No 391 | JULY 2023

SEE ENERGY BRIEF

Monthly Analysis

The Vital Role of Critical Minerals in Europe and SE Europe

Introduction

Record deployment of clean energy technologies, such as solar PV and batteries, is propelling unprecedented growth in the critical minerals markets. According to the IEA **(1)**, electric car sales increased by 60% in 2022, exceeding 10 million units worldwide. Energy storage systems experienced even more rapid growth, with capacity additions doubling in 2022. Solar PV installations continue to shatter previous records, and wind power is set to resume its upward march after two subdued years. This has led to a significant increase in demand for critical minerals. From 2017 to 2022, demand from the energy sector was the main factor behind a tripling in overall demand for lithium, a 70% jump in demand for cobalt, and a 40% rise in demand for nickel. In 2022, the share of clean energy applications in total demand reached 56% for lithium, 40% for cobalt and 16% for nickel, up from 30% for lithium, 17% for cobalt and 6% for nickel five years ago.

Driven by rising demand and high prices, the market size of key energy transition minerals doubled over the past five years, reaching $320 billion in 2022, as the IEA notes. This contrasts with the modest growth of bulk materials like zinc and lead. As a result, energy transition minerals, which used to be a small segment of the market, are now moving centre stage in the mining and metals industry. This brings new revenue opportunities for the industry, creates jobs for the society, and in some cases helps diversify coal-dependent economies.

This Monthly Analysis attempts to shed light on the vital role of critical minerals at European and SE European level, as numerous energy projects (e.g. EVs, RES, energy storage, etc.) are anticipated to be built in the wider region over the next years.

China Dominates the Critical Minerals Markets

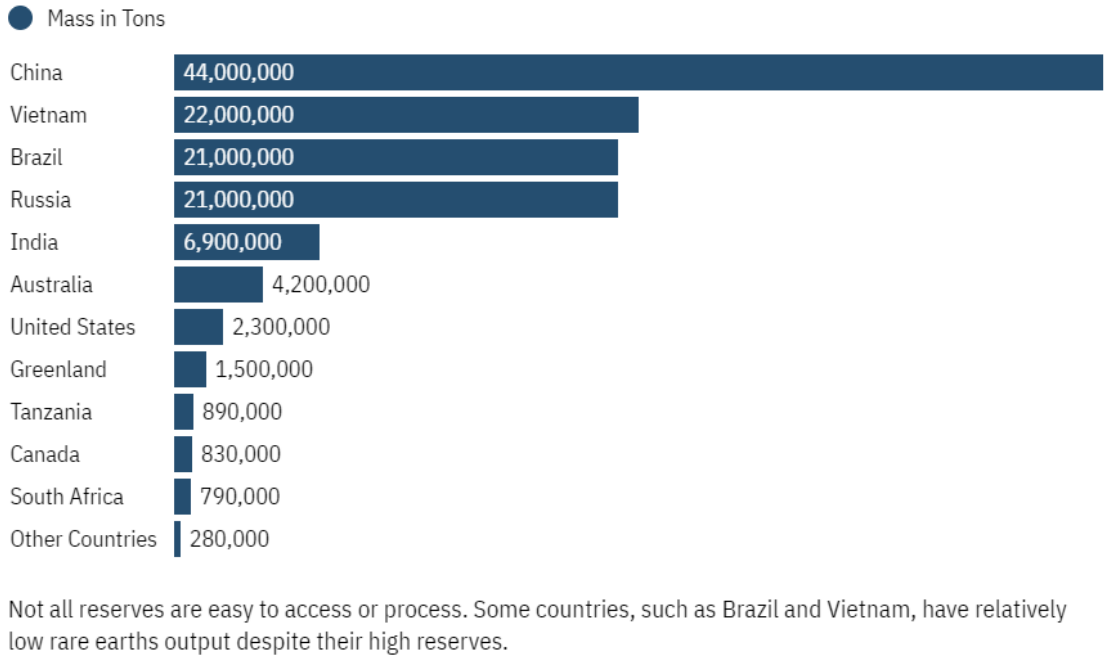
Critical minerals are a group of 17 elements used in products from lasers and military equipment to magnets found in electric vehicles, wind turbines, and consumer electronics such as iPhones. The 17 elements are: lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, lutetium, scandium and yttrium.

