Raw materials create the future

New Saxon Raw Materials Strategy

FUTURE.

STAATSMINISTERIUM
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ARBEIT UND VERKEHR

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Foreword

Dear Ladies and Gentlemen,

'Everything comes from the mine.' The first Raw Material Strategy of the Free State of Saxony began in 2012 with this culturally and historically meaningful sentence, as should the new Saxon Raw Material Strategy. A lot has happened recently in Saxony, in Germany, in Europe, and all over the world. The meaning of this phrase was shown to us in a way we could not have imagined, nor actually comprehended.

The effects of the Covid pandemic are still being felt, even if we have now learned to live with them. But we have also experienced what it means when years-old supply chains are interrupted without warning, and suddenly, raw materials for our industry are not available or can only be supplied with a delay.

With Russia's war against Ukraine, Germany in particular felt the importance of a diversified energy supply and of domestic energy resources.

Consequently, Europe and thus also the Free State of Saxony have set out on the path to achieve climate neutrality by 2050 at the latest. The Green Deal is settled, and it is imperative. It is important to limit the further warming of the Earth through a consistent decarbonisation of all our areas of life. This is not just a challenge for industry, but for society as a whole. This goal must be achieved in order to ensure the growth and prosperity of our society – for future generations as well.

For the phase-out of power generation from lignite by 2038, which was decided in Germany in 2020, we need suitable alternatives to ensure a secure supply of energy to our society. Proven technologies from the field of renewable energies are available for this and will continue to be developed in the coming years.

But not only the energy industry will change. The refurbishment of our buildings to improve energy efficiency, the conversion to electricity in our automotive industry, the digitisation of our work and the storage of energy in various media are all significant challenges, which we need to set in motion today in order to feel the benefits in the future.

I am firmly convinced that we will succeed in this transformation. And I am firmly convinced that the Free State of Saxony has an important role to play in this; because the Free State of Saxony was, is and will continue to be a home state for mining and, above all, a state in which the secondary raw materials industry and renewable raw materials are becoming increasingly important.

In the Free State of Saxony, we have known deposits of so-called high-tech raw materials, which are also included in the EU's list of critical raw materials. These have been intensively explored in recent years. In parallel, research has been carried out into suitable treatment processes. We also have an industry that needs these very same raw materials to make batteries, solar panels and microchips. What has not succeeded so far is the establishment of connections between the raw materials sources and the producers, and thus of new, closed Saxon value chains. These sustainable connections must be established in the coming years.

Recycling is already an important factor in securing our raw material requirements. Nevertheless, we want to do and can do even better in this area. The economical use of raw materials on the one hand and the constant increase in raw materials supplied from the secondary raw materials industry on the other are essential for achieving our transformation goals.

Primary raw materials can also be substituted or supplemented using renewable raw materials. This represents another component that is now to be considered and rethought for the first time in a raw materials strategy.

But to start with, the raw materials of the future must first be extracted, because (almost) all of them come from mining, including the raw materials that are bought on international markets.

This is a great opportunity for the Free State of Saxony, for its economy and its people who must conduct this transformation. With tradition and knowledge, with the rule of law and the highest environmental standards, we are building and developing the mining of the future while working on its partial substitution by a functional secondary raw material economy.

Our guidelines and fields of action will direct our course for the coming years. We have already achieved a great deal, but great tasks still lie ahead of us. Let us seize this opportunity together and fill it with life. Thank you for your support in this.

Good luck

Sincerely

Martin Dulig
Saxon State Minister of Economy,
Labour and Transport (and Mining)

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1 Saxon Raw Materials Strategy – a summary

It is time.

In 2012, the Free State of Saxony was the first German federal state to adopt a raw materials strategy. Ten years later, the Free State now presents a new raw materials strategy.

The new Saxon Raw Materials Strategy is a description of the dynamic development of the social framework and the changing requirements for the provision of primary, secondary and renewable raw materials. The effects of disrupted economic cycles and processes as a result of war and pandemics must also be taken into account, such as increasing dependencies on countries that supply a significant proportion of the required raw materials. The politically driven, rapid transformation of the economy that is necessary to achieve more environmental and climate protection, more resilience and adaptability to shock effects from epidemics, climate change, etc., will only succeed if raw materials are made available in a timely manner, their sources secured and socially accepted. This transformation is not subject to uniform market activity but is increasingly the subject of a geostrategic raw materials policy.

INFOBOX Raw material use per person

On average, each person in Germany needs around 44 kilograms of raw materials per day for everyday things such as housing, clothing, mobility and, proportionately, for transport systems, electricity and water supply as well as sports and entertainment facilities. A very different picture emerges in many countries around the world. In India, for example, each citizen needs an average of only approx. eight kilograms of raw materials every day. This difference primarily points to the different standard of living between industrialised nations and emerging countries.

Source: Drebenstedt/TU Freiberg (Publ.) (2021): Travels in the world of raw materials

In this context, the use of the term "raw materials" means primary mining raw materials, but also secondary raw materials from waste and renewable raw materials.

More consistently than ever, Europe and Germany have set out to counteract the causes and consequences of climate change and to drastically reduce greenhouse gas and pollutant emissions in all areas of life. There is a social obligation to set a course towards climate protection and climate adaptation in the coming years. These goals are anchored in the European Green Deal, in the Supply Chain Law of the Federal Republic of Germany, as well as in the Saxon Sustainability Strategy and in the Saxony Energy and Climate Program (EKP 2021), for example. The Saxon Raw Materials Strategy also aims to take these goals into account with the further development of mining and the use of secondary and renewable raw materials. It presents a holistic, actually sustainable and generation-fair raw material strategy.

The Free State of Saxony is characterised by the traditional extraction and use of the domestic and reliable energy source that is lignite. The coal phase-out law also requires the Free State of Saxony to carry out a complete transformation of the energy sector ("energy transition") by 2038 at the latest, which poses a great challenge for the preservation of the "energy state of Saxony".

This Raw Materials Strategy describes the **goals, guidelines and key areas of action of the Saxon Raw Materials Policy.**

These are primarily intended to create a creative and constructive environment for securing a sustainable raw material supply. They also serve to optimise the framework conditions for domestic mining, for the further development of a secondary materials and recycling economy and for the use of renewable raw materials in the Free State of Saxony.

Even if the improvement of material efficiency, by saving raw materials in the production process through low-material or durable product design, and by avoiding waste through joint or second-hand use of products, also represents an important building block for raw material security, these measures are not the subject of focus here.

In this strategy, the focus was and is on the supply of raw materials. The improvement of material efficiency through technology, process and product design, new usage models, etc. are the subject of other Saxon technical strategies interlinking with the raw materials strategy, in particular the Sustainability Strategy, the Innovation Strategy and the EKP 2021. Resource protection and efficiency are equally important objectives of the Saxony Environmental and Climate Alliance to promote sustainable economic development.

