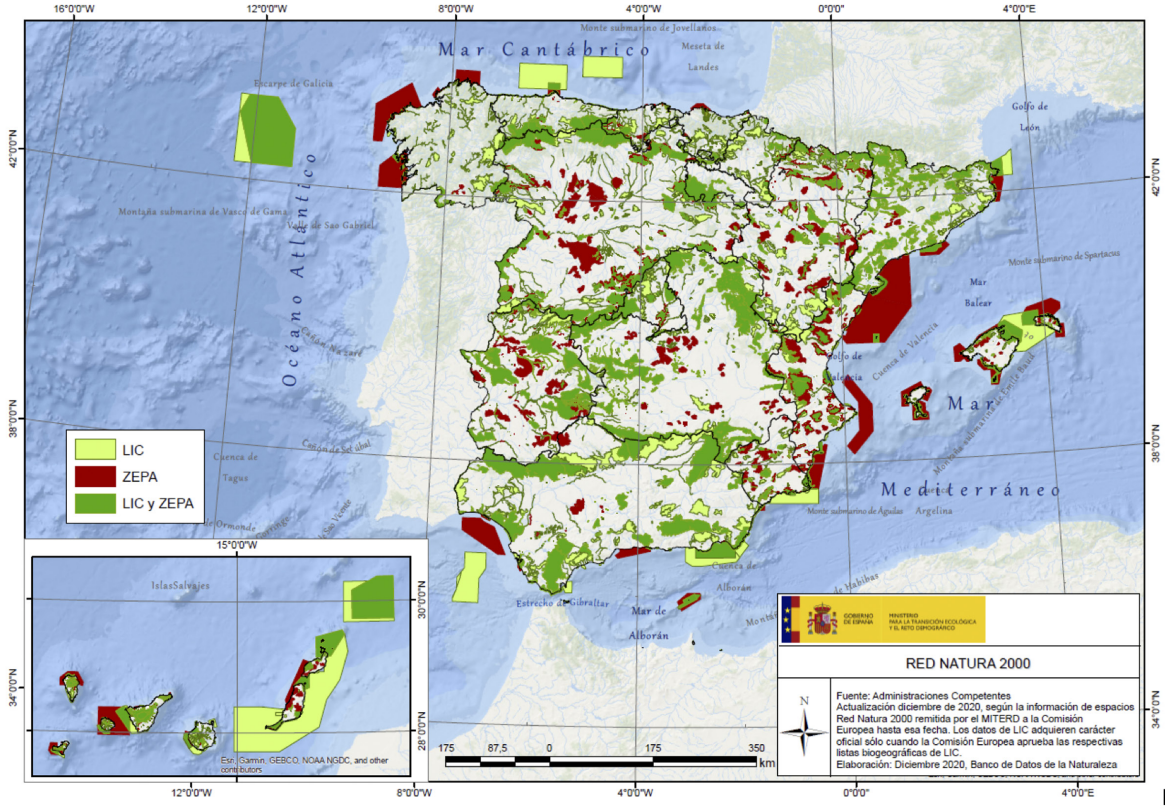
[88] JRC (2021), A review of European Union legal provisions on the environmental impact assessment of non-energy minerals extraction projects, https://publications.jrc.ec.europa.eu/repository/handle/JRC125111

[89] Comisión Europea (2017), Legal framework for mineral extraction and permitting procedures for exploration and exploitation in the EU, https://op.europa.eu/en/publication-detail/-/publication/18c19395-6dbf-11e7-b2f2-01aa75ed71a1/language-en

[90] Royal Decree 2994/1982, of October 15, 1982, on the restoration of natural areas affected by mining activities.

[91] United Nations, Protected Planet Report, https://www.protectedplanet.net/en

FIGURE 21. Red Natura 2000 in Spain. Source: MITERD



The area occupied by the extractive industry is estimated to be 0.15% (750 km^2)[92] of the total territory of Spain, lower than other uses such as agriculture (41%), forestry uses (33%), unused or abandoned areas (16.5%), residential use (7.5%) or industrial areas (5%). At the European Union level, the report LUCAS Copernicus 2018: Earth Observation relevant in-situ data on land cover throughout the European Union[93] based on a satellite sampling of the entire European Union, assigns 0.075% of land use in Europe to mining.

As for other effects, it is estimated that in Spain mining consumes about 1% of water resources[94], affecting around 2% of the quality of surface water bodies[95] (compared to 25% in the agricultural sector) and 10% of the groundwater surface (29% in the agricultural sector), with a special incidence of historical or abandoned operations.

In relation to emissions to the atmosphere, the extractive industry was responsible, in 2020, for the emission of about 11 Mt of CO_2 equivalent (4.5% of the total)[96] and 1.6% of particulate matter (PM2.5 particles)[97], with the contribution of non-methane volatile organic compounds (NMVOCs), and ammonia (NH_3)[98].

As for mining waste, in 2018, it constituted the second largest source of waste in the EU (26.2%) behind construction and demolition waste (36%). The volumes and characteristics of such waste depend on the substance mined; at the EU level, 2% of mining waste facilities are considered hazardous[99], 4% by mass, while the vast majority (96%) of waste is inert or non-hazardous.

[92] Eurostat - Land use overview by NUTS 2 regions, https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lan_use_ovw&lang=en
[93] https://essd.copernicus.org/preprints/essd-2020-178/essd-2020-178.pdf Table A2. LUCAS Copernicus level-3 land use distribution.
[94] Hispagua Spanish Information System concerning Water http://hispagua.cedex.es/datos/industria
[95] European waters-Assessment report (Agencia Europea del Medio Ambiente-2018), https://www.eea.europa.eu/publications/state-of-water
[96] National Greenhouse Gas Emissions Inventory: Summary Report. Edition 1990-2020, https://www.miteco.gob.es/es/calidad-y-evaluacionambiental/temas/sistema-espanol-de-inventario-sei-/resumen_inventario_gei-ed_2022_tcm30-534394.pdf
[97] National inventory of atmospheric emissions. Emissions of atmospheric pollutants. Series 1990-2020, https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/sistema-espanol-de-inventario-sei-/resumen_inventario_contaminantes-ed_2022_tcm30-534395.pdf
[98] National inventory of atmospheric emissions. Emissions of atmospheric pollutants. Series 1990-2020: non-methane volatile organic compounds. (COVNM), 0,017%; y ammoniac (NH_3), 0,02%.
[99] Best Available Techniques (BAT) Reference Document for the Management of Waste from Extractive Industries, https://publications.jrc.ec.europa.eu/repository/handle/JRC109657

III

DIAGNOSIS OF MINERAL RAW MATERIAL SUPPLY

3.1. GLOBAL CHALLENGES AND ISSUES

Minerals and metals are essential for the production of most of the goods and services enjoyed by our citizens and, therefore, for almost all sectors of activity in our economy. Moreover, as raw materials for industrial production processes, they are the starting point of many supply chains and, as such, are strategically important assets for the European economy and its industries, most notably those in the energy sector associated with the ecological transition.

Digitalization and the transition to a climate-neutral and resource-efficient society by 2050, while helping to decarbonize the economy, means increasing the consumption of certain mineral raw materials. From a global perspective, this implies a risk for developed countries to replace dependence on fossil fuels with new critical raw materials for the green transition, in both cases with deposits located in a few producing countries, but also a great opportunity.

On the one hand, because of the possibilities of reusing and recycling mineral raw materials for the energy transition, as opposed to the sole use as energy recovery inherent in the consumption of fossil fuels. On the other hand, because of the possibility of generating sustainable value chains from the use of raw materials.

According to the Ellen MacArthur Foundation's 2014 executive summary "Towards a Circular Economy[100]"price volatility levels for metals, food, and non-food agricultural products in the first decade of the 21st century were higher than in any other decade of the 20th century. In this regard, and as the European Environment Agency[101] (EEA) report points out, the fragility of the European economy is particularly striking, as it depends on an uninterrupted flow of natural resources and materials, including metals, minerals, and rocks. Much of the former comes from imports. The loss of resources that the current model, based on a linear economy, entails is something that no economy strongly dependent on the supply chain can afford, a situation that may be aggravated by an expected significant increase in raw materials and energy sources prices. Therefore, the failure to take advantage of the resources that can be recovered from the waste generated and to develop more efficient transformation processes based on lower levels of input consumption is, at present, an economic and competitive disadvantage for the EU economy.

The Spanish Circular Economy Strategy[102] (Estrategia Española de Economía Circular-EEEC/ España Circular 2030) proposes a 30% reduction in the national consumption of materials in relation to GDP by 2030, a 15% reduction in waste generation, and an increase in reuse to 10% of municipal waste. This means that, although demand will be covered by an increasing use of secondary raw materials, primary raw materials will continue to play a role in the demand for most mineral substances.

On the other hand, as the European Commission points out, it is very difficult for projects involving critical raw materials to reach the operational phase within a reasonable time. This is in part due to the associated risk and cost, but also to the lack of incentives and funding for exploration, the length of the permitting process, and the lack of public acceptance of mining in Europe. In this context, as highlighted by the European Council in its Conclusions of 21 July 2020, it is necessary to identify the obstacles faced by projects to streamline their processing, while maintaining high standards.

Therefore, the following challenges and actions are proposed:

CHALLENGE No. 1: Reduction of consumption. Increase reuse and recycling. To be a major player in the circular economy

- In line with the EU Action Plan on critical raw materials, the role of the extractive and processing industries in the circular economy needs to be enhanced. As in EU countries where the circular economy is more advanced, the Spanish mineral raw materials industries are key to closing the loop in the management of the most relevant waste streams - extractive industry waste and construction and demolition waste - in terms of volume produced annually, as well as in the management of metal waste. They must also play a more active role in reducing the consumption of materials by introducing competitive secondary raw materials into the production cycle and working together with manufacturers from the product and process design phase to facilitate their subsequent recovery.

[100] Executive_summary_SP.pdf (ellenmacarthurfoundation.org)
[101] European Environmental Agency (europa.eu)
[102] https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/economia-circular/estrategia/

- The contribution of recycling will have to be increased. Although the contribution of recycling to meeting the final demand for certain raw materials is relatively high, in global terms, it remains low (less than 10%). The main causes include low collection rates, losses in waste treatment, lack of industrial-scale processes for some raw materials, transportation costs, and low economic incentives compared to recycling costs.
  - The exploitation, with new technologies, of existing mine tailings dumps makes it possible to recover and put on the market previously discarded but much-needed raw materials and, at the same time, to reduce the country's needs in terms of raw materials, thanks to minimizing the volumes of waste coming from the past.
  - One issue to be considered is the recovery of old abandoned mining waste facilities through the application of Best Available Techniques (BAT) for treatment, and when technologically, economically, and environmentally possible, the recovery of the raw material, or with the application of new techniques for the restoration of these sites, which demand fewer resources.
- Measures will be adopted to reduce and improve the use of waste streams generated in the extractive activity, with the objective of achieving zero waste.
- In the industrial transformation stage, the recovery, recycling, and reuse of mining waste will be promoted, as well as the establishment of end-of-waste criteria for waste from iron and steel processes, such as slag, as a potential resource, mainly of metals and semi-metals. Likewise, the recovery, recycling, and reuse of other types of waste, such as construction and demolition waste, glass waste, foundry waste, incineration waste, etc., will be promoted.