As shown in Figure 1, China is estimated to have 44 million metric tonnes of rare earth oxide equivalent in reserves, or 34% of the world total, United States Geological Survey's data showed **(2)**. Vietnam, Russia and Brazil are estimated to have just over 20 million metric tonnes each, while India has 6.9 million, Australia has 4.2 million and the United States has 2.3 million metric tonnes.

In 2022, China accounted for 70% of global mine production of rare earths, followed by the United States, Australia, Myanmar and Thailand. In addition, China is home to at least 85% of the world's capacity to process

rare earth ores into materials that manufacturers can use, according to research firm Adamas Intelligence in 2019, while Chinese exports of rare earths have declined as it exported 20,987 metric tonnes in the first five months of 2023, down 4.4% year-on-year. China exported 48,728 metric tonnes of rare earths in 2022, down 0.4% year-on-year, Chinese customs data showed. The United States sources most of its rare earth imports from China, but that dependence has eased to 74% between 2018 and 2021, from 80% during 2014 to 2017. **(3)**

Figure 1: Reserves of Rare Earths by Country in 2022



Source: United States Geological Survey

Critical Minerals in Europe

The Russian invasion of Ukraine and the ensuing energy crisis has made the European Union acutely aware of its exposure to geopolitical risks in key supply chains. Policymakers are now asking whether, in its drive to decarbonise its economy, Europe risks creating new dependencies. For example, when replacing an internal combustion engine car running on Russian fossil fuels by an electric vehicle with batteries made from Chinese minerals, it seems that one dependency is just swapped for another.

The EU's reliance on imported critical raw materials is very different to its reliance on Russian fossil fuels. Unlike fossil fuels, which are consumed pervasively throughout the economy, critical raw materials are needed at small volumes as vital ingredients in specific manufacturing processes. For instance, lithium, cobalt and manganese are key inputs in electric-vehicle battery production. Rare earth elements and borates

are needed to produce permanent magnets, essential elements in the electric-car motors and the generators of wind turbines. While indispensable for these manufacturing processes, the monetary value of the EU's imports of individual minerals is rather small. In 2021, before the energy crisis, the EU imported €120 billion of fossil fuels from Russia alone. In contrast, the value of EU imports of raw materials ranged between €4 billion for palladium to €5 million for beryllium. The risk therefore is not in the absolute (monetary) value of these imports, but the high degree of market concentration.

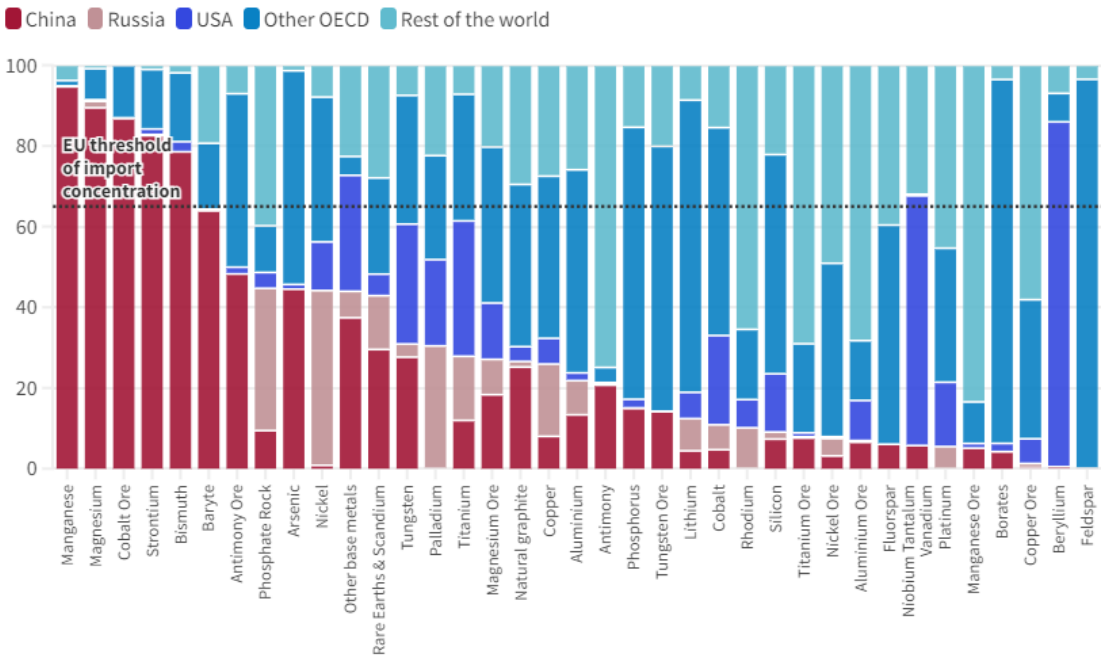
On March 16, 2023, the European Commission unveiled its Critical Raw Materials Act **(4)** in a bid to secure the resources needed for technologies such as renewable energy and battery power. The Act aims to make the EU more self-reliant in mining, processing and recycling a list of 34 critical metals and minerals, to shield the region from the impact of increasing international competition for these resources. It would require the EU to increase domestic production as well as limit the sourcing of critical minerals from third countries by 2030. However, the EU will find it difficult to meet the targets set out by the Act, whose passage is not likely to improve substantially supply-chain resilience for the region.