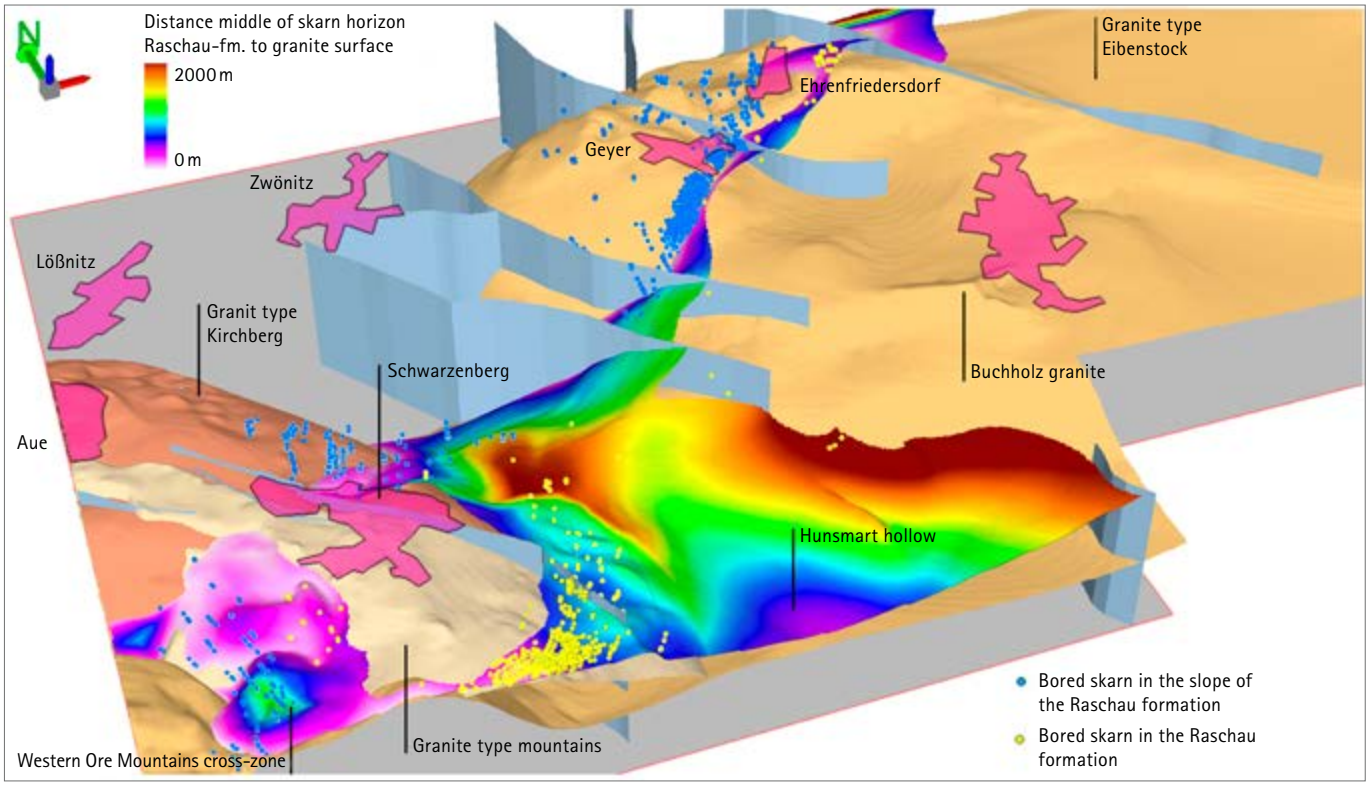


Illustration 1: 3D model of the geological subsoil ROHSA 3 (Source: LfULG)

Motives, focus points and results

Ten years since the start of the first Saxon Raw Materials Strategy – ten successful years! From the very beginning, the Saxon Raw Materials Strategy was more than just a sober inventory of the raw materials in the Free State of Saxony. It examined the economic importance of these domestic resources and revealed the considerable potential that can arise from the promotion and use of these treasures. The historical awareness of Saxony's mining and sustainability traditions has led to a high level of raw material acceptance among the population, which is still present today, and wich gives the Free State of Saxony technical and scientific competence like no other federal state, established at the mining site in Freiberg, among others.

In order to secure the extraction and use of the mineral resources that are essential for a modern economy in the long term as well, strategic guidelines (G) and key areas of action (KAA) were defined in the Raw Materials Strategy 2012 and underpinned by a large number of short and medium-term tasks. It was and is a shared understanding that the Raw Materials Strategy can only work thanks to a network of actors from business, science, society, politics and administration. Not every goal was achieved, but there are outstanding examples that present an impressive picture of the achievements of the past ten years.

The ROHSA 3 project started in 2013 in the field of **"Domestic primary raw materials: Saxony as a mining country"** with the aim of systematically recording, securing and evaluating raw material geological data for ores and spar in the Free State of Saxony. After completion of this key project in 2024, a comprehensive information base on existing raw material deposits will be publicly available – the basis for current and future investment decisions for mining projects. A geological 3D model has already been created to represent the raw materials potential in Saxony and probability forecasts for tin, tungsten, fluorspar and barite in the Central Ore Mountains. The dimension of this project is considerable, as approx. 6.4 million euros have funded this measure so far.

As part of the task area "**Secondary raw materials: Saxony as a state of secondary raw materials"**, in addition to numerous projects by economic actors, networks and research institutions, the data foundations for the sustainable use of primary and secondary building materials of mineral origin, taking interactions into account, were also developed in two modules of the "MinRessource" project. The "Guideline for the reuse and recycling of reclaimed asphalt", presented in 2019 in the context of the Saxony Environmental and Climate Alliance, aims to support companies and authorities in increasing the use of recycled asphalt in road construction in the future, instead of its disposal as waste. The "Saxon Zero Waste Strategy" and the "Strategy for the Implementation of the New Circular Economy Act" project will run until the end of 2023, aiming to use potentials for the avoidance, reuse, recycling and other disposals of municipal waste. The innovation cluster "Circular Saxony" was initiated for the implementation of the task "Building a secondary raw materials network", which will be supported by the Free State of Saxony until 2025 with a grant of 1.48 million euros.

Exchange and networking between business, science and administration, including civil society, are key elements in bringing the Raw Materials Strategy to life. In this understanding, the activities were focused on the task areas **"Saxony as a location for the raw materials industry", "Saxon administration"** and **"Raw material awareness"**, with events and training courses, support for networking and the provision of information material. This also includes the use of social media ("Martin Dulig Konkret") and the Saxon raw materials theme day, including relevant technical exchanges on site, such as with the Federal Environment Agency during a joint visit to the Ore Mountains fluorspar and barite works in Niederschlag.

In the area of **"International cooperation"**, the long-standing cooperation with partners from Mozambique, focusing on the training of students at the TU Bergakademie Freiberg and the establishment of a qualified Mozambican mountain administration by members of the Geo-Competence Centre Freiberg, is particularly noteworthy.

Raw material competence in the Free State of Saxony has been constantly expanded in recent years through research and development, as well as through coordinated support campaigns. The list of stakeholders is long and diverse and ranges from Saxon universities and reasearch institutions to companies in the raw materials industry, mining centres and approval authorities, as well as the Geo-Competence centre. **"Saxon raw materials research"** thus has a broad foundation and occupies a high position in the European Union, which is also reflected in the participation of Saxon partners in diverse German and EU projects, as well as in the amount of research funds raised and patent applications submitted.

As in all sectors of the economy, the **"Training of skilled workers for the raw materials industry"** and the securing and further qualification of employees represent a major challenge for the future. With an attractive range of study and training courses, especially in the fields of raw materials industry, mining, geosciences and engineering, the Free State of Saxony has made a name for itself that goes beyond its borders. This also includes the skilled worker and technician training for the raw materials sector at the "Julius Weißbach" vocational school in Freiberg.

2 Raw materials potential in Saxony

Saxony is rich in raw materials! The Free State of Saxony basically has almost all of the raw materials in the stone and earth sector that are necessary to cover the existing domestic needs. An exception to this is gypsum, which is however currently still extracted and used as a "waste product" in the operation of flue gas desulfurization systems in lignite-fired power plants (FGD gypsum) (e.g. gypsum plasterboard as a building material). In Saxony, FGD gypsum reserves are currently available for up to approximately seven years after the end of lignite-fired power generation in two depots that are under mining supervision (Spreyerhöhe, Peres). In Saxony, gypsum waste also generates secondary raw materials or is recycled.

Lignite is a recoverable energetic raw material that will make an important contribution to the stability of the German electricity market until the decided phase out of the use of lignite for energy. The energy source that is uranium, which is still important in other countries, is also available in Saxony, although its mining was stopped in 1990 and the mines and other legacies of this era have now been almost completely converted. In contrast, there are no relevant oil and natural gas deposits in our state.

With the Ore Mountains, the Free State of Saxony has a wide range of mineral resources from the ore and spar groups. The history of Saxon mining, which is more than 850 years old, has not been forgotten and will be kept alive with the World Heritage Site reward, bestowed in 2019. The mining industry has not yet fully exhausted the existing potential for ores and spar, which could make an important Saxon contribution to the development of new technologies.

The quantity of secondary raw materials used is still significantly lower than that of primary raw materials. That should and must change – there is great potential for the future here. The quality of the recovered secondary raw materials must also be improved.

Likewise, the potential of renewable raw materials, especially wood, is large and diverse, participating in a range of material, thermal and energetic value-added processes.