CHALLENGE No. 2: Supply of mineral raw materials. Security of supply of key raw materials for the economy.

- Current domestic production of primary and secondary raw materials is not sufficient to meet demand. This implies a high dependence on imports of certain raw materials, in particular, those necessary for the energy transition, being necessary to establish scenarios of future supply and demand.
- While the current production of mineral raw materials needed for the digital and energy transition is concentrated in certain countries, mineral resources are not, or need not be in the future[103], with innovation and technological development in reuse and recycling processes and knowledge of indigenous mineral resources and their more efficient processing being particularly relevant for this purpose. It is, therefore necessary to improve knowledge of the available indigenous mineral resources (primary and secondary) and to identify priority raw materials for the Spanish economy as a whole.
- It will be necessary to update the basic mining management regulations to adapt them to the current regulatory reality and strategies, as well as to improve their management and application.
- It is also required to streamline the processing of industrial initiatives by improving administrative processes and procedures to speed up the obtaining and management of permits on strategic raw materials, without undermining EU sustainability standards.
- Mechanisms are needed to improve the integration of mineral resources and the entire value chain (production, processing, and utilization) into spatial planning.
- To incentivize this key industry, a public-private investment framework needs to be promoted to attract strategic investments, facilitating the use of EU investment channels for Raw Materials projects, such as ERMA, or Important Projects of Common European Interest (IPCEI).
- In addition, a clear framework is required to guide public and private investments towards sustainable investments by establishing sustainable financing criteria for the Mineral Raw Materials industry in the delegated acts on taxonomy.

[103] IRENA https://www.irena.org/publications/2019/Jan/A-New-World-The-Geopolitics-of-the-Energy-Transformation

CHALLENGE No 3: Industry 4.0 of mineral raw materials, more efficient and sustainable

- Greater information on the importance of minerals to society, in general, and of the impacts, both positive and negative, on the mineral raw materials industry, will be promoted.
- The compatibility of extractive activity with the protection and preservation of the natural environment must beimproved, encouraging the application of good practices for the prevention of environmental impacts, biodiversity, the creation of ecological corridors, the development of green infrastructure, and the recovery of degraded land.
- It is necessary to unite the efforts of companies, sub-national and national authorities, and EU institutions, aligning national measures with the objectives and lines of action set out in the EU Action Plan for critical raw materials.

CHALLENGE No 4: Contribution to the transition to a climate-neutral economy

- The economy's ecological transition will have to improve the capacity to manage mineral raw material resources more sustainably, increasing energy efficiency, progressively introducing energy generation from renewable sources, and reducing waste through the implementation of the circular economy. This will foster a more competitive, lowcarbon, and environmentally sustainable economy that will contribute to the fight against climate change.
- The generation of new products aimed at improving energy efficiency in construction will require adjustments to the production model of the Mineral Raw Materials industries, which are the main supplier of construction products.
- The development and implementation of new sustainable technologies for the recovery of mineral raw materials through recycling and reuse of industrial wastes and by-products will make it possible to reduce the carbon footprint associated with the use of raw materials.
- Measures are required to boost the decarbonization of the Mineral Raw Materials industry, which faces significant technological challenges associated with electrification, the difficulty of reducing process emissions, the price of energy, or the risk of carbon leakage.
- Environmental footprint analysis, environmental product declarations (EPD), control of atmospheric emissions, and, in particular, the reduction of CO_2 emissions, are some of the essential aspects to be addressed in the Roadmap to achieve this objective.
- Mineral raw materials are essential to boost infrastructures related to Agenda 2030 and the Integrated National Energy and Climate Plan (PNIEC), such as those linked to water management (regulation, distribution, loss reduction (26%), sewerage, purification, recycling, and reuse), the renewable energy network, infrastructures for the circular economy (green points, transfer stations, treatment plants for material and/or energy valorization), inclusive and sustainable urban planning (railroad track enclosures, high traffic streets, bypasses), intermodal connections and logistics hubs, prevention of the effects of climate change on coastal protection and river flooding, of water scarcity and desertification (erosion control and irrigation), sustainable mobility (metro and commuter networks, park-and-ride parking lots, etc.), improvement of the freight rail network. The last is several times more efficient and has a level of greenhouse gas emissions five times lower than other modes, etc.
- Greater participation of the sector's agents in R&D&I projects is necessary to achieve the objectives of a climateneutral economy by 2050 and a zero-emission economy.

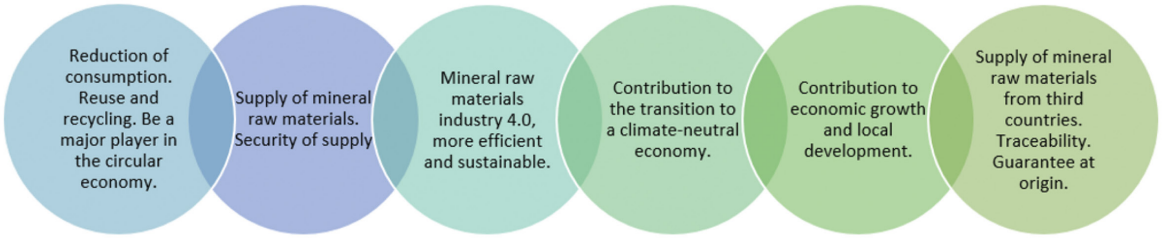
CHALLENGE No 5: Contribution to the economic growth and the local development

- The participation of local communities must be encouraged in the development of mineral resource development projects from the earliest stages, maximizing benefits throughout the value chain (from extraction to recycling), compensating for the impacts generated, and planning for the future after the cessation of the extractive activity.
- Mechanisms must be promoted to ensure that the communities where extraction takes place, capture the greatest possible value from the first uses of the raw material extracted, to guarantee the creation of indigenous value chains that go from the local to the supra-national level, generating value in each one of their links.
- Technological and innovative solutions transforming the sector must be promoted, designing specific measures for their implementation by small and medium-sized companies.

CHALLENGE No. 6: Supply of mineral raw materials from third countries. Traceability. Guarantee at origin

- In the framework of a common customs territory in the EU, the establishment of guarantees of origin that ensure that raw materials from third countries are extracted and produced with respect for human rights, the environment, and the safety and health of workers is to be promoted.

FIGURE 22. Global Challenges and Issues



3.2. STRATEGIC ORIENTATIONS

The Integrated National Energy and Climate Plan 2021-2030[104] (PNIEC) states that, in the context of the new energy and climate priorities and actions, the industrial policy will be affected by the new demand profiles for raw materials that will change significantly. Consequently, it must be ensured that innovations in the field of advanced technologies will not be hindered by the lack of availability or volatility of mineral raw materials on the market

For its part, the Long-Term Decarbonization Strategy 2050[105], establishes reuse and recycling as the first option to feed the productive processes. And once this route has been exhausted, and provided it is technically and economically feasible, the Strategy moves to the use of domestic mineral resources under European environmental and sustainability standards that do not displace greenhouse gas emissions to other regions, as it also contributes to the reduction of global emissions by reducing those of their transportation to the points of consumption.

All of the above, as the Strategy points out, will involve shaping a national policy on indigenous raw materials that ensures that resources are exploited in an economically viable and sustainable manner, using the best available techniques, ensuring the reduction of greenhouse gas emissions and atmospheric pollutants in the sector and reducing, as far as possible, dependence on imports.

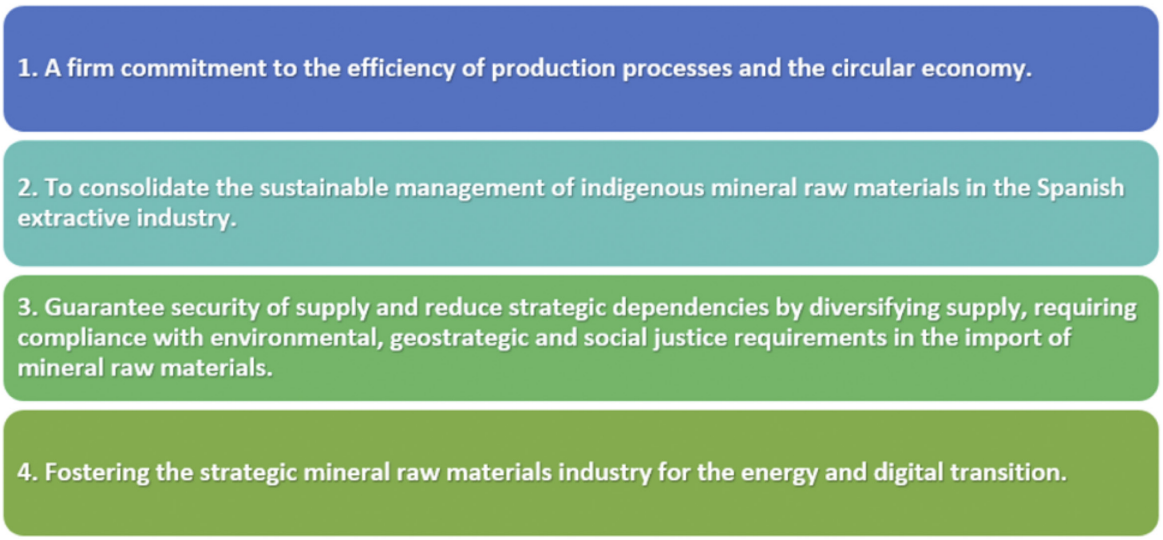
In parallel, the EU's strategic objectives on critical raw materials point to the need to develop resilient value chains for the EU's industrial ecosystems; reduce dependence on critical raw materials through the circular use of resources, sustainable products, and innovation; as well as to strengthen domestic sourcing and processing in the European Union, and diversify supply with sustainable and responsible sourcing from third countries.

On the other hand, the National Security Strategy 2021[106], states that it is essential to reduce strategic dependencies on raw materials and essential components of industrial value chains by diversifying production and supply, maintaining reserves, and boosting production and investment in Europe. To this end, one of its lines of action establishes the identification of essential industrial resources to guarantee the supply of those goods and services that are considered to be of prime necessity and strategic nature, as well as safeguarding the industrial base that supplies these resources, such as strategic materials.

Thus, this Road Map establishes the four strategic orientations that are to guide the national mineral raw materials policy.