According to the Act, at least 10% of the EU's annual consumption of mined strategic minerals must be sourced domestically, while 40% of processed strategic materials and 15% of its recycled strategic materials must also be domestically produced. In addition, the EU aims to diversify its global supply of minerals so that no more than 65% of its annual consumption of each strategic raw material – at any stage of processing – should come from a single third country.

Figure 2 shows the origin of EU imports of all 34 of these critical raw materials. Using the Commission's threshold of 65% for market concentration highlights eight elements as particularly problematic. Imports from China exceed this threshold for bismuth, cobalt ore, magnesium, manganese and strontium. Similar levels of import concentration can also be seen for borates and feldspar from Turkey, and beryllium from the United States.

Under the proposed legislation, EU member states are expected to develop national programmes for exploring their geological resources. Projects deemed as "strategic" will benefit from access to financing opportunities as well as a shorter wait for permits – two years for mining projects and one year for processing and recycling. The EU also aims to increase its bargaining power by forming partnerships or "Critical Raw Materials Clubs" with countries with which it is on good terms, such as Canada and Australia. Canada has processing know-how, especially for rare earths, while Australia has reserves of lithium and rare earths. Lynas, an Australian company, is the only Western company that mines rare earths.

Figure 2: Origin of EU Imports of Critical Raw Materials in 2021



Source: Bruegel

Despite the provision of the Act, the EU will face several challenges in achieving its target of mining at least 10% of strategic minerals within the bloc. **Sweden, Finland** and **Portugal** are the most likely locations for new mines, but all three are likely to face their own legislative barriers. Long lead times for mining investment and approval will make it hard to ramp up output quickly enough to meet demand.

In Sweden, where a large rare-earth deposit was recently discovered **(5)**, the government-owned Luossavaara-Kiirunavaara Aktiebolag (LKAB) plans to apply for an exploitation concession in late 2023. However, the number of oxides in the reserve is reportedly quite low (only 0.18%), which could make it more difficult to secure a permit. With demand for batteries soaring, Sweden will also come under pressure to increase output from Europe's only graphite mine. Owned by Australia's Talga, the mine took ten years to secure a production license.

Finland, on the other hand, has amended its mining laws, giving local residents greater control over the permissioning of new mining areas. This could limit access to the country's rich supplies of nickel and cobalt. In Portugal, which has vast amounts of lithium reserves, the government has given permits to six different sites but there is still substantial local opposition to new mining activities. Protests have stalled the auctions of mining permits even as environmental impact studies are carried out. Portugal is Europe's top lithium producer and accounts for about 11% of the global market, but its lithium is currently used entirely to make ceramics and glassware. **(6)**

While mining faces legal challenges, processing capacity across Europe is also limited. LKAB plans to develop its own processing facilities if it secures a permit for its rare earths mine in Sweden. At the moment, however, **Estonia** has the only rare-earth processing facility in Europe. It is run by Neo Performance Materials (NPM), a Canadian company, which also plans to construct a magnet factory and R&D centre. While the company will invest €81.25m in the venture, the Estonian government plans to invest €18.75 million via the EU's Just Transition Fund. The European Raw Materials Fund will need to direct more investment into Estonia to help its development into a processing hub for rare earths. More partnerships with Australia and Canada would also be helpful.