By far the most important potential, however, are the people in the Free State of Saxony who work in various areas of research, education, training and administration, in industry or in trades and who ensure that raw material treasures are extracted, processed and used in a legally secure, environmentally friendly and climate-conscious manner. Last but not least, they make a significant contribution to securing long-term acceptance and awareness of the topic of raw materials among the population.

INFOBOX FGD-Gypsum

The Free State of Saxony itself has no natural gypsum deposits. However, the use of so-called FGD gypsum for the manufacture of gypsum plasterboard, for example, plays an important role in the German construction industry. FGD gypsum is mainly obtained as a by-product in the desulfurization of flue gases in coal-fired power plants, which results in their designation as flue gas desulfurization plants. The lignite-fired power plants Boxberg and Lippendorf deliver significant amounts of FGD gypsum and make a significant contribution to the gypsum supply. More than half of the gypsum requirements in Germany are covered.

Source: State Geological Surveys of Germany (2021): Inventory of gypsum deposits in Germany.

Illustration 2: Extraction in a quarry (Source: UVMB/Oliver Fox 2022)

Primary raw materials potential

Lignite

The Free State of Saxony is still one of the most important lignite-producing states in Germany, with its two mining areas in Lusatia (Nochten and Reichwalde opencast mines) and in Central Germany (United Schleenhain opencast mine). According to the coal industry[1], approx. 126 million tons of coal were mined in Germany in 2021, with around 50 percent each in the Lusatian/Central German mining area and in the Rhenish mining area, respectively. The majority of this coal (88 percent) was used to generate energy. Compared to 2020, this is an increase in production of over 17 percent.

Even if the known and balanced as well as the recoverable coal reserves based on these mining statistics were sufficient for a few more decades, the mining of lignite will end by 2038 at the latest. The Free State of Saxony and the local lignite companies fully support the socially imperative results of the Commission for Growth, Structural Development and Employment (KWSB) and their legal anchoring in the Coal Phase-Out Act (KAG) and the Coal Power Generation Termination Act (KVBG).

Lignite is currently still an important domestic source of energy for Germany, which can provide complementary compensation for fluctuations in the supply of energy from renewable sources. In the German electricity system, conventional technology based on fossil fuels must be used in order to reliably supply Germany with energy until the goals for the expansion of renewable energy generation have been achieved.

Securing the energy supply with lignite requires long-term planning security and reliable political framework conditions for the people affected, the companies affected and the approval authorities. The lignite companies LEAG in Lusatia and MIBRAG in Central Germany have committed themselves to this transformation and are actively involved as motors in the structural change that has begun.

Illustration 3: Opencast mine in Nochten, overburden conveyor gantry F60 (Source: LEAG/Andreas Franke 2018)

1 https://kohlenstatistik.de

Geothermal energy

Geothermal projects are becoming increasingly important on the path to fossil-free energy production. In conjunction with the use of heat pumps, near-surface geothermal energy in particular has been making an important contribution to the heat supply of residential and functional buildings for a long time already. The number of approved geothermal systems has been continually increasing for years. The "Geothermal Atlas" provides Internet-based maps with regionalised geothermal extraction rates in Saxony for such projects.[2]

There is still a need for further exploration and research in Saxony regarding the potential of medium-deep and deep geothermal energy. In the Free State of Saxony, the responsible water authorities or the Saxon Mining Office, including the State Office for the Environment, Agriculture and Geology, are responsible for the necessary permit or approval procedures. The Site Selection Act (StandAG), which came into force in 2017, results in new requirements for projects with depths of >100 meters, as a consequence of the nationwide search for a repository for long-lived, heat-generating, highly radioactive waste. These requirements can be competently observed and fulfilled in a timely manner through joint implementation by all the authorities involved.

Ore and spar

"If we were to look at the Ore Mountains from space with future exploration technology, we would discover a very diverse polymetallic deposit of which only the surface has been scratched – by our 850 years of ore mining." (Prof. Dr. Bernhard Cramer, chief mining officer)

In large parts of Saxony, 850 years of ore mining have only "scratched the geological surface". New exploration methods, modern technology and a changed understanding of deposits and processing technologies make the Ore Mountains appear more than ever as ORE Mountains. With today's knowledge and state of research, it is known that the Ore Mountains have wealth to offer, especially in the area of ores and spar. So far, however, it has only been possible in one case to re-establish a mine for the extraction of fluorspar and barite. The Ore Mountains have the potential to become a European model region for modern mining.

Three other projects are currently in the course of a construction and operation approval examination, actively supported by the Free State of Saxony. There are also a large number of pending permits and approvals, the current status of which is transparently tracked on the homepage of the Saxon Mining Office. This has been called the new "Berggeschrei" – an old German term for an "ore rush".

As a result, the mining licenses for ore and spar in the Free State of Saxony as of July 2022 are as follows:

- 19 existing permits
- Five existing approvals
- One existing mine property

Evolution of the total amount of geothermal installations in Saxony

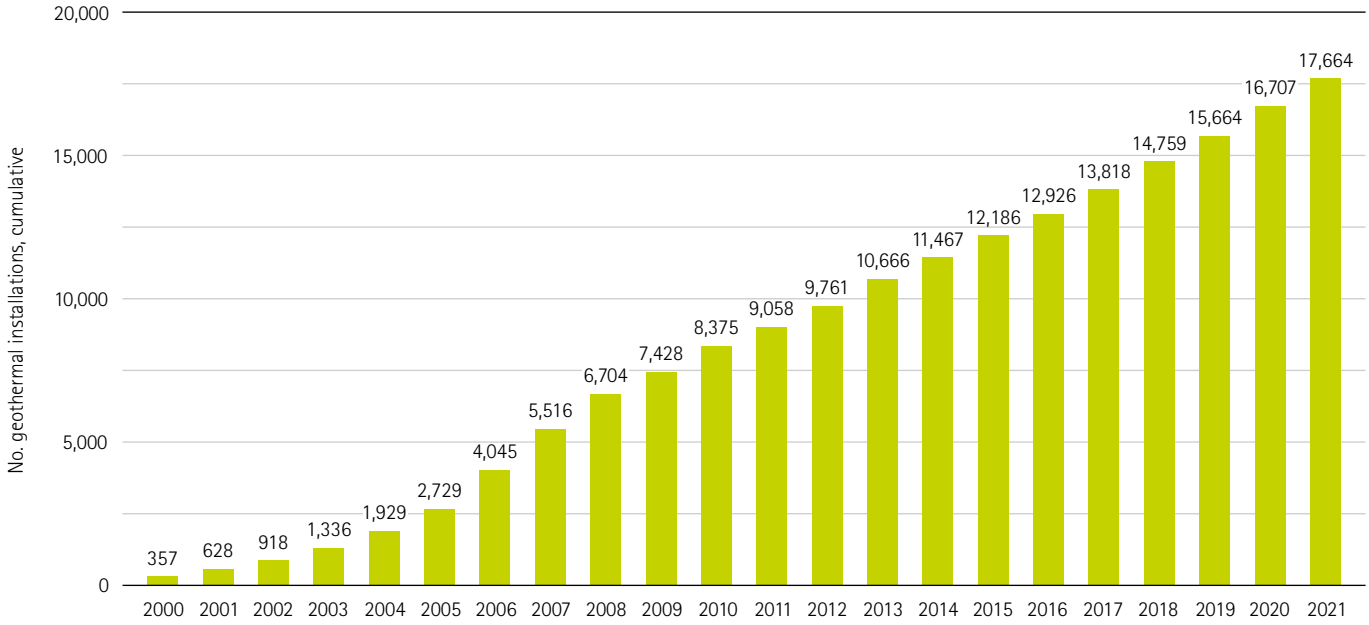


Illustration 4: Evolution of the total amount of geothermal installations in Saxony (Source: LfULG 2022)