[104] https://www.miteco.gob.es/images/es/pnieccompleto_tcm30-508410.pdf
[105] La Moncloa. 03/11/2020. Estrategia a largo plazo para una economía española moderna, competitiva y climáticamente neutra en 2050 [Consejo de Ministros]
[106] https://www.dsn.gob.es/es/documento/estrategia-seguridad-nacional-2021

FIGURE 23. Strategic Orientations



N. º 1 A FIRM COMMITMENT TO THE EFFICIENCY OF PRODUCTION PROCESSES AND THE CIRCULAR ECONOMY

The Road Map places efficiency and circular economy at the forefront of the mineral raw materials supply value chains. Taking as a starting point the reduction of consumption through better design, reuse and recycling are the first options to feed production processes. Therefore, this Road Map integrates, and specifies, for the Mineral Raw Materials industry, the objectives and lines of action of España Circular 2030, and includes the main actions in terms of efficiency of industrial production processes, promoting R&D&I in mining processes for lower water consumption, more efficient mineral treatments and less waste generation.

N. º 2 CONSOLIDATING THE SUSTAINABLE MANAGEMENT OF INDIGENOUS MINERAL RAW MATERIALS IN THE SPANISH EXTRACTIVE INDUSTRY

The Road Map is an opportunity to promote and consolidate the environmental protection tools of the extractive sector as a whole, both from the point of view of regulatory effectiveness and also from the promotion of the best available techniques and good environmental practices, ensuring that resources are exploited in an economically viable way and based on the principles of sustainable development as a factor of growth and generation of wealth for the citizens.

Targeting, in the long run, for a complete understanding of the impacts of these activities, this consolidation involves

an analysis of the legal framework of these activities and the simplification and improvement of the administrative management of this public domain to provide legal certainty to all parties involved. In this sense, the lines of action of this Road Map contain actions that seek real transparency and public participation, both from the beginning of the projects and in the management of the mining activity, until the end of the life of the exploitation with the culmination of its restoration. Reciprocally, the governance and corporate social responsibility of the companies, regardless of their size, must be promoted. The local level and the weaknesses, and opportunities of the rural environment, are also addressed in this Road Map, both from the demographic point of view and from a just transition to a climate-neutral economy.

The Mineral Raw Materials Industries, which are mostly SMEs, are generally located in rural areas and on the outskirts of more populated areas, where they have the potential to create stable, long-term employment of high quality and well remunerated -usually lasting several decades, which establishes the population for one or several generations-, being a sector that contributes to the backbone of regional economic development.

The development of mining projects acts as an anchoring element of the value chain upstream (suppliers) and downstream (industries of client sectors dependent on the supply), in addition to all the rest of the industry: the component related to technological innovation, that related to the supply of equipment and technological services, the Universities, the Research and Technological Centers, etc.

N. º 3 ENSURE SECURITY OF SUPPLY AND REDUCE STRATEGIC DEPENDENCIES BY DIVERSIFYING SUPPLY, REQUIRING COMPLIANCE WITH ENVIRONMENTAL, GEOSTRATEGIC AND SOCIAL JUSTICE REQUIREMENTS IN THE IMPORTATION OF MINERAL RAW MATERIALS

For the Mineral Raw Materials industry and the rest of the Spanish industry to become more competitive as they become greener and more circular, they will need a secure and affordable supply of mineral raw materials. This Road Map presents actions at an international level on diversifying supply and reducing the carbon footprint of mineral raw material industrial value chains. Likewise, within the framework of the EU common customs territory, it pays special attention to the guarantee at origin, especially of those mineral raw materials coming from conflict zones or produced in third countries, with lower levels of respect for human rights, the environment and the safety and health of workers and citizens.

N. º 4 FOSTERING THE STRATEGIC MINERAL RAW MATERIALS INDUSTRY FOR THE ENERGY AND DIGITAL TRANSITION

The Road Map deploys a broad set of measures on critical raw materials and/or on those considered essential for the energy and digital transition, due to their massive use in the implementation of renewable energies, batteries for electric vehicles, medium and long-term energy storage, etc., in line with European policies on access to resources and sustainability, key factors for the resilience of the EU.

The design and development of the Road Map must generate a reliable and stable framework that enables and, where appropriate, encourages domestic and foreign investment, which will promote sustainability, competitiveness, and productivity of companies, as well as the transition of this industry towards a more sustainable economic and social model, contributing to the generation of wealth and employment for Spain, and to meet the threat of the demographic challenge.

IV

ACTION LINES

4.1. REGULATORY INSTRUMENTS FOR A NEW REGULATORY FRAMEWORK FOR THE SECTOR

To achieve the goal of reaching a stable and competitive supply of raw materials from domestic sources while promoting good governance, an improvement of the legislative framework on mining management is necessary to adapt it to the current situation. In this sense, it should be a priority to align the associated legislation with España Circular 2030 objectives and to better integrate mineral resources into regional and local planning.

On the other hand, the technical and economic solvency of the operating companies must be fully guaranteed, as well as the commitment to environmental protection in all mining activities and the promotion of good practices for the prevention of environmental impacts, the protection of biodiversity, the creation of ecological corridors and the recovery of degraded land, analyzing, case by case, the compatibility of the extractive activity with environmental protection.

It is also necessary to review the legal framework that regulates mining activity as a whole and environmental restoration, the mining-environmental inspection and sanction regime, and the fiscal and tax regime through the creation of instruments that seek to ensure that part of the wealth derived from the use of public property reverts to the society.

The Road Map for the sustainable management of mineral raw materials consists of 11 measures linked to the regulatory instruments listed in the following table:

TABLE 1. Measures linked to regulatory instruments

REGULATORY INSTRUMENTS	
Process efficiency and Circular Economy	M-1 Alignment with the goals of España Circular 2030
Sustainable management of indigenous Mineral Raw Materials	M-2 Improvement of the regulatory framework for Mines and its compliance M-3 Adequate integration of mineral resources in land use planning and compatibility with other land uses M-4 The figure of the mining law in the 21st century M-5 Determination of technical and economic solvency criteria for mining companies M-6 Revision of the legal framework for the environmental restoration of mining operations M-7 Revision of the mining-environmental inspection and sanction regime
Security of supply and import of sustainable Mineral Raw Materials	M-8-Application of EU regulatory and policy instruments to the supply of mineral raw materials from third countries
Strategic Mineral Raw Materials for the energy transition	M-9 Review of the classification of the resources of the mineral raw materials M-10 Review of the fiscal and taxation regime applicable to mineral raw materials M-11 Alignment of mining legislation with regulations related to strategic industries for the energy transition and the fight against climate change, as well as those related to the resource contribution of the national security act

Measure 1: Alignment with the goals of España Circular 2030

Analyze mining-environmental regulations, including instruments that allow aligning the Mineral Raw Materials industry with the objectives of España Circular 2030 (see section 2.3), introducing, for example, criteria for reducing the consumption of raw materials and water, as well as new mining waste management obligations that allow their reduction and improve the use of the minerals they may contain.

Measure 2: Improvement of the regulatory framework for Mines and its compliance

It is necessary to address, in the current social, economic, and regulatory context, the modification of Law 22/1973, of July 21, 1973, on Mines, and its regulatory development, to adapt it to the distribution of competencies between the State and the Autonomous Communities and to harmonize it with the legislation on environmental protection, biodiversity and sectorial legislation in general (land and soil management, services, water, energy, waste, as well as the Aarhus Convention).

In particular, there is a need for a modern and stable regulatory framework, dynamic and integrating the entire value chain of mineral raw materials necessary to ensure the ecological transition to a decarbonized economy, which weighs, appropriately and in a balanced way, all the concurrent values, through an integrated processing procedure.

The improvement of the regulatory framework for Mines will seek a reduction of administrative burdens, greater integration and transparency of administrative procedures, early participation of the agents involved, elimination of barriers, harmonization of criteria, as well as agility in those procedures directly related to the transition to a climateneutral economy, and the review and effectiveness of the control, coordination and intervention mechanisms of the Public Administrations, all without prejudice to compliance with environmental standards and the protection of biodiversity

Measure 3: Adequate integration of mineral resources in land use planning and compatibility with other land uses

To carry out, jointly with the Autonomous Communities, an analysis of the situation of the raw materials needed to guarantee the supply of the industrial chains associated with the transition of the economy as a whole..

This analysis aims to identify and determine the causes that condition and prevent sustainable and balanced access to resources for the different raw materials necessary for this process of ecological transition and formulate a proposal for measures to resolve them based on the experience of the competent authorities in the administrations of the Autonomous Regions.

Tools will be established for the identification of mineral deposits considered strategic, as well as the areas with the greatest environmental and urban development conditions for the development of the extractive activity; these tools, in no case, will be exempt from the pertinent environmental evaluation procedure.

Likewise, based on the above analysis, it will be necessary to identify, together with the Autonomous Communities, which urban planning figures should allow the compatibility and use of mineral resources (existing or potential) with other land use, protected natural areas, and areas of special environmental sensitivity.

Measure 4: The figure of the mining law in the 21st century

Analyze the need to adapt the legislation so that mining rights can be better adjusted to the specific requirements of time duration and surface area required for efficient and sustainable exploitation of the deposits, adequate to the requirements of the industrial procedures of the value chain, as well as to improve the procedures for the extension of mining rights.

Measure 5: Determination of technical and economic solvency criteria for mining companies

Analyze the impact and the need to establish a set of precautions and criteria for the technical, economic, social, and environmental solvency of companies exploiting mineral raw materials to adapt them to the different types of extraction methods, the size of the projects, and the environmental impacts caused, adapting them to the legislation of market unity.

Measure 6: Revision of the legal framework for the environmental restoration of mining operations

Review and update Royal Decree 975/2009 to simplify the modification and review of restoration plans to align them with public policy objectives such as climate change, circular economy, and biodiversity. Apply new restoration

techniques, plant new vegetation species as CO_2 sinks, introduce renewable energies, give them new compatible uses, generate sites of geological interest or contribute to the preservation of natural and cultural heritage, among other aspects.

Likewise, the control mechanisms for phased restoration will be strengthened in order to improve and update the procedures for establishing financial guarantees, as well as the criteria applicable to their calculation.

This regulatory initiative is necessary to determine the modifications that allow the alignment of the environmental restoration obligations with the content of the National Strategy on Green Infrastructure and Ecological Connectivity and Restoration, favoring that the companies adopt measures to prevent the decrease of the loss of connectivity between natural spaces during the exploitation of the mineral resource and for the strengthening and improvement of the biodiversity once the exploitation has ceased.

Measure 7: Revision of the mining-environmental inspection and sanction regime

Analyze, together with the Autonomous Communities, the need to modify the applicable mining-environmental inspection and sanction regime to guarantee environmental protection in all phases of the mining cycle and compliance with the principles of the European Union to guarantee the use of mineral raw materials.