Europe's main exposure to critical raw materials is through its imports of manufactured products. In 2021, for example, the value of the permanent magnets imported by the EU was 12 times greater than the value of imports of all types of rare earths combined. The value of imported solar panels was 13 times greater than the value of imported silicon, and for imported lithium batteries versus imported lithium it was 75 times. This not only reflects the higher added value of goods further upstream in value chains, but is in large part driven by the fact that the EU does not produce many of these goods domestically. For example, only about 10% of EU demand for solar panels is met by domestic production. **(7)**

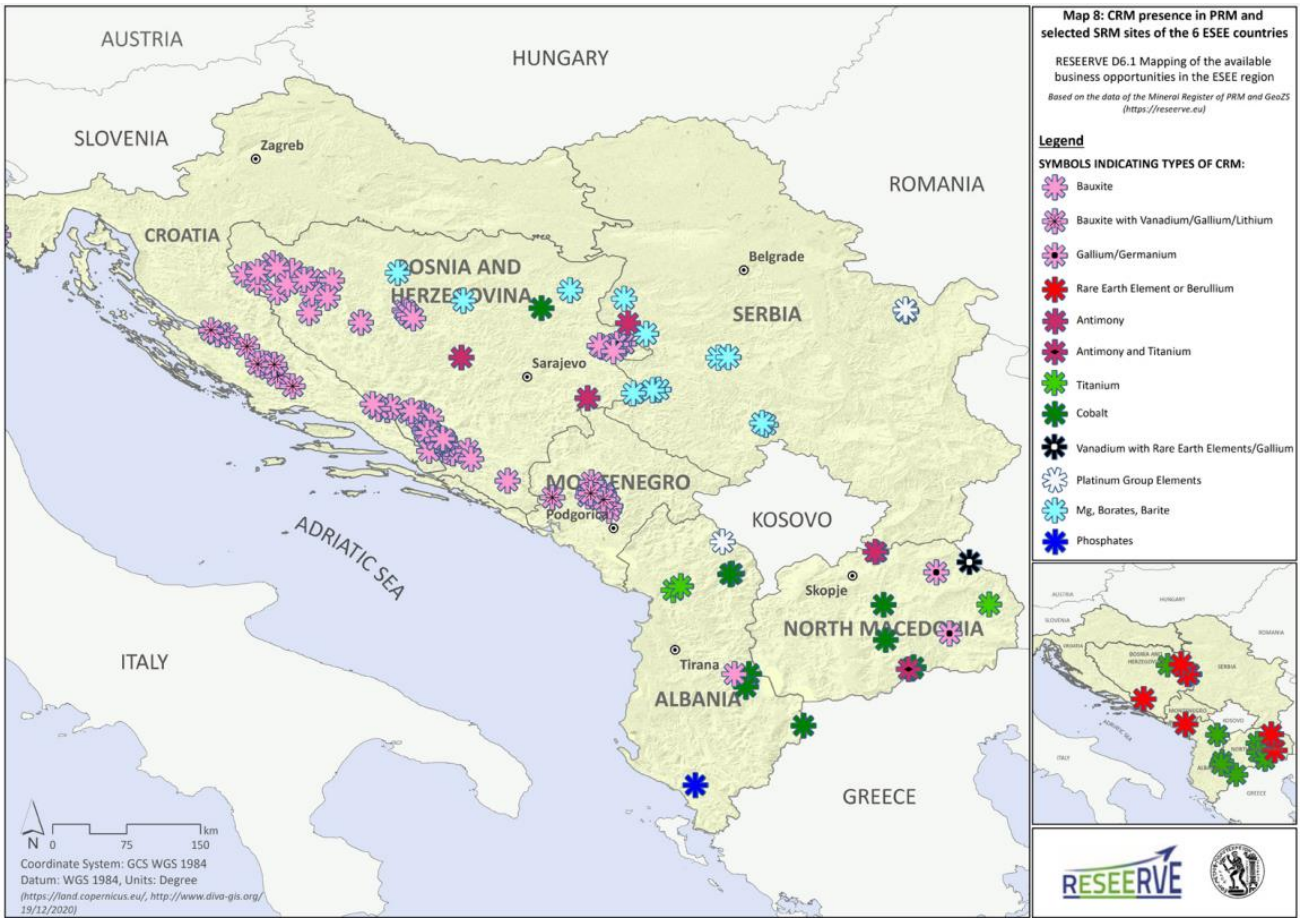
Critical Minerals in SE Europe

Based on the findings of the RESEERVE project[1] **(8)**, the geological potential of the SE European countries is important. For instance, Albania presents a remarkable potential for metallic primary raw materials, consisting mainly of chromites, iron-nickel and copper ore deposits, as shown in the following Map.