2 https://www.geologie.sachsen.de/geothermieatlas-13914.html

Raw material	Saxon deposits of ore and spar (GDR) in tons	Saxon deposits of ore and spar (current) in tons	World mining production 2020 in tons	Ratio of untouched Saxon deposits to World production 2020 in percent Relation GDR/ current	Global reserves 2020 in tons	Ratio of untouched Saxon deposits to the global reserves 2020 in percent Relation GDR/ current
Aluminium	22,947,550		65,351,568	35.1	n. i. (very large)	n. i.
Arsenic	55,070		51,898	106.1	> 1,200,000	< 5
Barite	1,070,650		8,085,570	13.2	> 400,000,000 (eleven most important production countries)	< 1
Bismuth	14,295		9,513	150.3	370,000 (2016)	approx. 4 (2016)
Lead	317,170	121,090	4,745,983	6.7 / 2.6	90,000,000	< 1 / < 1
Boron	6,473		3,601,366	0.2	1,100,000,000 (2017) (B2O3)	< 1 (2017)
Cadmium	1,051		24,970	4.2	0.03 % of zinc reserves ≈ 75,000	≈ 1,4
Iron	578,172	3,356,000	1,522,558,857	0.0 / 0.2	85,000,000,000	< 1 / < 1
Fluorite	2,820,617		7,575,997	37.2	320,000,000	< 1
Gallium	7		304	2.3	n. i.	n. i.
Germanium	2		96	2.1	n. i.	n. i.
Indium	240	761	944	25.4 / 80.6	n. i.	n. i.
Copper	161,531	85,123	20,788,363	0.8 / 0.4	880,000,000	< 1 / < 1
Lithium	33,000	194,240	185,850	17.8 / 104.5	22,000,000	< 1 / approx. 1
Molybdenum	3,017		283,582	1.1	16,000,000	< 1
Nickel	12,435		2,491,866	0.5	> 95,000,000	< 1
Niobium	0	4,000	93,509	0.0 / 4.3	> 17,000,000	< 1
Rubidium	46,000		n. i.	?	n. i.	n. i.
Scandium	282		15–20	1,880–1,410	n. i.	n. i.
Rare earth oxides	0	20,100	225,277	0.0 / 8.9	120,000,000	n. i. / < 1
Silver	354	197	26,248	1.3 / 0.8	530,000	< 1 / < 1)
Uranium	3,933		56,269	7.0	8,070,400 (2019)	< 1
Tungsten	53,849		87,507	61.5	3,700,000	1,5
Zinc	485,088	207,643	12,608,299	3.8 / 1.6	250,000,000	< 1 / < 1
Tin	486,791	276,400	277,291	175.6 / 99.7	4,900,000	10 / approx. 6

Illustration 5: Overview of metal and spar reserves in Saxony compared to global reserves and global production (Source: LfULG 2022 – Data basis: LfULG 2022, GKZ 2008, Reichl/Schatz 2022, USGS 2022)

Projects are primarily focused on deposits of fluoride, tin, lithium, tungsten, nickel, indium and other metal ores. In connection with the new global hunger for raw materials, these raw materials are considered to be high-tech raw materials, partially also as critical with regard to market availability.

Strategic raw material and geopolitical developments as well as a persistent and historically significant market shortage of relevant high-tech raw materials are affecting almost all ores and spars. In thecoming decades, it can be assumed that the demand for specific ores and spars will be unprecedented in its intensity and dynamics. In the global competition for the raw materials of the future, Europe plays a very important role as a buyer, but has so far hardly played a role as a producer. A diversification of raw material procurement and the return to a domestic raw material base are urgently required. Saxony has a large number of raw materials and would like to contribute to ensuring that these treasures are obtained with high requirements for the sustainability of the extraction and processing of mining raw materials, in the interests of society, economy and politics.

Stone and earth

Of the currently around 220 active mining projects in the Free State of Saxony, which are under the supervision of the Saxon Mining Office, over 95 percent are located in the stone and earth sector. This number alone underscores the outstanding position of the predominantly medium-sized stone and earth industry in the Free State of Saxony. Annual production is constant at 35 to 40 million tons.

Natural stone (greywacke, granite, granodiorite, rhyolite) accounts for more than 50 percent of the quantity of raw materials extracted, sand and gravel for almost 40 percent, and kaolin and clay for the rest.[3] Fundamentally, the use of these raw materials can be classified as follows:

3 Information from UVMB, Version: January 2022.

Illustration 6: Gravel quarry (Source: UVMB/Oliver Fox 2022)

- Mineral mixtures and aggregates for building construction, civil engineering and hydraulic engineering consisting of sand, gravel and broken natural stone
- Natural stone made of sandstone, slate, porphyry, gneiss and granite
- Ceramic masses for the brick and porcelain industry, consisting of loam, clay and kaolin
- Raw materials and additives for the paper, paint, foundry and glass industries, among others

The extraction of raw materials always represents an intervention in nature and the landscape. In order to minimize these interventions and to provide opportunities for nature, substitute habitats are increasingly being created right from the extraction phase. The "Interim Nature" project was developed jointly with the German Nature and Biodiversity Conservation Union for the "active interim use of unexploited areas for nature". The sand martin, which nests in sand and gravel mines, and the eagle owl in quarries, are no longer uncommon.

The stone and earth industry also makes an important contribution to the expansion of renewable energies. Every foundation of a wind turbine, a photovoltaic system installed on the ground or an overland power line requires an immense amount of such raw materials. Local quarrying ensures short transport routes between the place of quarrying and the construction site and contributes to regional value creation.

A secure supply of raw materials for construction is also essential with regard to the goals of the Federal Government.[4] Examples include the new construction of 400,000 apartments across the country each year, measures to improve the energy efficiency of existing buildings and the modernisation of the rail infrastructure.

The safeguarding of these goals is increasingly in competition with other uses of space and planning intentions. It is therefore necessary to anchor the domestically usable raw material potential permanently and securely in the Saxon state and regional planning in order to ensure future supplies. In this context, there is also a need for a profound transition in the construction industry towards more sustainability. The priority is to pursue the goals of recyclable construction and conversion before new construction, more use of renewable raw materials and secondary raw materials and an improvement of raw material efficiency.

INFOBOX Raw materials for construction in Germany

Gravel, sand and broken natural stone are important raw materials for the construction industry. Demand in Germany in 2020 amounted to approx. 485 million tons (of which approx. 262 million tons were gravel and sand and approx. 223 million tons were broken natural stone). The majority of it is used for domestic needs as a raw material for construction. Transporting these bulk raw materials over long distances should be avoided, which is why securing them through regional planning is of great importance.

Source: Germany – Raw Materials Situation 2020, BGR (2020)

4 Coalition agreement of the Federal Government 2021

Secondary raw materials potential

Sources for secondary raw materials are basically valuable materials in waste. However, the potential does not only depend on which wastes are available, with which composition and in which quantities. The location at which the respective wastes are generated and the proceeds that can be achieved through recycling are decisive for the economic efficiency of recovery and the necessary transport. In addition, the volatility of the amount of waste poses a particular challenge. If, for example, economic production or construction activity stagnates, less recyclable waste is produced and there is less demand for (secondary) raw materials on the market.

In this strategy, only the waste occurring in Saxony is considered as a potential source of secondary raw materials. In particular, the disrupted supply chains of the recent past have shown the great importance of regionally available and secure sources of raw materials. Against this background, the waste generated in Saxony is also becoming more relevant, with the shortest possible transport routes contributing not least to the implementation of the goals of the European Green Deal.

In order to conserve natural resources, the targeted control of material recycling flows is essential. For this purpose, all material flows along the value chain, from the extraction of raw materials to waste management, must be taken into account. The recycling of goods at the end of their useful life must therefore be forcefully driven in order to return the materials contained in them to the cycle.

Waste generation and waste treated in Saxony

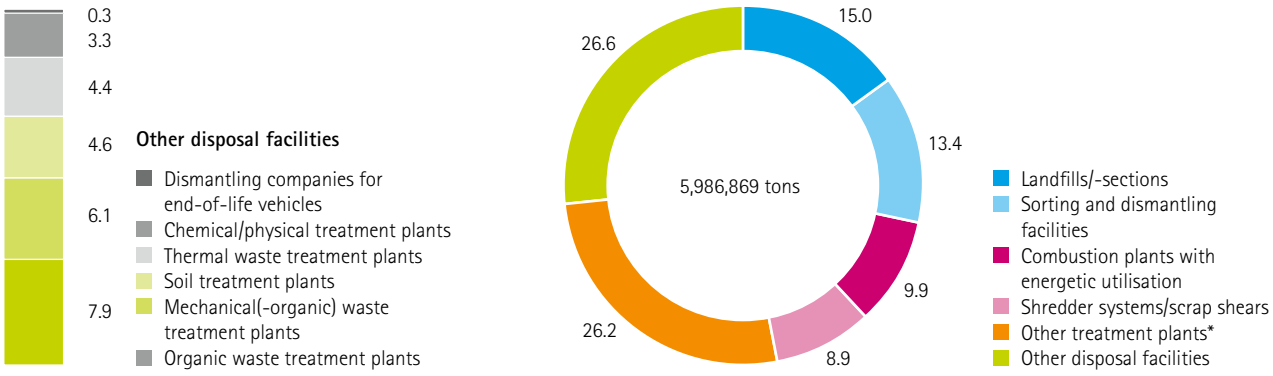
In Saxony, most waste is recycled with the aim of producing secondary raw materials as intermediate and end products.