Measure 8: Application of EU regulatory and policy instruments to the supply of mineral raw materials from third countries

Support and promote initiatives in Spain and the European Union to establish mechanisms to ensure due diligence, transparency, and traceability of the origin of mineral raw materials imported into Spain, to unequivocally guarantee that they have been extracted and produced following the social, environmental, labor and human rights values that prevail in today's European and Spanish society.

Measure 9: Review of the classification of the resources of the mineral raw materials

Analyze the need to review the classification of mineral raw material resources established by Law 22/1973 on Mines and the figures contemplated to preserve the general interest of certain minerals to adapt it to the priorities that frame this Road Map, and in particular, to the promotion of the strategic raw material industry.

Measure 10: Review of the fiscal and taxation regime applicable to mineral raw materials

Analyze jointly with the sector's agents the fiscal and tax regime applicable to mineral raw materials to align it with the priorities that frame this Road Map, especially for activities directly related to strategic raw materials, in order to identify proposals that allow aligning the taxation of these activities to the objectives established by the Ministry of Finance and Public Function. Likewise, mechanisms will be analyzed to improve the redistribution of income in the places where the mineral raw materials industries are located.

Measure 11: Alignment of mining legislation with regulations related to strategic industries for the energy transition and the fight against climate change, as well as those related to the resource contribution of the national security act

Analyze the necessary measures for the alignment of mining legislation with the strategic guidelines - Spanish and European - for energy transition and climate change, as well as with industrial guidelines, as an essential industry for the creation of resilient value chains that set strategic industries for the objectives of climate change and energy transition and contribute to the fight against the demographic challenge, particularly in rural areas.

Likewise, to undertake the necessary measures to align the legislation of the extractive industry and the transformation of critical raw materials with those related to the contribution of resources to national security under the National Security Act.

4.2. SECTORAL INSTRUMENTS

The Mineral Raw Materials industry must be a strategic player in achieving the España Circular 2030 objectives of reducing materials consumption by 30% of GDP and reducing waste generation by 15%, for example, through the use of mining waste or the optimization of resources in the restoration of mining sites. Similarly, industry, and the sector as a whole, must integrate biodiversity management into their processes and policies. In this line, the opportunities offered by mining voids or the recovery of old degraded areas, most of which abandoned, are explored in depth.

On the other hand, it is important to increase transparency on the availability of raw materials in our country. This requires a better knowledge of the reserves and resources of raw materials and, in general, of the geological-mining reality of our country. Likewise, information on exploration, mineral production, trade, reserves, and resources should be standardized and systematically communicated, when the information is available and without infringing competition rules.

It is also necessary to draw up a list of those mineral raw materials that are key to strategic industrial processes and, in particular, to the ecological transition, or the digitalization of the economy or due to the high probability that their supply will be interrupted. Essential to mention those raw materials that, without being critical for these two reasons, represent a strategic supply in terms of employment or economic development in certain areas.

The Road Map for the sustainable management of mineral raw materials consists of 17 measures linked to the sectoral instruments listed in the following table:

TABLE 2. Measures linked to sectoral instruments

INSTRUMENTOS SECTORIALES	
Process efficiency and Circular Economy	• M-12 Promoting the Mineral Raw Materials industries as a strategic actor for the circular economy • M-13 Use of mining tailings dumps • M-14 Promoting the rehabilitation of mining waste facilities
Sustainable management of indigenous Mineral Raw Materials	• M 15 Enhancement of the value of mining voids • M-16 Review and update of the administrative regime of the mining registry • M-17 Improving knowledge on the existence of mineral resources in Spain • M-18 Analysis of the demand and supply, present and future, of mineral raw materials in Spain • M-19 Tools for biodiversity management and compatibility with natural areas • M-20 Development of mechanisms and initiatives for the recovery and enhancement of old abandoned degraded areas and cultural heritage in mining areas • M-21 Improving the provision of human, material and technological resources to mining administrations • M-22 Fostering the integration of industrial value chains • M-23 Development of sectorial policies of good governance, transparency, ethics and regulatory compliance • M-24 Promotion and encouragement of talent and employment with a gender equality perspective in the Mineral Raw Materials industry • M-25 Promotion of European industrial alliances and design of financial instruments to support the raw materials industry. • M-26 Definition of Best Available Techniques for the reduction of environmental impact and emissions

INSTRUMENTOS SECTORIALES	
Security of supply and import of sustainable Mineral Raw Materials	• M-27 Social and environmental quality label or mark. Application of EU guidelines and common initiatives
Strategic Mineral Raw Materials for the energy transition	• M-28 Preparation of a list of strategic mineral raw materials for the energy transition in order to ensure their supply to industry

Measure 12: Promoting the Mineral Raw Materials industries as a strategic actor for the circular economy

Promote the role of the Mineral Raw Materials industries as a strategic actor in the circular economy, as they are decisive in the management, reuse, and recycling of different wastes, from the recovery of metals and other high-value components to the production of recycled aggregates, from the management of CDW (Construction and Demolition Waste).

In addition, to promote actions to improve efficiency in the management of mineral raw material resources, reducing the volume of waste generated, improving existing waste management plans, and applying BATs[107] for the proper management and, where appropriate, reuse, recovery, and recycling of the waste generated. In order to boost the transition towards a circular economy, the establishment of end-of-waste criteria will be promoted to speed up the use of secondary raw materials.

Measure 13: Use of mining tailings dumps

The exploitation, with new technologies, of existing waste dumps makes it possible to recover and put on the market previously discarded but much-needed raw materials and, at the same time, to reduce the country's needs in terms of raw materials.

Consequently, analyze and develop the most appropriate measures to promote the recovery of old waste facilities that are abandoned or close to abandonment through the application of BATs for treatment, when the recovery of raw materials or by-products is technologically, economically, and environmentally possible, or with the application of new techniques for the restoration of these sites.

Measure 14: Promoting the rehabilitation of mining waste facilities

Propose to the competent mining authorities of the Autonomous Communities the preparation and coordination of a plan for the rehabilitation of abandoned mining waste facilities with the support of the industry, the Autonomous Administrations themselves, the General State Administration, and the European Commission.

Measure 15: Enhancement of the value of mining voids

Preparation of inventories of available mining voids to analyze their use in biodiversity enhancement actions in restoration processes: connectivity for some species, recovery of habitats that are currently scarce and vital for some vulnerable species, wildlife refuge (pollinators), etc. or other actions such as the use of excavation surpluses in nearby works in restoration or leisure or sports activities. Likewise, measures will be studied for the valorization of mining shafts as areas for waste management from other activities. To this end, it will be necessary to prepare support documentation for the regional authorities to differentiate between backfilling and dumping operations in order to properly process the corresponding authorizations in each case.

[107] Best Available Techniques (BAT) Reference Document for the Management of Waste from Extractive Industries. Joint Research Centre - Comisión Europea (2018)

Measure 16: Review and update of the administrative regime of the mining registry

Review and update the administrative regime and the operation of the mining registry, both at the regional and national levels, so that the data from the mining registries are adequately considered in the instruments for land use planning and protection of natural areas. Likewise, establish measures to improve the management of the mining registry and its interconnection with public land and registry data.

Measure 17: Improving knowledge on the existence of mineral resources in Spain

Update and improve the knowledge of the potential of rocks and minerals in Spain to cover present and future needs of raw materials through a national public-private research program of mineral resources led by the CSIC-IGME, as a technical and scientific center, which will allow the update of the existing inventories and the identification of preferential exploration areas. In this way, thematic cartographies and databases will be developed and updated to locate existing resources, and the information available in the regional and national mining registries will be kept up to date, making this information easily accessible on-line.

Likewise, analyze the establishment of incentives for the improvement of mining exploration, mining geological knowledge and the management of the information generated, including the mechanisms, criteria and requirements for the communication of its results to the Administration and the conditions for making it available to the general public.

Measure 18: Analysis of the demand and supply, present and future, of mineral raw materials in Spain

Analyze the situation of raw materials in Spain, the types of rocks and minerals, their geographical distribution, reserves/resources, national and international supply, as well as import and export capacity as, in the context of the new priorities and actions in energy and climate, the industrial policy will be affected by the new demand profiles for raw materials that will change significantly. So it must be ensured that innovations in the field of advanced technologies are not hindered by the lack of availability or volatility of mineral raw materials on the market[108].

Analyze the potential for production and consumption of mineral raw materials at both the national and regional levels, as well as their socioeconomic impact. In particular, study the present and future demand and supply of mineral raw materials in Spain, including an estimate of the needs to comply with national, European and international strategies towards a climate-neutral and resource-efficient society by 2050.

Specifically, the following will be studied: the potential for consumption reduction; the dynamics of mineral raw material supply, including secondary raw materials; supply and demand in different sectors; available primary and secondary mineral resources; the degree of self-sufficiency; the mineral raw material markets associated with both types of resources and the elements that alter their behavior; and the capacity for substitution.

Measure 19: Tools for biodiversity management and compatibility with natural areas

Develop tools for biodiversity management throughout the life cycle of mining operations based on nature and measures that favor ecological connectivity.

Establish tools to assess the industry compatibility with protected natural areas, establishing, where appropriate, the necessary measures to avoid and compensate for adverse effects on biodiversity and ecosystems.

Measure 20: Development of mechanisms and initiatives for the recovery and enhancement of former abandoned degraded areas and cultural heritage in mining areas

Analyze the development of mechanisms and initiatives for environmental recovery and enhancement of former degraded spaces, promoting public-private collaboration. Instruments will be articulated to ensure the correct identification and, where appropriate, preservation and enhancement of Cultural Heritage in mining areas.

[108] Integrated National Energy and Climate Plan (PNIEC)

Measure 21: Mejora de las dotaciones de recursos humanos, materiales y tecnológicos a las administraciones mineras

Mejorar los medios de las administraciones mineras, con objeto de impulsar la Administración 4.0, digitalizada, y dotarla de más recursos materiales, humanos y tecnológicos. Desarrollar un programa de actualización de conocimientos y de aplicación de nuevas tecnologías, para los técnicos e impulsar la implantación de metodologías BIM *(Building Information Modeling)* en explotaciones, oficinas de proyectos y Administración, favoreciendo así la tramitación digital.

Measure 22: Fostering the integration of industrial value chains

Analyze and establish mechanisms to facilitate the establishment of processing facilities and other industries in areas adjacent to those of extraction to minimize the transport of mineral raw materials and its impacts, as well as to create value chains that fix the population and create wealth at the local level.

Concerning globalized products (international markets), regional products, and local products (national market), a study will be made on the factors (labor market, infrastructure, regulations, energy costs, etc.) that influence the profitability, competitiveness, and productivity of the Mineral Raw Materials industry and the different subsectors, proposing actions to improve their competitiveness and increase their added value.