Bosnia and Herzegovina is a typical mining country in which numerous mineral deposits and countless occurrences of various metallic and non-metallic mineral primary raw materials are found. Bosnia and Herzegovina has a long tradition in exploration, exploitation and processing of minerals. The formation and distribution of primary raw materials deposits in space and time are closely related to the Adriatic carbonates platform (bauxites), as well as the Dinarides ophiolite zone, where one can find magnesite, chromite, chrysotile-asbestos and talc deposits, as well as nickel, cobalt and gold bearing ore deposits due to hydrothermal activity. Further, the Durmitor Nappe, Panonian-Golija-Macedonia Nappe and Mid-Bosnian Schist include various primary raw materials, like quartz, quartzite, barite, iron, gold, antimonite, fluorite, gypsum-anhydrite, leadzinc-barite, manganese, cinnabar and others.

[1] The RESEERVE project is a project mapping the mineral resources of the six following countries: Albania, Bosnia and Herzegovina, Croatia, Serbia, Montenegro and North Macedonia. The main outcome is the West Balkan Mineral Register of primary and secondary raw materials, the starting point to integrate the region in pan-European Mineral Intelligence Network and bring it closer to the global mineral market.

Map: Primary and Secondary Raw Materials Sites in SE Europe



Source: RESEERVE Project

Croatia's metallic primary raw materials potential looks rather low at present. More specifically, only aluminum mineralization has been reported, in the form of böhmite contained in many small sized scattered bauxite deposits, as shown in Map 3.

Regarding bauxites in Montenegro, two municipalities, namely Nikšić and Cetinje, are the country's major mining centres, as shown in Map 4. Many small size bauxite deposits are located in the Municipality of Nikšić, while only four out of them are being exploited currently, at the operating mines of Zagrad, Durakov do I, Biocki stan and Stitovo II. Another project regarding the development of primary raw materials, proposed as business opportunity, concerns a large copper ore deposit at Varine (Greenfields), which is currently at the feasibility stage. Montenegro is also developing its lead-zinc mining sector, mainly in the municipalities of Mojkovac, Pljevlja and Berane. Five Greenfields areas (Strmošne bare (Sjekrica), Paljevine, Djurdjeve vode, Ribnik and Igrišta) are at the feasibility stage. The non-metallic primary raw materials potential of Montenegro is rather limited and conventional, concerning extraction of mineral raw materials for the production of (mostly) crushed rock aggregates, as well as sand & gravel aggregates, and dimension

stone (limestone) used in the construction industry. Almost all areas concern operating quarries exploiting small to medium sized deposits.

Despite North Macedonia's small size, a remarkable variety of sites with valuable and rare metallic and non-metallic primary raw materials are found in its territory. The country's mining sector is developing taking into account that not only it includes primary raw materials, such as lead, zinc, copper, antimony, iron ores and iron nickel, but almost half of the sites reported in the RESEERVE Mineral Register correspond to Greenfields or/and projects being at the stage of feasibility study or under development. This by itself consist a favourable environment for business opportunities in the mining sector. However, potential delays encountered for permitting new mining projects should be taken into account, as well as the availability of experts and specialized technical personnel.

A number of the most important primary raw materials cases are located in the Municipality of Bor in Serbia. Bor metallogenic zone constitutes perhaps the most significant one in the country, where more than 650 million tonnes of copper ore corresponding to 4.93 million tonnes of copper metal and 280 tonnes of gold, have been produced in the area since 1902. Based on the RESEERVE Mineral Register, some medium sized, but mainly large and very large copper deposits are hosted in Bor territory with copper ore resources of the class of 4 billion tonnes. Besides the huge copper deposits of Bor, other areas hosting very large deposits is the municipality of Majdanpek (583 million tonnes), the municipality of Medveđa (250 million tonnes) and the municipality of Žagubica, increasing thus total probable and proved reserves, almost to 1 billion tonnes.