Waste from a wide range of sources, such as households, industrial companies and the construction industry, is either reused in production processes, processed in recycling plants with innovative sorting and separating technologies, or it enters fermentation, gasification and combustion processes. The resources contained in the waste are either fed back into the economic cycle through the extraction of secondary raw materials, or they can be considered energy sources and can thus make an important contribution to the energy transition.

In 2020, around 6 million tons of waste were treated or disposed of in Saxon waste disposal and recycling plants. The waste or products resulting from a wide variety of disposal processes were prepared for reuse, recycled, used for other purposes or disposed of.

Mineral waste

Mineral waste, especially construction and demolition waste, is the most important bulk waste in the Free State of Saxony. It represents a large reservoir of recyclable materials, with the waste hierarchy prioritising recycling over any other use through backfilling. Although a large part of the construction and demolition waste was recycled in recent years, more than half of it was used to backfill above-ground quarries.[5]



* Including (production) plants for recycling waste oil and sewage sludge digesters with co-fermentation

Illustration 7: Treatment and disposal of waste in waste treatment plants in the Free State of Saxony 2020 (figures in tons per year or in percent)
(Source: Statistical Office of the Federal State of Saxony 2022)

5 Statistical Office of the Federal State of Saxony (2021): Statistical report "Recycling of waste in the Free State of Saxony 2018".

Relative price development for LME metals

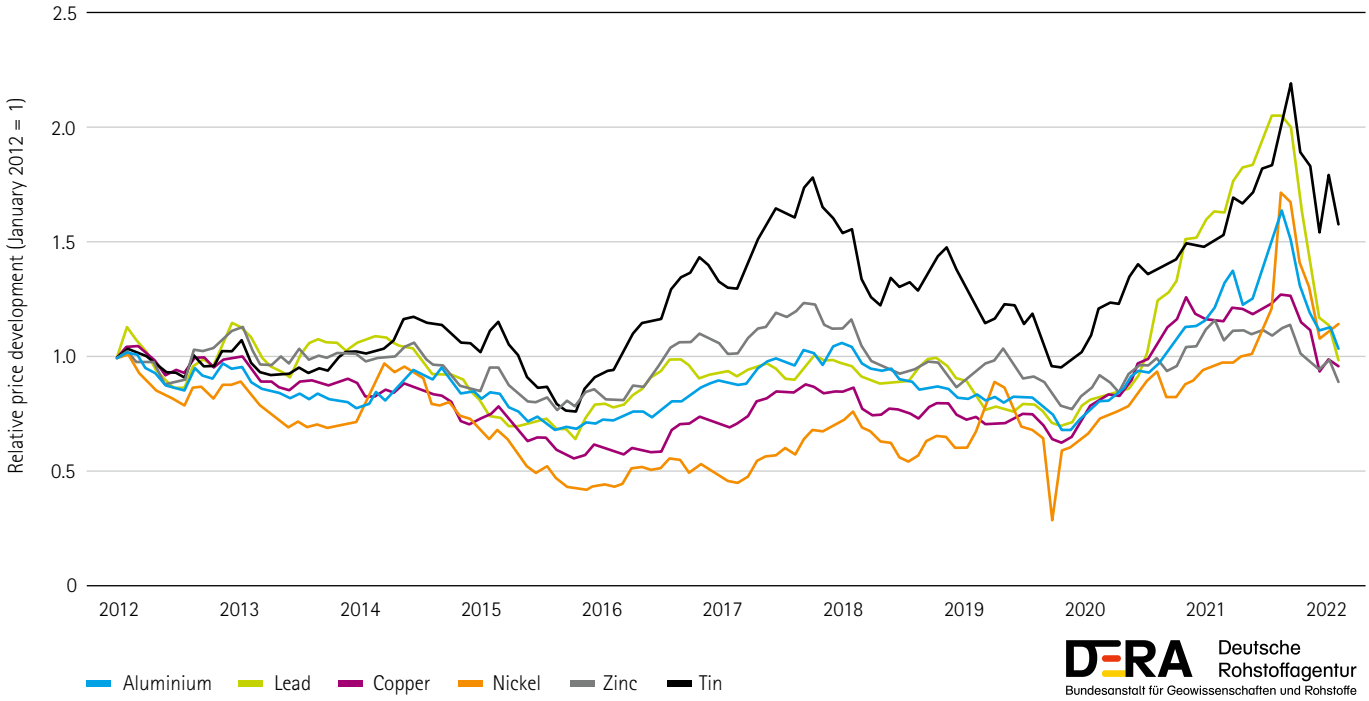


Illustration 8: Relative price development for the industrial metals traded at the London Metal Exchange (LME) (Source: DERA 2022)

Depending on their area of use and their purpose, secondary building materials are subject to various different ecological and structural requirements. Due to the applicable quality requirements, only the non-hazardous types of mineral waste from, among other things, construction and demolition, thermal processes, waste treatment and from the municipal waste sector can usually be used as secondary building materials or processed into such. The secondary building materials are used as aggregates in technical structures (e.g. road and path construction, commercial areas, noise barriers).

It is still important to promote the potential of innovative processing methods and the acceptance of secondary building materials among users and the public in order to ensure a supply of secondary building materials of sufficiently high quality and at competitive prices. A targeted approach, for example when a building is demolished, could optimise the recovery and processing of building materials and promote their recycling or their reuse.

In 2019, the Saxon Circular Economy and Soil Protection Act (Sächs-KrWBodSchG) included the obligation for the Free State of Saxony, the administrative districts, urban districts, municipalities and other legal entities under public law to contribute to the achievement of circular economy goals in an exemplary manner.

Section 10 sentence 4 Sächs-KrWBodSchG states: "An exclusion of recycling material or products is only possible in exceptional cases and must be justified in a plausible manner". Thus, recycled building materials must not be unjustifiably discriminated against in the awarding of contracts; tenders should instead be open to a variety of products and technologies. In the future, the requirements for substitute mineral building materials will be redefined by the provisions of the Federal Substitute Building Materials Ordinance, with the aim of facilitating the possibilities for the use of these materials in the sense of a circular economy.

Metallic raw materials

The recycling or recovery of metals and their return to the material cycle has been a firmly established part of the secondary raw materials industry in Saxony for years. Metal waste (scrap) and metal-containing waste come from different areas of origin. New and old scrap is used, as well as circulating scrap or own waste from steel mills and foundries. New scrap includes production waste from the iron- and steel-producing and ferrous and non-ferrous processing industry and commerce. Old scrap occurs after the consumption or use of steel and iron products and consists of up to 75 percent industrial, commercial and demolition scrap and up to 30 percent consumer goods scrap. Both types of scrap are defined by the scrap type lists and the classifications of the metal trade. These lists are the basis for preparing the material for later sale.

Companies in the field of environmental and recycling technology with innovative and leading technologies, in particular the recovery of ferrous and non-ferrous metals from different types of waste, have established themselves in the Freiberg region, based on the raw material processing industry that emerged there in connection with the extraction of raw materials. Significant amounts of mineral waste (including dust, slag or filter cake) are generated during the recovery of metals. These process residues still contain metalliferous waste in varying concentrations. They are currently mainly used in landfills as a replacement construction material or dumped as waste. This continues to lead to a loss of usable metalliferous secondary raw materials.