Regarding the value chain, actions will be studied to develop synergies between the different stages and the companies and sectors that integrate them, so that projects and companies that generate activity can be promoted and supported: Production of raw materials (from exploration to restoration); First treatment; Storage and transport; Manufacture of products with high added value; Integration in the value chain of other sectors; Use of waste and by-products; etc.

Measure 23: Development of sectorial policies of good governance, transparency, ethics and regulatory compliance

Develop actions to promote corporate social responsibility through policies of good governance, transparency, ethics, and regulatory compliance, fostering governance of mineral raw materials projects in which local administrations, regional institutions of reference, and the different representative territorial interest groups are included in the outset.

Include, in these actions, incentives for the inclusion, within corporate social responsibility policies, of programs for training and promotion of economic activity in nearby environments, once mining activity has ceased.

Measure 24: Promotion and encouragement of talent and employment with a gender equality perspective in the Mineral Raw Materials industry

Develop actions to promote equal opportunities and inclusive growth, as well as to foster and promote talent and employment with a gender equality perspective in the Mineral Raw Materials industry, including specific training programs, equality and inclusion policies, as well as the dissemination of the industry as an opportunity for employment.

Measure 25: Promotion of European industrial alliances and design of financial instruments to support the raw materials industry

Promote the participation of key players in the raw materials and downstream sectors in the value chain in the establishment of industrial alliances at the European level, to attract investments for strategic developments. It is key to align with EU initiatives in the field of critical raw materials, such as ERMA, and to promote Important Projects of Common European Interest (IPCEI) focused on the security of supply of raw materials.

The General Secretariat for Industry, Small and Medium-sized Enterprise will analyze the barriers and obstacles to investment and evaluate the possible support measures for the raw materials industry within its loan and aid programs for innovation and sustainability of industrial processes, with a special focus on SMEs.

Measure 26: Definition of Best Available Techniques for the reduction of environmental impact and emissions

Preparation, by the Ministry for Ecological Transition and the Demographic Challenge, of a Guide, by subsectors of the Mineral Raw Materials industry, to define the Best Available Techniques to improve efficiency in the use of water and the reduction of environmental impact and emissions, as well as a Methodological Guide for the restoration of land affected by extractive activities.

Measure 27: Social and environmental quality label or mark. Application of EU guidelines and common initiatives

Promote training and informative actions to encourage the voluntary application of the UNE standards on Sustainable Mining-Mineral-Metallurgical Management or other similar standards by companies as a basis for promoting the quality of environmental and social management of the Mineral Raw Materials industry[109].

In addition, promote the application of domestic and imported mineral raw materials, with the guidelines developed by the European Commission, the European Environment Agency, or the European Agency for Safety and Health at Work, among others.

Measure 28: Preparation of a list of strategic mineral raw materials for the energy transition in order to ensure their supply to industry

Prepare and periodically update a list of strategic mineral raw materials for the energy transition, understanding as such, those necessary for the fulfillment of the objectives of this Road Map and the supply of the country's main industrial value chains. The elaboration will be carried out by taking into account EU methodologies and proposals regarding critical raw material dependencies. Once the strategic mineral raw materials have been determined, the actions necessary to ensure their supply to the industry will be evaluated, including the convenience of maintaining strategic stocks of raw materials, transformed products, and final products to be used by the industry.

4.3. CROSS-CUTTING INSTRUMENTS

Mineral raw materials play an essential role in modern life. It is, therefore, necessary to improve public awareness of their importance by promoting consumption reduction, reuse, recycling, and making the mineral raw materials industry more efficient and sustainable. All this without forgetting that raw materials have enormous potential in this ecological transition towards a carbon-neutral economy and can also be a vector for stimulating the economy and employment in less populated areas.

The Road Map for the sustainable management of mineral raw materials consists of the 13 measures linked to the cross-cutting instruments listed in the table below:

[109] https://www.une.org/encuentra-tu-norma/busca-tu-norma/norma?c=N0061905
https://www.une.org/encuentra-tu-norma/busca-tu-norma/norma?c=N0061904

TABLE 3. Measures linked to the cross-cutting instruments

CROSS-CUTTING INSTRUMENTS	
Eficiencia de los procesos y Economía Circular	• M-29 Application of cross-cutting instruments for the reuse, recycling and recovery of waste
Sustainable management of indigenous Mineral Raw Materials	• M-30 Reducing greenhouse gas emissions in industry and the value chain • M-31 Supporting investment in more sustainable processes: efficiency and emission reduction • M-32 Continuous improvement in worker safety and health protection
Security of supply and import of sustainable Mineral Raw Materials	• M-33 Application of life cycle analysis, carbon footprinting and environmental product declarations (EPD) to mineral raw materials and first and second transformation products • M-34 Improvement of logistics and transport infrastructures for mineral raw materials • M-35 Commercialization and internationalization of operating, auxiliary and service companies in the mineral raw materials sector
Strategic Mineral Raw Materials for the energy transition	• M-36 Promotion of projects in Just Transition zones • M-37 Action plan to maximize the sectoral contribution to the SDGs • M-38 Analysis of the socio-economic impact of mineral raw materials and their contribution to the fight against depopulation of rural areas • M-39 Increasing transparency and knowledge of the extractive sector in the educational sphere • M-40 Encouraging citizen participation, local entities and other stakeholders • M-41 Improving training and professional qualification. Adaptation to digitalization

Measure 29: Application of cross-cutting instruments for the reuse, recycling and recovery of waste

Analyze and evaluate, within the scope of this Road Map, the cross-cutting instruments established and coordinated by España Circular 2030, which help the Mineral Raw Materials industry to advance in the prevention of waste generation and to supply quality raw materials that increase the durability of the products in which they are incorporated (prevention of generation).

Manage deposits, treatment plants, and factories with the application of the most advanced BATs, improving efficiency in the management of resources and promoting the reuse, recycling, and other waste recovery (promoting the use of local resources and by-products, improving the quality of secondary raw materials, promoting standardization and certification regarding the use of recycled materials and secondary raw materials, etc.).

Promote investments in technologies that increase efficiency in the management of mining resources and technologies for the reuse, recovery, recycling, and valorization of the waste generated and co-products. In addition, the development of Sector Technology Platforms and the effective incorporation of circular economy criteria in public procurement of goods and services will be promoted.

Measure 30: Reducing greenhouse gas emissions in industry and the value chain

Develop actions for the introduction and use of renewable energies, electrification of machinery, increased energy efficiency, digitalization for process optimization, and technological improvement to reduce greenhouse gas emissions along the entire value chain. Likewise, to promote the restoration of areas affected by mining use, with clean and renewable energy operations (photovoltaic, wind, etc.).

Measure 31: Supporting investment in more sustainable processes: efficiency and emission reduction

Moving towards more sustainable and efficient processes in the exploration, extraction, treatment of mineral raw materials, and manufacture of products will require the design of support measures to promote the necessary investments to achieve the goal of carbon neutrality, including both combustion and process emissions and reducing the emission of atmospheric pollutants.

Investments must also be made in technologies to increase efficiency in the management of mining courses, the mitigation of other environmental impacts, health, and safety, as well as in technologies for the reuse, recovery, recycling, and valorization of the waste generated.

Measure 32: Continuous improvement in worker safety and health protection

To establish, within the framework of the Mining Safety Commission, the necessary actions to continue improving the prevention of accidents and the protection of the health of workers in the Mineral Raw Materials industry.

Measure 33: Application of life cycle analysis, carbon footprinting and environmental product declarations (EPD) to mineral raw materials and first and second transformation products

In line with the guidelines established by the EU, support and encourage the establishment of measures and incentives to require the life cycle analysis of mineral raw materials and first and second transformation products, environmental product declarations (EPD), as well as the determination of the carbon footprint, throughout the entire production and distribution chain, including imports and their transportation to Spain, in order to reduce the outsourcing of emissions and other environmental impacts to third countries.

Measure 34: Improvement of logistics and transport infrastructures for mineral raw materials

Analyze the logistics needs of primary and secondary raw materials, to increase their competitiveness and minimize the impacts derived from their transportation. Based on this analysis, formulate proposals to improve logistics infrastructures for the transport of bulk products (rail freight networks, dry ports, transfer points, interchanges, storage areas in seaports), to diversify the means of transport and contribute to meeting the global objective of reducing greenhouse gas emissions and atmospheric pollutants.

Likewise, to study and implement measures to speed up transit through border crossings and ports, to declare strategic products to those related to the Spanish industry, with the consequent reduction of port taxes.

Increase the Maximum Authorized Mass of vehicles for the transport of goods by road to 44 tons of the countries around us (compared to the current 40), as a maximum weight in the five-axle tractor and semi-trailer configurations, which would improve industrial competitiveness globally and reduce GHG emissions.

Measure 35: Commercialization and internationalization of operating, auxiliary and service companies in the mineral raw materials sector

To draw up, with the support of the Secretary of State for Trade, an action plan for the import and export of mineral raw materials to help access foreign markets, in order to be able to ensure the supply of the productive activities of the industrial fabric and guarantee the direct, indirect and induced employment they generate.

Likewise, an analysis of the import and export markets of mineral raw materials will be carried out, with special attention to the fundamental ones, which will facilitate the knowledge of potential vulnerabilities in their supply, as well as the identification of possible suppliers or alternative markets.

Measure 36: Promotion of projects in Just Transition zones

Develop territorial plans that can be guided by the Road Map towards a Just Transition, which will offer Spain an early opportunity to assess the potential of critical raw materials as one of the alternative business models and sources of regional employment. As the European Commission itself recognizes, many of the mining and engineering skills can be transferred to the exploitation of other minerals, often in the same regions.

Thus, the Just Transition Mechanism will help to alleviate the socio-economic effects of the transition to climate neutrality in coal and carbon-intensive regions, as it can contribute to the economic diversification of the regions, for example, through investments for the promotion of the circular economy..

The sustainable infrastructure component of InvestEU as well as the updated EU Skills Agenda will be able to support the development of mineral raw materials on a regional scale.

Measure 37: Action plan to maximize the sectoral contribution to the SDGs

Prepare an action plan with sectoral objectives and a practical Guide that develops a methodology and recommendations for companies, including SMEs, to increase their contribution to the Sustainable Development Goals (SDGs), in order to ensure compliance with the objectives of the Road Map, such as those of the European Green Pact and each and every one of the 17 SDGs of the United Nations[110].

Measure 38: Analysis of the socio-economic impact of mineral raw materials and their contribution to the fight against depopulation of rural areas

To analyze the impact of the mineral raw materials industry, including associated auxiliary sectors, not only in the extractive and first transformation phase but throughout its life cycle and value chain, evaluating its contribution to the productive system as a whole and the society in general. In addition, to specifically analyze their potential contribution in rural and deindustrialized areas.

Measure 39: Increasing transparency and knowledge of the extractive sector in the educational sphere

Establish mechanisms to increase the transparency of mineral raw materials companies in terms of publicly available information, with special emphasis on the immediate social environment. Likewise, design public-private initiatives to improve society's knowledge about the consumption of mineral raw materials.