Gold is contained in many of the above deposits, while the sites of Korkan and Bigar Hill, consist of two sediment-hosted gold mineralization deposits of 12.3 million tonnes, and 30.6 million tonnes respectively. These deposits presently constitute projects under development, being thus potential business opportunities.

Discussion

Critical minerals, essential for a range of clean energy technologies, have risen up the policy and business agenda ladder in recent years. Rapid growth in demand is providing new opportunities for the industry, but a combination of volatile price movements, supply chain bottlenecks and geopolitical concerns has created a potent mix of risks for secure and rapid energy transition. This has triggered an array of new policy actions in different jurisdictions to enhance the diversity and reliability of critical mineral supplies.

The discovery of the large critical minerals deposit in Sweden (over 1 million tonnes) is an important development, as today the EU is almost completely dependent on China (98% of the EU's critical minerals

imports are coming from China). In general, the EU is vulnerable to critical raw materials supply squeezes. Critical minerals form a strong industrial base, producing a broad range of goods and applications used in everyday life, in modern and green technologies and in electric engines. Without sufficiency in critical raw materials, the EU will not be able to lead the green and digital transition and consequently will not be in a position to develop its defense capabilities either.

In SE Europe, business opportunities for Albania, Bosnia and Herzegovina, Montenegro, North Macedonia and Serbia are mainly associated with metallic commodities and include exploration activities to increase the level of confidence and reserves and Development of Mines or Green Field areas. In Croatia, the majority of business opportunities are related to the exploration and development of mines of non-metallic commodities.

However, the problem is that time is limited. According to the World Bank **(9)**, global demand for critical raw materials is expected to increase 500% by 2050, causing prices to skyrocket. Also, the prices of critical minerals and permanent magnets, where China has a quasi-monopoly, rose by 50%-90% in 2021. That's why the USA (with the Inflation Reduction Act of 2022[2]), Japan or South Korea are all deploying sizable support and investments to lessen their dependence on the extraction, processing and recycling of critical raw materials.

References

1. IEA (2023), "Critical Minerals Market Review 2023", https://iea.blob.core.windows.net/assets/afc35261-41b2-47d4-86d6-d5d77fc259be/CriticalMineralsMarketReview2023.pdf
2. United States Geological Survey (2023), "Rare Earths", https://pubs.usgs.gov/periodicals/mcs2023/mcs2023-rare-earths.pdf
3. Nguyen, M. (2023), "China's rare earths dominance in focus after it limits germanium and gallium exports", https://www.reuters.com/markets/commodities/chinas-rare-earths-dominance-focus-after-mineral-export-curbs-2023-07-05/
4. European Commission (2023), "Critical Raw Materials: ensuring secure and sustainable supply chains for EU's green and digital future", https://ec.europa.eu/commission/presscorner/detail/en/ip_23_1661

[2] The Inflation Reduction Act of 2022 (IRA) is a landmark United States federal law which aims to curb inflation by possibly reducing the federal government budget deficit, lowering prescription drug prices, and investing into domestic energy production while promoting clean energy.

5. Fleming, S. (2023), "Sweden discovers biggest rare earths deposit in EU", https://www.ft.com/content/78706a10-7ea6-445e-835c-ad8dd51b6a34
6. Economist Intelligence (2023), "EU acts to secure access to critical raw materials", https://www.eiu.com/n/eu-acts-to-secure-access-to-critical-raw-materials/
7. Le Mouel, M. and Poitiers, N. (2023), "Why Europe's critical raw materials strategy has to be international", https://www.bruegel.org/analysis/why-europes-critical-raw-materials-strategy-has-be-international#footnote2_belrwn8
8. RESEERVE (2021), "Mapping of the available business opportunities in the ESEE region (D6.1.)", https://reseerve.eu/upload/content/87/d-6-1_reseerve-website-version_final_mr.pdf
9. Hund, K. et al. (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

IENE SEE ENERGY BRIEF MONTHLY ANALYSIS - Issue No. 391 – ISSN:179-9163
Prepared by IENE's Research Team
Monthly Analysis is published by the INSTITUTE OF ENERGY FOR SOUTH-EAST EUROPE (IENE)
3, Alex. Soutsou st. 106 71 Athens, Greece, T: +30-210 3628457, 3640278, F: +30 210 3646144, marketing@iene.gr, www.iene.eu