The waste that represents the most important secondary raw material potential for technologically significant, metallic secondary raw materials particularly includes old electrical and electronic equipment, old batteries and accumulators, old vehicles and waste-containing, ferrous and non-ferrous metals. The latter also include, for example, used catalysts, chips, sludge, ash, solutions and concentrates containing precious and non-ferrous metals. Saxon waste disposal companies recover gold, silver, platinum, palladium, rhodium, indium, lead, antimony, tin, zinc, aluminium, silicon and tellurium, among other things.

Critical raw materials	Recyclability (existing, according to the current state of knowledge)
Antimony	existing – theoretically possible
Barite	not possible
Beryllium	theoretically possible – not possible
Bismuth	not possible
Borate	not possible
Cobalt	existing (batteries) – theoretically possible (magnets)
Coking cole	not possible
Fluorspar	not possible
Gallium	existing (photovoltaics) – not possible (LED)
Germanium	theoretically possible – not possible
Hafnium	not possible
Heavy rare earths	existing – theoretically possible – not possible
Light rare earths	existing – theoretically possible – not possible
Indium	existing (solar cells) – theoretically possible – not possible
Magnesium	existing (solar cells) – theoretically possible – not possible
Natural graphite	theoretically possible
Natural rubber	existing
Niobium	existing
Metals of the platinum group	existing
Phosphorite	not possible
Phosphorus	existing
Scandium	not possible
Silicon metal	existing
Tantalum	theoretically possible – not possible
Tungsten	existing (tools) - theoretically possible – not possible
Vanadium	existing
Bauxite	existing (aluminium)
Lithium	existing
Titanium	existing
Strontium	existing (cathode ray tubes, not a raw material) – theoretically possible (permanent magnets)

Illustration 9: Recyclability of critical raw materials (Source: BMU 2021, unpublished)

There are 34 plants in Saxony with a capacity of 290,000 tons per year for the professional disassembly, dismantling and processing of old electrical and electronic equipment, including fluorescent tubes. End-of-life vehicles are processed in Saxony by 68 dismantling companies with a total available capacity of 182,000 tons. There are also nine thermal metal recovery plants with a processing capacity of 337,000 tons per year and important processing technologies for the recovery of metallic secondary raw materials.

For the most part, suitable technologies or economically viable recycling processes are still lacking for the recovery of technologically significant future raw materials, most of which are classified as "critical". The extent to which recycling can take place depends, among other things, on the chemical composition, the energy required for the process or the demand for the specific raw material. There are already numerous innovative recycling plants in Saxony for so-called "raw materials of the future" (e.g. zinc recycling plant, secondary lead smelter, chemical-physical treatment plant for metalliferous waste with thermal processing). Illustration 9 shows the recyclability status of the critical raw materials contained in waste, partly for different types of waste.

Energy carriers

The waste hierarchy defined by the Closed Substance Cycle Waste Management Act considers material recycling as having priority over energetic recycling. If the requirements for material recycling are not met, waste can be used as, or used to generate, or used as, alternative fuels and energy sources. Various types of waste, such as municipal waste and organic waste, can be used as secondary energy sources to generate electricity, heat and process energy in a wide variety of technological processes. For energy recovery in Saxony, there are thermal waste treatment, combustion and fermentation plants as well as the co-incineration of sewage sludge in lignite-fired power plants. Mixtures and mono-fractions from mechanical sorting and processing plants can be used to produce substitute fuels and contribute to energy production.

Illustration 10 shows the existing annual capacities of relevant Saxon waste treatment plants that generate energy from waste. Depending on the type of waste, the technology used and other conversion and processing processes, electricity, heat and gaseous energy carriers (e. g. biogas in natural gas quality or hydrogen) are fed into the public grid, used on site for the processor's own operating facilities or provided to locally based facilities.

In addition, in 2020, for example, up to 100,000 tons of biodiesel were produced by processing used fat.[6]

However, a comprehensive overall quantification of secondary energy sources as a potential for energy generation in Saxony is not yet available.

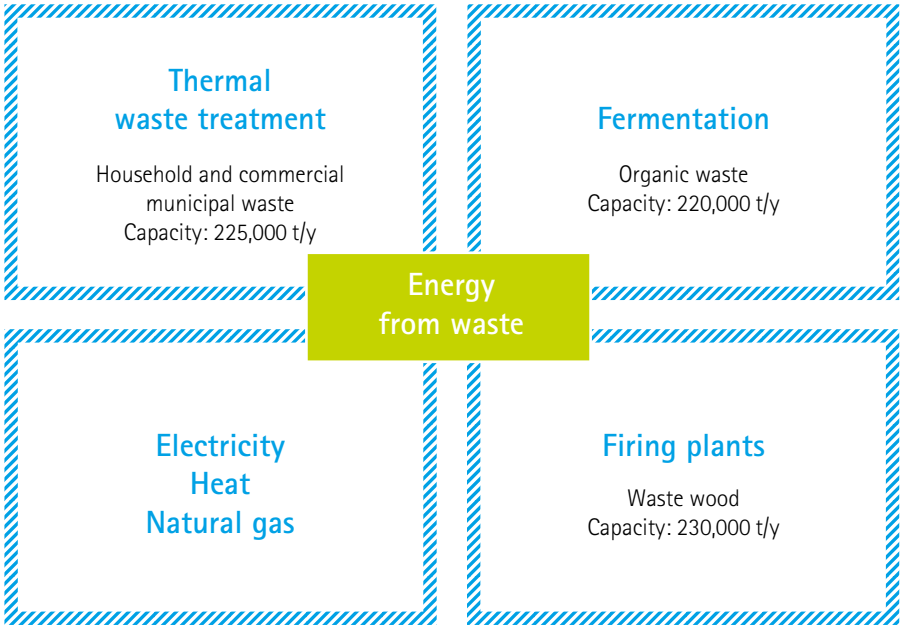


Illustration 10: Annual capacities of relevant Saxon waste treatment plants (Source: Cadastre of waste disposal plants (ABENSA) based on data from the State Information System for Plants (LIS-A), as of March 2021)

6 SMEKUL (2021): Agricultural report in figures 2021.

Renewable raw materials potential

Renewable (biotic) raw materials are diverse and have various different possible uses and quality characteristics. As biotic raw materials can also be constituted by waste, co-products and by-products, there are many possible uses in different value chains.

Agricultural products

The cultivation volumes of individual crops are known from the cultivation data of agricultural holdings in Saxony, but not the amounts that are used for food, material or energy.

Alternatively, different intermediate and end products (e.g. organic acids from biogas production) can be produced from most of the substrates of all the utilisation directions mentioned and used for many applications.

At the present time, it is estimated that an area potential of 20 to 25 percent of arable land could be used for biomass and energy production without endangering food security.[7] The nature conservation compatibility of the cultivation of energy crops must be taken into account in each specific case.

Cereals, silo maize and rapeseed are the most commonly grown crops. According to estimates by the State Office for the Environment, Agriculture and Geology, around 20,000 hectares of silo maize are required for biogas plants. The cultivation of rapeseed as a renewable raw material for biofuels has already been reduced by 40,000 hectares compared to 2010. Sugar, alcohol, starch, lubricants, etc. are generated from the cultures mentioned, for material and energetic uses.

With approx. 250 hectares of short rotation plantations (SRP) and 68 hectares of miscanthus (grasses), the agricultural area under cultivation in Saxony for solid biomass for energetic use is currently only of minor importance. Alternative material recycling is currently only present to a small extent. Suitable value chains have yet to be developed in this area. For example, hemp can be used to produce solid fibres for industrial fabrics and nonwoven materials, and miscanthus (a raw material plant with good biomass yields) can be used to produce a great variety of compounds and packaging materials, among other things. If profitability is achieved and with a stronger focus on social sustainability for such production chains, further raw material potential could also be tapped here.

Another potential that has hardly been exploited so far is the cultivation of agroforestry systems for material and energetic utilisation, e. g. in the form of valuable wood and wood chips.

Type of crop	Utilisation possibilities for renewable raw materials
Silo maize (incl. husk meal)	Biogas substrate
Cereals (incl. grain maize)	Biogas, bioethanol, starch production
Winter rapeseed (for grain production)	Technical oils and biofuels (vegetable oil fuel and biodiesel)
Sugar beets	Bioethanol and biogas substrate
Crops for green harvesting, forage (except corn)	Biogas substrate
Sunflowers (for grain production)	Technical oils
Co-products, residues (husks, straw, kernels, husks, ...)	Biogas, bioethanol, fuel, heat, fibres, 3D-printing, ...