Measure 40: Encouraging citizen participation, local entities and other stakeholders

To establish actions, aligned with Measure 43, to ensure the participation of citizens, Local Entities and other interested groups, in relation to activities related to the mineral raw materials industry.

Measure 41: Improving training and professional qualification. Adaptation to digitalization

Analyze, within the framework of the Vocational Training Modernization Plan, the simplification and unification of the professional qualification framework. Identify and meet the current and future training needs of the Mineral Raw Materials industries, aimed at greater professionalization and specialization, with special emphasis on the knowledge required for the ecological transition and the application of new technologies.

Promote public-private collaboration agreements to strengthen the link between Vocational Training and Higher Education centers and companies in the mineral raw materials industries, in order to adapt the educational model to these needs.

[110] White Paper: Mapping Mining to the SDGs: An Atlas. United Nations Development Program, the World Economic Forum, the Columbia Center on Sustainable Investments and the Sustainable Development Solutions Network, https://www.undp.org

To design, in the face of an aging workforce in companies, plans for updating knowledge and adapting skills to digitalization and new technologies..

Finally, due to its specificity, to maintain instruments to support training in the mineral raw materials industry, extending the current lines of action, in order to promote actions to meet the challenges in this field.

4.4. BOOSTING R&D&i

Innovation plays an essential role in the sustainable management of mineral raw materials, security of supply, and competitiveness of the sector. New technological solutions in the field of substitution and recycling allow, for example, to diversify the sources of supply while the development of innovative solutions in areas such as exploration, extraction, and processing allows access to resources more sustainably.

Support for research and digitization processes in the mineral raw materials industry is therefore essential, with a particular focus on circular economy-oriented technological improvements, improvements in the performance of mineral raw materials processing, and energy efficiency.

The Road Map for the sustainable management of mineral raw materials consists of the five measures linked to the boosting of R&D&i shown in the table below:

TABLE 4. Measures linked to the boosting of R&D&i

BOOSTING R&D&i	
Process efficiency and Circular Economy	• M-42 Program for technological improvements oriented to the circular economy
Sustainable management of indigenous Mineral Raw Materials	• M-43 Support for Mineral Raw Materials industry digitization projects • M-44 Support for research to optimize the performance and sustainability of mining and beneficiation operations of the Mineral Raw Materials
Security of supply and import of sustainable Mineral Raw Materials	• M-45 Implementation of traceability systems for Mineral Raw Materials imported from third countries
Strategic Mineral Raw Materials for the energy transition	• M-46 Promoting innovative projects for strategic Mineral Raw Materials value chains, as well as for the development of new products and applications.

Measure 42: Program for technological improvements oriented to the circular economy

Elaboration of a technological improvement program[111] aimed at promoting the circular economy in the mineral raw materials industry, preventing the generation of waste at all stages of the production processes, developing products with greater durability and recyclability, implementing a product passport (raw material content), developing new management techniques for waste from extractive industries or other industries, or conditioning mining voids for the management, valorization or final disposal of waste.

[111] State R&D&i Program oriented to Society's Challenges, "Sustainability of Primary Production and Forestry Systems, Food Safety and Quality, Marine and Maritime Research and Bioproducts", and "Climate Change and use of natural resources and raw materials".

Measure 43: Support for Mineral Raw Materials industry digitization projects

To develop a priority line for digitalization as an essential element to adapt to the concept of Mineral Raw Materials 4.0 industry, laying the foundations for its evolution towards industry 5.0, through digital transformation, the growing application of artificial intelligence to the processing of big data and the massive interconnection of systems, equipment, and digital devices.

Also, to promote the application of satellite technology and artificial intelligence to the identification of mineral raw materials, and the efficient management of deposits and their exploitation.

Measure 44: Support for research to optimize the performance and sustainability of mining and beneficiation operations of the Mineral Raw Materials

To establish the bases for the promotion of R&D&i, through the Center for the Development of Industrial Technology (CDTI) as a promoter of projects and facilitator of the internationalization of innovation, with specific measures and actions adapted to the different sizes of companies and, in particular, oriented towards SMEs.

To adopt, likewise, measures to support R&D&i of technologies in the mineral raw materials value chain. Supporting the innovation of auxiliary companies in the mining sector will facilitate the expansion of the value chain, which will also result in the improvement and growth of these auxiliary companies and in attracting investment in upstream projects.

To create an exclusive line of financing for projects in the value chain of mineral raw materials in the successive State Plans for Scientific and Technical Research and Innovation. Also, adopt initiatives for the promotion of R&D&i in the mineral raw materials industries, aligned with EU guidelines, the European Raw Materials Innovation Partnership[112], the EIT Raw Materials[113] and the European Raw Materials Alliance[114] (ERMA).

Measure 45: Implementation of traceability systems for Mineral Raw Materials imported from third countries

Promote the application of new technologies to the traceability of mineral raw materials imported from third countries, to guarantee their sustainable origin and compliance with European standards.

Measure 46: Promoting innovative projects for strategic Mineral Raw Materials value chains, as well as for the development of new products and applications

Establish mechanisms to favor the presentation of innovative projects for the value chains of strategic mineral raw materials, such as those linked to electric vehicles, renewable energies, or digitalization, among others.

Likewise, to promote innovative projects for the study and demonstration of the development of new products and applications for mineral raw materials, the development of sustainable processes and systems for the treatment and recovery of critical raw materials, and new sustainable metallurgical processes, with the support of the National Center for Metallurgical Research (CSIC-CENIM).

[112] https://ec.europa.eu/growth/sectors/raw-materials/eip_en
[113] https://eitrawmaterials.eu
[114] https://erma.eu

4.5. SUMMARY TABLE OF MEASURES

TABLE 5. Summary table of measures

STRATEGIC GUIDELINES	REGULATORY	SECTORAL	CROSS-CUTTING	R&D&i
N.º1 Process efficiency and Circular Economy	• M-1 Alignment with the goals of España Circular 2030	• M-12 Promoting the Mineral Raw Materials industries as a strategic actor for the circular economy • M-13 Use of mining tailings dumps • M-14 Promoting the rehabilitation of mining waste facilitiess	• M-29 Application of cross-cutting instruments for the reuse, recycling and recovery of waste	• M-42 Program for technological improvements oriented to the circular economy
N.º2 Sustainable management of indigenous Mineral Raw Materials	• M-2 Improvement of the regulatory framework for Mines and its compliance • M-3 Adequate integration of mineral resources in land use planning and compatibility with other land uses • M-4 The figure of the mining law in the 21st century • M-5 Determination of technical and economic solvency criteria for mining companies • M-6 Revision of the legal framework for the environmental restoration of mining operations • M-7 Revision of the mining-environmental inspection and sanction regime	• M-15 Enhancement of the value of mining voids • M-16 Review and update of the administrative regime of the mining registry • M-17 Improving knowledge on the existence of mineral resources in Spain • M-18 Analysis of the demand and supply, present and future, of mineral raw materials in Spain • M-19 Tools for biodiversity management and compatibility with natural areas • M-20 Development of mechanisms and initiatives for the recovery and enhancement of old abandoned degraded areas and cultural heritage in mining areas • M-21 Improving the provision of human, material and technological resources to mining administrations • M-22 Fostering the integration of industrial value chains • M-23 Development of sectorial policies of good governance, transparency, ethics and regulatory compliance • M-24 Promotion and encouragement of talent and employment with a gender equality perspective in the Mineral Raw Materials industry • M-25 Promotion of European industrial alliances and design of financial instruments to support the raw materials industry • M-26 Definition of Best Available Techniques for the reduction of environmental impact and emissions.	• M-30 Reducing greenhouse gas emissions in industry and the value chain • M-31 Supporting investment in more sustainable processes: efficiency and emission reduction • M-32 Continuous improvement in worker safety and health protection	• M-43 Support for Mineral Raw Materials industry digitization projects • M-44 Support for research to optimize the performance and sustainability of mining and beneficiation operations of the Mineral Raw Materials

STRATEGIC GUIDELINES	REGULATORY	SECTORAL	CROSS-CUTTING	R&D&i
N.º3 Security of supply and import of sustainable Mineral Raw Materials	• M-8 Application of EU regulatory and policy instruments to the supply of mineral raw materials from third countries	• M-27 Social and environmental quality label or mark. Application of EU guidelines and common initiatives.	• M-33 Application of life cycle analysis, carbon footprinting and environmental product declarations (EPD) to mineral raw materials and first and second transformation products. • M-34 Improvement of logistics and transport infrastructures for mineral raw materials. • M-35 Commercialization and internationalization of operating, auxiliary and service companies in the mineral raw materials sector.	• M-45 Implementation of traceability systems for Mineral Raw Materials imported from third countries.
N.º4 Strategic Mineral Raw Materials for the energy transition	• M-9 Review of the classification of the resources of the Mineral Raw Materials • M-10 Review of the fiscal and taxation regime applicable to Mineral Raw Materials • M-11 Alignment of mining legislation with regulations related to strategic industries for the energy transition and the fight against climate change, as well as those related to the resource contribution of the national security act.	• M-28 Preparation of a list of strategic mineral raw materials for the energy transition in order to ensure their supply to industry	• M-36 Promotion of projects in Just Transition zones • M-37 Action plan to maximize the sectoral contribution to the SDGs • M-38 Analysis of the socio-economic impact of mineral raw materials and their contribution to the fight against depopulation of rural areas. • M-39 Increasing transparency and knowledge of the extractive sector in the educational sphere. • M-40 Encouraging citizen participation, local entities and other stakeholders • M-41 Improving training and professional qualification. Adaptation to digitalization.	• M-46 Promoting innovative projects for strategic Mineral Raw Materials value chains, as well as for the development of new products and applications

V

SUSTAINABLE MANAGEMENT OF MINERAL RAW MATERIALS. OPPORTUNITIES AND NEEDS. 2030 AND 2050 VISION 0

The Road Map is an opportunity to align the sustainable management of mineral raw materials with the main axes of EU and national policies related to the 2030 and 2050 Agenda and the fight against climate change and its effects. It should also contribute to the fulfillment of the associated objectives of the European Green Pact and the Sustainable Development Goals (SDGs) of the United Nations[115], in addition to contributing to the reconstruction of Spain after the pandemic by COVID-19 and contributing to the sustainable growth of its economy, in the coming decades, in line with "Spain can - Recovery, Transformation and Resilience Plan for Spain" (España puede – Plan de recuperación, transformación y resiliencia de España).

A ton of mineral raw material extracted and processed in Spain complies with more SDGs and generates lower CO_2 emissions than a ton coming from almost anywhere else in the world, where its extraction and processing are carried out under legislation that is probably less strict than that of Europe in terms of environmental protection, human health, and safety, human rights, transparency, etc. To this production in third countries must be added higher environmental costs (CO_2 footprint (GHG Scope[116]), among others) and economic costs derived from transport, compared to local exploitation with high standards of environmental control and clearly lower impacts of all kinds.