Illustration 11: Agricultural funding (Source: SMEKUL (2021): Agricultural report in figures 2021)

Type of crop	Utilisation possibilities for renewable raw materials	Cultivation in hectares 2020
Hemp	Grain and fibre extraction	376
Medicinal and aromatic plants	Medicines, fragrances and dyes	164
Culinary herbs		
Miscanthus	Material use, fuel and animal bedding, fibres	72
Fast-growing forest trees (SRC)	Fuel, material use	244
Fodder millet, sorghum, other cereals	Biogas substrate, starch, fibres	470
Forest	Material and energetic use	521,000 (2.3 million m³ annual logging)

Illustration 12: Agricultural subsidies and wood sales (source: SMEKUL (2021): Agricultural report in figures 2021 and state enterprise Sachsenforst: www.sbs.sachsen.de/holzverkauf-7801.html)

7 LfULG (2015): Cultivation of energy crops in Saxony.

Illustration 13: Tender of valuable raw wood (Source: Dörte Gregor 2021)

In this way, numerous secondary effects could also be achieved with regard to the ecological status of watercourses, the improvement of biodiversity, climate protection and climate adaptation as well as tourist use.

The use of residues from agriculture offers only little potential, as almost all of these residues can be used in agriculture itself (e.g. to maintain the humus content in the soil). This also applies to the energetic use of liquid manure and manure in smaller animal populations, of which the quantities are however declining.

Additional potential is seen in the material recycling of co-products from the sawmill industry in a cascade use. For example, wood residues from the wood industry can be processed into other pressed products. The same applies to leftovers from the food industry, where dried and ground fruit stones, for example, could be used for the 3D printing of filigree packaging for medical products.

Wood and wood products

There are a total of 521,000 hectares of forest in the Free State of Saxony, which corresponds to approx. 28 percent of the state's area. These consist of 236,000 hectares of private forest, 209,000 hectares of state forest and 56,000 hectares of corporate forest. There are also trust forests and federal forests. According to the surveys of the third national forest inventory (version 2012), the wood stock per hectare in the Free State is of 312 m³. On average, more than 3.5 million m³ of wood is lost each year (usage, dead wood, crop residues, etc.), of which more than 2.3 million m³ are harvested as timber. At the same time, a good 5.8 million m³ of wood is grown back. With wood, the Free State of Saxony thus has a lastingly available, sustainable and ecological raw material, which binds CO_2 from the atmosphere during its growth and stores it in the forest ecosystem in the long term. This effect can be further expanded through subsequent use (material, chemical, energetic). Therefore, the strategic approach of cascade use is being pursued in order to give priority to long-lasting wood products over energetic use, for example as building or construction wood, but also innovative applications in mechanical engineering, car or ship construction.

Forests and wood are essential building blocks for reducing greenhouse gas emissions in the energy and building sectors, and their potential for effectively substituting climate-damaging materials and fossil fuels is far from exhausted. In particular when it comes to its own construction and modernization projects for public buildings, the Free State would like to set a good example and mainly build with wood and wood-hybrid construction methods, under consideration of building regulation requirements. In parallel, a continuous further development of the building code law appears to be necessary in order to include future technical developments in the timber construction sector in a timely manner.

At the end of the value chain, in addition to waste wood, the primary sources of energy use are the residues/by-products from wood processing (e.g. for the production of wood pellets) that cannot be further recycled. Quantities of wood arising directly from forest care and timber harvesting, for which no economic material recycling is possible, can be used on a limited local or regional scale as an energy source, increasing the potential for energy efficiency for climate-friendly energy production.

With all these efforts and developments, especially when it comes to wood, all forest ecosystem issues must always be taken into account, in particular the protection and improvement of biodiversity in forest areas.

3 European and national framework

The EU raw materials strategy

In 2008, the European Commission presented a raw materials initiative for the first time, entitled "Meeting our critical needs for growth and jobs in Europe".[8] It is based on a so-called three-pillar strategy and defines the following central goals:

- Non-discriminatory access to raw materials on the world market
- Permanent supply of raw materials from European sources
- Reduction of primary raw material consumption in the EU (resource efficiency, recycling)

The focus of the initiative was on international raw material trading and on increasing the availability of raw materials through recycling. Raw material diplomacy with investment aid in developing countries for the extraction and transport of raw materials played an important role, including trade agreements and the monitoring of export restrictions. This initiative is supported by a consensus of values between the EU Member States.

INFOBOX European Green Deal

The European Green Deal presented in 2019 is a central umbrella strategy of the European Commission, which is intended to lead the EU into a sustainable future. At its heart is the goal of making Europe the world's first climate-neutral continent by 2050. The transformation of the economy should take place with a view towards climate protection, sustainability and resource efficiency and make a significant contribution to more growth, competitiveness and prosperity in Europe.

With the beginning of the Covid pandemic and disrupted supply chains, but also with increasing economic and political upheavals on the global world raw materials market, Europe was made aware of its own dependence on raw materials and the fact that the global market no longer has uniform rules. With this realisation, a process was started to rethink a secure supply of raw materials for Europe, reinforced in particular by the goals of the European Green Deal, the strengthening of circular economy and the use of renewable raw materials.

In addition, Russia's war of aggression against Ukraine in particular and China's increased efforts to obtain economic, political and military dominance demonstrated how valuable stable and crisis-proof partnerships are. But it has been shown that the value of trade agreements is not only defined by stable supply chains and affordable prices, but also by compliance with basic democratic rules and human rights.

In response, the European Commission set an important new course with the publication of an Action Plan for Critical Raw Materials[9] on 3 September 2020. For the first time, this action plan highlights the necessity and importance of a domestic European mining of raw materials, accompanied by the promotion of resource efficiency and circular economy.