In reference to the import of raw materials, Sustainability Impact Assessments (SIAs)[117] are used in all EU free trade agreement negotiations.

The Commission's 2016 SIA guidelines highlight the need to assess the potential contributions of the agreement to greening the economy, resource efficiency goals, and promoting sustainable consumption and production. The review of all SIAs published since 2016 shows potential impacts on resource use and efficiency, as well as waste management. Although the SIAs do not specifically refer to the circular economy as such, they do encompass this idea.

It is also an opportunity for the Autonomous Communities, which need a common framework as a reference for the elaboration and integration of their own initiatives in a Country Strategy.

In the 2030 and 2050 horizons, the Mineral Raw Materials industry must aspire to ensure an adequate supply to the country's needs, through a more sustainable, circular, safe, and efficient activity, improving the competitiveness of its companies, actively collaborating to achieve the objectives of the energy transition, climate neutrality and overcoming the demographic challenge.

[115] White Paper: Mapping Mining to the SDGs: An Atlas. United Nations Development Program, the World Economic Forum, the Columbia Center on Sustainable Investments and the Sustainable Development Solutions Network, https://www.undp.org

[116] Following the guidelines contained in the Corporate Value Chain Accounting and Reporting Standard, published by the Green House Gas Protocol Initiative, the WRI and the WBCSD

[117] https://ec.europa.eu/trade/policy/policy-making/analysis/policy-evaluation/sustainability-impact-assessments/index_en.htm

VI

MONITORING AND EVALUATION

6.1. MONITORING INDICATORS

The indicators linked to the monitoring of the measures contained in this Road Map, both from a territorial (national and regional) and economic (value chains identified for the industrial subsectors linked to the different strategic raw materials identified) perspective, will be as follows:

- Economic (Industrial Production Index; Turnover; Industrial Price Index; GVA sector/GVA total industry; Imports; Exports; Material investment; Main product lines; Origin of Imports; Destination of Exports; Size of SME/non-SME companies; Size of companies per employee; etc.).
- Environmental (CO_2 emissions; rehabilitated areas; total area affected; PM2.5 particle emissions; impact on water (including net balance of water consumption and pollutants) and soil; biodiversity; waste generation; management of own and other waste streams; energy efficiency; etc.).
- Technological (R&D&i investment; R&D&i investment over turnover; % of total personnel dedicated to R&D&i; % of companies performing R&D&i; Investment in Innovation; Innovation Intensity; % of Innovative companies, Investment in geological and mining research; etc.).
- Administrative (Resolution period for different mining, environmental, other sectorial and municipal procedures; evolution of the number of mining operations; evolution of the number of authorized reserves per substance; evolution of mining rights in force; etc.).
- Social (Employment; Number of companies; Number of farms; Training; Health and Safety; Gender indicators; Relations with the social environment, Inclusion of vulnerable people, Conciliation, etc.).

The standards UNE 22480:2019 "Sustainable mining management system. Requirements[118]" and UNE 22470:2019 "Sustainable mining-mineral-metallurgical-metallurgical management system. Indicators[119]", provide reference methodologies for the calculation of the indicators to be defined. Also, the Raw Materials Scoreboard[120] prepared by the European Innovation Partnership on Raw Materials for the European Commission includes indicators of interest that can be applied.

6.2. RE-EVALUATION AND FOLLOW-UP. ACTION PLANS

For the approach, design, elaboration, implementation and development of the Road Map, as well as for the coordination with regional policies, five-year action plans will be approved, with a follow-up report on each plan between the second and third year of the plan.

The action plans will include the necessary mechanisms to allow the effective coordination of the Road Map with the regional policies on the management of mineral raw materials, which is essential for the alignment of objectives and strategies and, above all, for the achievement of the objectives pursued..

For the proposal and monitoring of the action plans, a working group will be formed comprising representatives of the Ministry of Ecological Transition and the Demographic Challenge (MITERD) and the rest of the General State Administration, the Autonomous Communities with the greatest weight in terms of mineral raw material production value and the Spanish Federation of Municipalities and Provinces (FEMP), to which experts of recognized prestige proposed by the MITERD may be invited.

[118] https://www.une.org/encuentra-tu-norma/busca-tu-norma/norma?c=N0061905
[119] https://www.une.org/encuentra-tu-norma/busca-tu-norma/norma?c=N0061904
[120] https://op.europa.eu/en/publication-detail/-/publication/117c8d9b-e3d3-11e8-b690-01aa75ed71a1

ANEX A - FINANCING

A.1. NACIONAL INSTRUMENTS

At the national level, there are financial instruments aimed at supporting initiatives and projects with high R&D&i content to address the challenges of strategic areas and critical productive sectors of the Spanish economy aligned with the Spanish Strategy for Science, Technology, and Innovation 2021-2027 and the Shock Plan for Science and Innovation. These challenges include those related to the decarbonization of the economy and the energy transition.

On the other hand, the Recovery, Transformation, and Resilience Plan does not include direct funding for the actions included in this Road Map. However, given the cross-cutting nature of this Road Map on mineral raw materials and the value chains associated with them, its lines of action are indirectly related to various lever policies and components of the Plan. The increase in the demand for raw materials for the promotion of sustainable mobility or the deployment of renewable energies, the opportunity of mining restoration for the enhancement of biodiversity or the promotion of efficiency in the processes of extraction and treatment of raw materials, and a lower generation of waste are some of the actions that are reflected in the reforms and investments of the Recovery, Transformation and Resilience Plan. Without being exhaustive, the following related reforms and investments can be highlighted: C1.R1, Plan for the deployment of recharging infrastructure and promotion of electric vehicles; C4.R2, Restoration of ecosystems and green infrastructure; C4. I3, Restoration of ecosystems and green infrastructure; C7.R1, Regulatory framework for the promotion of renewable generation; C8.R2, Energy storage strategy; C12.R1, Spanish Industrial Promotion Strategy 2030; C12.R2, Waste policy and promotion of the circular economy.

CIEN Projects[121]

This is a financing mechanism of the Center for the Development of Industrial Technology (CDTI), in the form of partially reimbursable aid, aimed at large industrial research and experimental development projects, with no restriction as to the sector or technology to be developed. This mechanism operates in the form of a continuous call for proposals, so that projects may be submitted throughout the year.

CIEN projects must be projects developed in effective collaboration by business consortia of a minimum of three and a maximum of eight companies (two of which must be autonomous, and at least one of which must be an SME). Likewise, CIEN projects are intended to promote public-private cooperation in R&D, and therefore require the subcontracting of activities to research organizations, at least one of which must be publicly owned.

The requested budget for the projects submitted must be between 5 and 20 M€, of which 50% will be destined for industrial research activities.

The aid consists of financial coverage of up to 85% of the approved budget, with an interest rate of one-year Euribor and a repayment period of seven or ten years. Depending on the availability of funds, the characteristics of the project, and the type of companies, up to 33% may be classified as non-refundable.

Candidate projects to become CIEN projects will be evaluated based on a series of criteria grouped into four categories:

- Assessment of the commercial exploitation plan.
- Assessment of technology and innovation.
- Capacity of the consortium concerning the project.
- Assessment of the socioeconomic and environmental impact.

Science and Innovation Missions

This is a CDTI program that seeks to support, through grants, large strategic initiatives, intensive in R & D, carried out by a group of companies and with relevant research organizations that aim to contribute to the development of five missions identified for their great relevance in Spain's future challenges.

[121] https://www.cdti.es/index.asp?MP=100&MS=803&MN=2

- Energy, safe, efficient and clean for the 21st century.
- Sustainable and intelligent mobility.
- Promoting Spanish industry in the industrial revolution of the 21st century.

Programs of the General Secretariat for Industry and Small and Medium-Sized Enterprises for financial support to industry

The General Secretariat for Industry and Small and Medium-Sized Enterprises (SGIPYME) of the Ministry of Industry, Trade, and Tourism has programs for financial support to investment projects for the improvement of industrial competitiveness or that contribute to reindustrialization through the granting of long-term loans. The SGIPYME will evaluate the strengthening of support to the raw materials industry within its loan and aid programs for the innovation and sustainability of industrial processes, with special attention to SMEs.

Aid Program for Energy Efficiency Actions in SMEs and Large Industrial Companies (FNEE)[122]

The FNEE, managed by the Institute for Energy Diversification and Saving (IDAE), aims to encourage and promote actions in the industrial sector that reduce carbon dioxide emissions, either through the improvement of technology in industrial equipment and processes or the implementation of energy management systems. Among the sectors covered is the Mineral Raw Materials industry.

A.2. INTERNACIONAL INSTRUMENTS

European Raw Materials Alliance, ERMA

The European Raw Materials Alliance (ERMA) aims to ensure access to sustainable raw materials, advanced materials, and industrial processing know-how. By 2030, ERMA's activities are expected to increase the production of raw materials and advanced raw materials and contribute to the circular economy by boosting the recovery and recycling of critical raw materials. More specifically, the Alliance:

- Drive innovation and environmentally and socially sustainable infrastructure.
- Implement a circular economy of complex products such as electric vehicles, clean technology, and hydrogen equipment.
- Support the capacity of the European raw materials industry to extract, design, manufacture, and recycle materials.
- Promote innovation, strategic investment, and industrial production in specific value chains..

Horizon Europe[123]

Continuing on the path of Horizon 2020 in which nearly €600 million was allocated to raw materials projects, Horizon Europe will have a budget of €95.5 billion for the period 2021-2027, of which 35% will be allocated to address the challenges of climate change, supporting policies for the transition to a low-carbon economy and environmental protection. The three pillars on which the new program focuses are:

- Strengthen EU science and technology thanks to increased investment in highly qualified people and innovative research.
- Promote EU industrial competitiveness and innovation performance.
- Deliver on the EU's strategic priorities as well as the Paris Agreement on climate change.

[122] https://www.idae.es/ayudas-y-financiacion/para-eficiencia-energetica-en-la-industria/convocatorias-cerradas/segunda-convocatoria-ayudas-pyme-fnee
[123] https://ec.europa.eu/info/horizon-europe-next-research-and-innovation-framework-programme_en

European Investment Bank

The European Investment Bank (EIB) supports the transition to a climate-neutral economy through financing, advisory services, and awareness-raising. Between 2014 and 2018, it dedicated €2.3 billion to co-financing projects related to the circular economy and lends to innovative projects aimed at reducing waste generation, extending product lifetimes, and increasing the circularity of materials.

In November 2019, the EIB, in its new energy sector policy, opened up financing for projects for critical raw materials needed for low-carbon technologies in the EU.

European Bank for Reconstruction

The European Bank for Reconstruction and Development (EBRD) finances projects in European regions and neighboring countries deemed eligible. In 2015, it launched the Green Energy Transition (GET) approach aimed at increasing green finance to around 40% of total EBRD financing by 2020, with a specific category for projects dedicated to the durable and efficient use of materials and resources. As for the mining sector, more than €1 billion has been invested in 30 projects for the period 2012-2017; the 2018-2022 mining sector strategy consolidating this portfolio established competitiveness, sustainability, and maximizing impact on local communities as top priorities.

ANEX B - REGIONAL STRATEGIES ON MINERAL RAW MATERIALS

Mining Strategy of Andalusia 2013-2020

The Andalusian Mining Strategy 2013-2020[124] was created to highlight the Andalusian mining sector and its processing sector as one of the pillars to support regional development.

The strategy, conceived as a continuation of the 2010-2013 Mineral Resources Management Plan, was based on four main objectives: exploitation of the mining potential, job creation and improvement of the sector's competitiveness; improvement of public services and administrative management; environmental integration of mining activity and enhancement of the mining heritage; and development of a framework agreement in the labor area with special emphasis on safety and job training.

Castilla y León Mineral Resources Strategy 2017-2021

The strategy[125], integrated into the Master Plan for Industrial Promotion and the Plan for Economic Revitalization of the Mining Municipalities of Castilla y León, set as its objectives the consolidation of mining projects and the enhancement of existing deposits.

Oriented around five axes, mining-environmental management, monitoring and control, economic valorization both business and territorial, administrative efficiency, and training and information, it established a total of 33 measures, among which those aimed at the generation of business activity and the valorization of the geomining heritage stand out..

Strategic Plan for Non-Energy Mineral Resources of Castilla-La Mancha. Horizon 2020 (PERMINE)

In November 2014, Castilla-La Mancha published its Strategic Action Plan to 2020[126] in order to adequately plan and order actions in the field of mineral resources.

The main objectives were to guarantee access to raw materials, establish an adequate framework to promote a sustainable supply, and the efficient use of resources, including the promotion of recycling. To this end, the following strategic lines were designed: social and environmental integration of mining activity; updating and improving the management of public services linked to the mining sector; updating technical training, job training, and safety in the sector; and promoting mining activity together with innovation and competitiveness.

Galician Agenda for Sustainable Mining 2030

The Galician Agenda for Sustainable Mining 2030, currently under development, aims to modernize the Galician mining sector by making it more sustainable, strengthening talent and social responsibility, environmental integration, promoting the circular economy, and enhancing the value of mining heritage.

[124] https://www.juntadeandalucia.es/organismos/transparencia/planificacion-evaluacion-estadistica/planes/detalle/92318.html
[125] https://energia.jcyl.es/web/es/mineria/estrategia-recursos-minerales.html
[126] https://www.fempclm.es/Plan-Estrategico-de-Recursos-Minerales-no-Energeticos-de-CastillaLa-Mancha-Horizonte-2020-Permine_es_0_1138.html

ANEX C - PUBLIC CONSULTATION

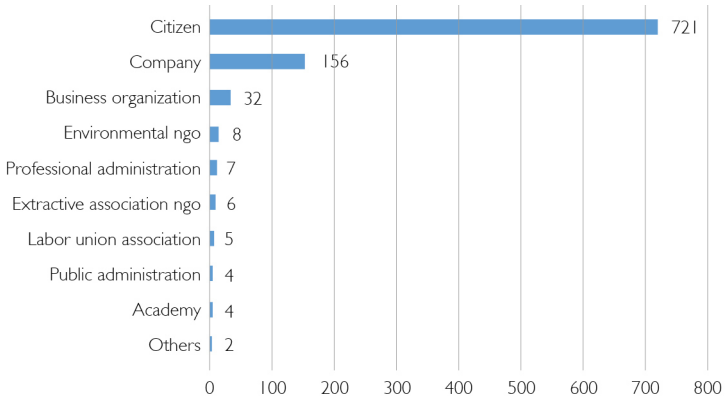
The elaboration of the Road Map for the sustainable management of Mineral Raw Materials has been supported by an important process of public participation, giving the different agents involved the opportunity to contribute to its elaboration. This public participation was carried out in two stages, the first prior to the drafting of the text and the second once the draft Road Map had been drawn up.

C.1. PRIOR PUBLIC CONSULTATION

The purpose of the consultation was to gather the opinion of interested individuals and entities. Different questions were included, among them, what actions are considered necessary to improve the supply of mineral raw materials in Spain or how the Mineral Raw Materials industry can contribute to the Spanish Circular Economy Strategy, the demographic challenge, or the Just Transition Strategy. The consultation was made available to the public on the website of the Ministry for Ecological Transition and the Demographic Challenge between October 26 and November 26, 2020[127].

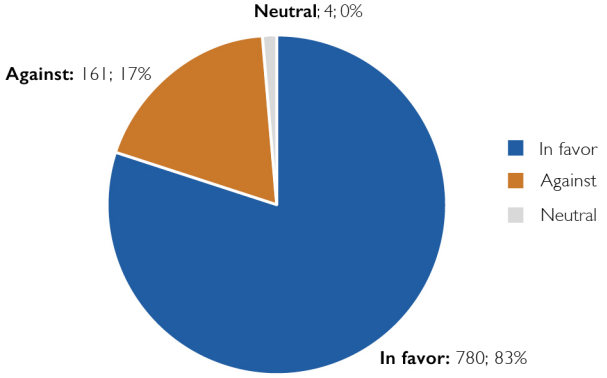
In the consultation process, a total of 1,025 responses were received of which 945 were considered valid[128]. Of these, 903 were identified as campaign responses and 42 as individual responses. The largest number of responses were from citizens (76%), mostly as part of one of the identified campaigns, followed by companies (16%) and business organizations (3.4%).

FIGURE 24. Prior consultation. Number of responses by category



The responses can be classified into two main groups. On the one hand ("in favor"), those who consider the sustainable management of Spain's mineral resources and the development of the associated value chains to be possible, and on the other hand ("against"), those who understand that a sustainable raw materials industry is not possible, the only way being the reduction of consumption, reuse, and recycling, the latter being issues on which both groups agree.

FIGURE 25. Prior consultation. Number of responses according to the direction



[127] https://energia.gob.es/es-es/Participacion/Paginas/DetalleParticipacionPublica.aspx?k=352
[128] A total of 43 responses arrived after the deadline and 37 were not considered valid because the person or entity was not properly identified.

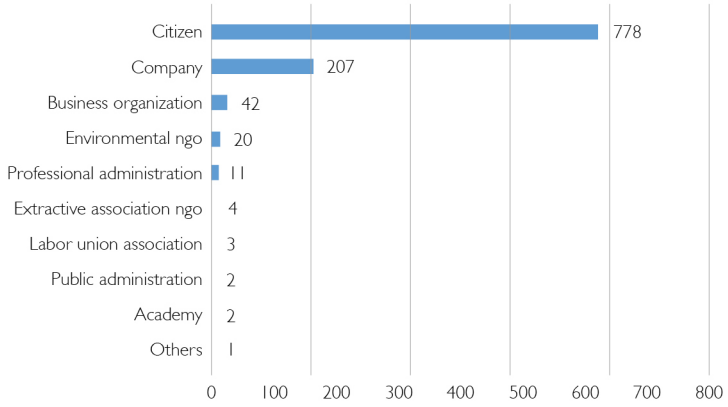
In relation to specific aspects to be included, it was pointed out that the Road Map should address environmental protection as a fundamental pillar, promoting the reduction of material consumption, recycling, and the effective control of these industries.

On the other hand, the need to modernize the regulatory framework, improve compatibility with other land uses, increase knowledge of the primary and secondary raw materials available in Spain and their future demand, as well as the need to decarbonize and digitalize the sector, with special emphasis on measures to support SMEs.

C.2. PUBLIC INFORMATION

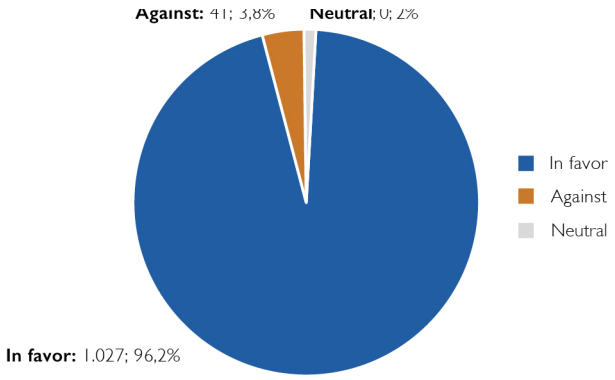
The draft Road Map for the sustainable management of Mineral Raw Materials was submitted for public information between March 14 and April 8, 2022, on the website of the Ministry for Ecological Transition and the Demographic Challenge. A total of 1,082 responses were received, of which 1,070 were considered valid. Of these, 1,039 were identified as campaign responses and 31 as individual responses. The largest number of responses were from citizens (72.7%), mostly as part of one of the identified campaigns, followed by companies (19.3%) and business organizations (3.9%).

FIGURE 26. Public Information. Number of responses by category



As in the prior public consultation, two general positions were identified concerning the text of the Road Map. One agrees with the direction of the draft Road Map and on which specific observations were made, and the other considers the only valid alternative to be the reduction of consumption, recycling, and reuse.

FIGURE 27. Public Information. Number of responses by direction



In relation to the observations received, all of them coincided with the promotion of reuse and recycling, although most of them emphasized the need for primary and secondary production of mineral raw materials to feed the country's strategic industrial value chains. Therefore, they focused on issues such as the need to make environmental protection and urban planning compatible, the need to modify the Mining regulations at least in specific aspects, the existing barriers in the administrative processing of files or the coordination with climate change policies and the necessary participation of all the agents of the sector in the implementation and monitoring of the Road Map itself.

Among the observations against the content of the Road Map, it can be highlighted the appreciation that recycling is not sufficiently considered, that the Road Map minimizes the impacts of the extractive activity, that it cannot be stated that the extraction of raw materials in Europe is more sustainable or that the modification of the basic legislation of Mines should consider aspects such as the establishment of an exploitation fee.

Other allegations pointed to the concern about the supply of certain raw materials and the measures provided for in the Road Map in this regard, the possibility of incentivizing the areas where raw material projects are located and that they are compensated for the externalities caused, or how to be more ambitious in the use of the Industrial Mining Heritage.

In the end, the more than 1,000 contributions received have been duly evaluated and the text of the Road Map has been modified and enriched accordingly. The diversity of the contributors shows the interest that exists in all sectors of the population in the supply of mineral raw materials to society, and which is not only limited to the purely mining or industrial sphere, demonstrating that in order to achieve sustainable management of mineral raw materials, the active participation and consensus of all sectors of the population is indispensable.