8 COM (2008) 699 final.
9 COM (2020) 474 final.

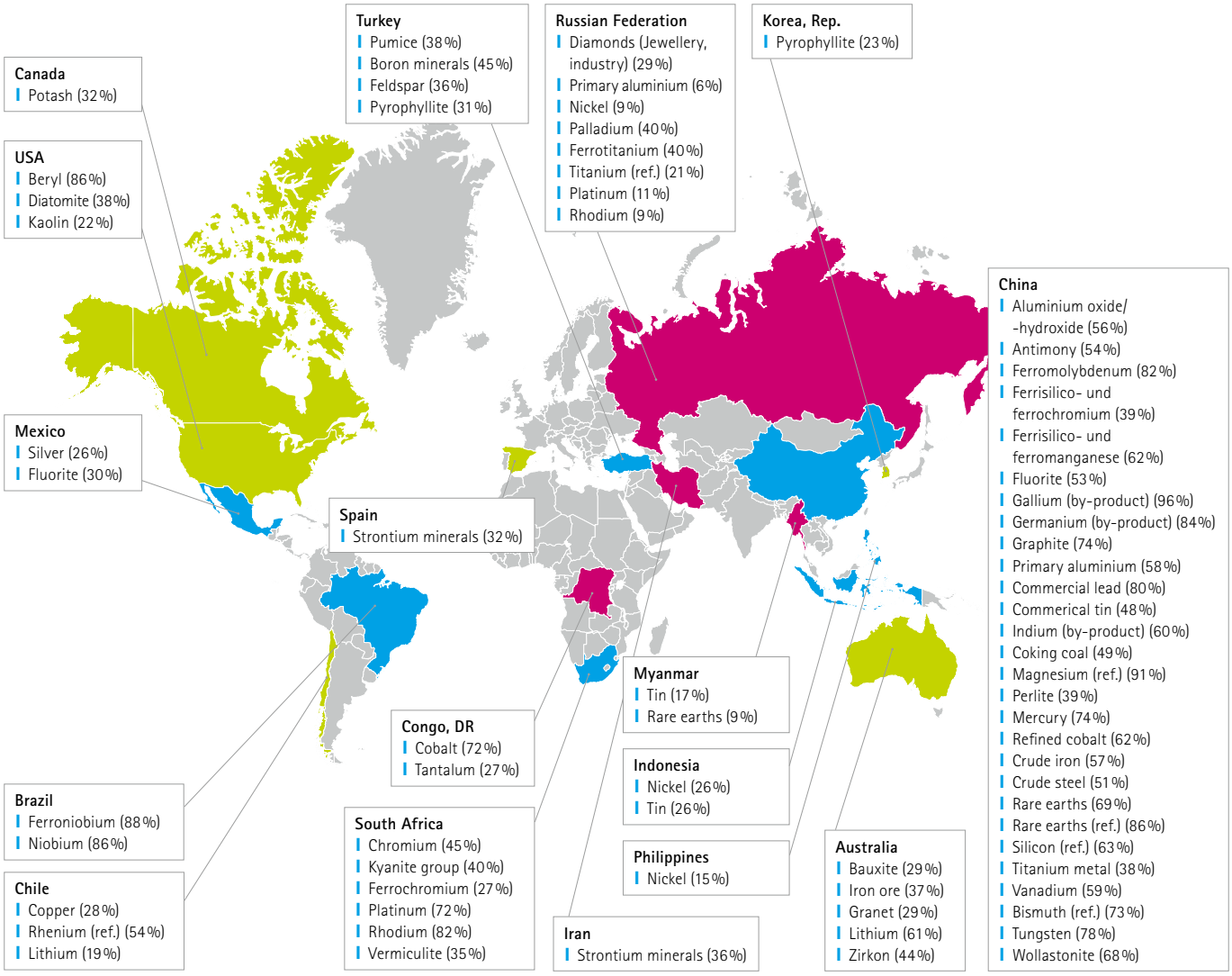


Illustration 14: Main producers of mined and refined products from raw materials in risk group 3 (i.e. raw materials with a particularly high probability of delivery failures or price risks) (Source: DERA 2022)

The preliminary highlight of the European raw materials policy is the announcement by the EU Commission of a European law on critical raw materials ("European Critical Raw Materials Act"), included in the speech by the President of the Commission on the state of the European Union on 14 September 2022. Access to and availability of raw materials is a key factor for the success of the European transformation process and the Green Deal. The demand for particularly critical raw materials will increase significantly in the coming years. Against the backdrop of one-sided dependencies on raw materials, in addition to establishing new partnerships with countries outside the EU, the use of raw materials along the entire value chain (extraction, refinement, processing, recycling) should be reorganised, according to the Commission.

This changed strategic approach at the level of the European Union must be taken into account in the further implementation of the new Saxon Raw Materials Strategy and forms a strong argument for the expansion of the Saxon raw materials policy with the pillars of mining raw materials, secondary raw materials and renewable raw materials. Decisions about domestic extraction must therefore be based in particular on the Action Plan for Critical Raw Materials of the EU Commission.

The Raw Materials Strategy of the Free State of Saxony builds on the goals of the Raw Materials Strategy of the EU and substantiates and supplements them with its own goals and guidelines.

The EU Raw Materials Strategy contributes to the implementation of the European Green Deal. The new Raw Materials Strategy of the Free State of Saxony should make a significant Saxon contribution to the ambitious goals of the European Green Deal.

With its Raw Materials Strategy, the Free State of Saxony supports the EU's efforts to strengthen an independent European supply of raw materials and makes an important contribution to promoting domestic raw material extraction and increasing resource efficiency and the development of circular economy.

The federal raw materials strategy

The Federal Government updated its Raw Materials Strategy in 2020. Furthermore, oriented towards non-energy mineral raw materials, the previous strategy was assessed and a regulatory framework for action was set, "intended to support companies in purchasing mineral raw materials more safely, responsibly and with a commitment to sustainability".

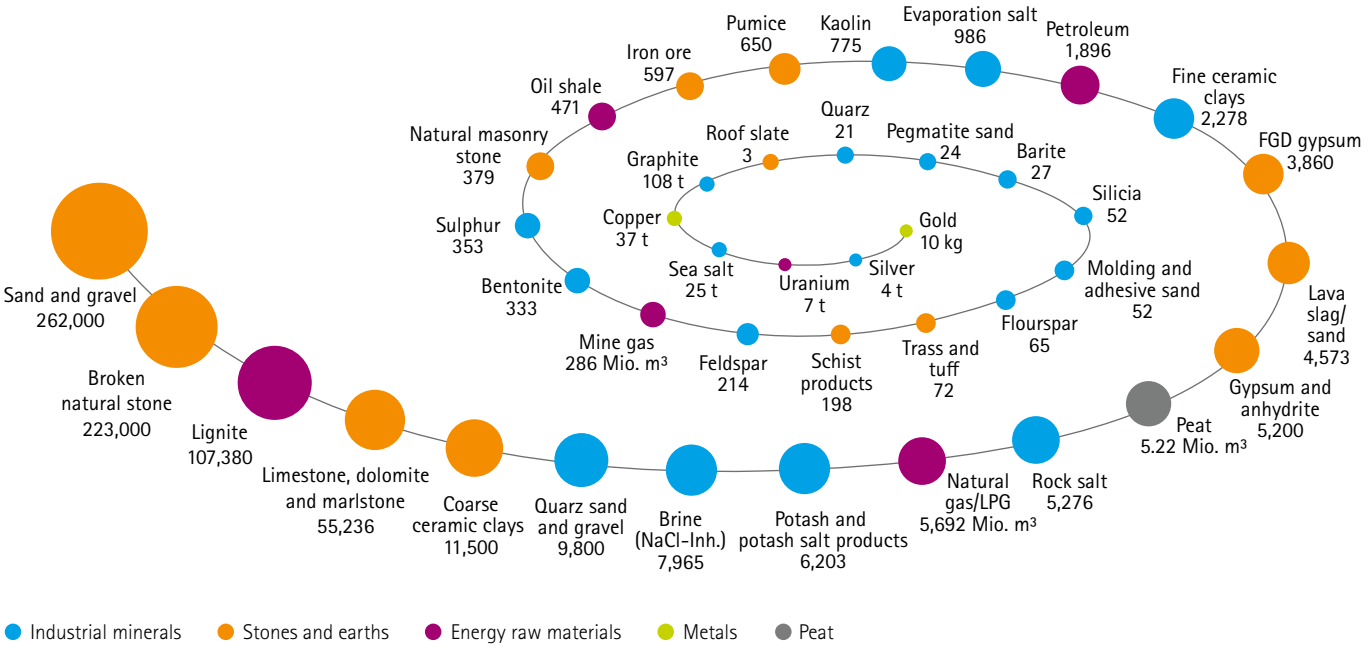
The updated strategy goes well beyond the previous approach, using the three European pillars, and identifies a total of **17 measures** to achieve the goals. Individual measures offer basic points of reference for the Free State of Saxony. Citing geopolitical upheavals and new pressure to act for raw materials supply, the Federal Government announced in autumn 2022 that it intended to supplement the Raw Materials Strategy 2020 with further measures. In doing so, it wants to make a contribution to the medium and long-term security of supply for industry and society and to support the efforts of German companies to secure raw materials. The Federal Government also wants to support the "Critical Raw Materials Act" announced by the European Commission with its own proposals and recommend, for example, the review of existing financing instruments to support projects for the production of raw materials and critical metals (mines, refineries and recycling capacities).

The first priority in the raw materials strategy of the Federal Government is the contribution of domestic raw materials as an "indispensable pillar of the domestic raw material supply". The **Measure 1** derived from this still relies on strategic partnerships, with the welcome approach of establishing the high German standard in mining throughout Europe and internationally.

The Free State of Saxony fundamentally shares this position, but would like to go beyond this approach by expanding domestic mining.

Following the European approach, initiatives of the European Commission that are "aimed at ... reviving the primary extraction of necessary metallic raw materials for e-mobility and the energy transition" should be supported. This declared objective of the **Measure 3** can in particular also strengthen domestic (ore) mining. Limiting the target to raw materials for e-mobility and the energy transition is, at least for now, a limitation that should be reconsidered, firstly due to the European Action Plan for Critical Raw Materials, but in particular due to the effects of disrupted supply chains in the course of the political challenges that are emerging. The Free State of Saxony would therefore like to make a clear commitment to the domestic mining of high-tech raw materials as a whole.

The Federal Institute for Geosciences and Natural Resources (BGR) is to develop a program "with which the state geological services of the federal states can be ... supported in the explo-



Specifications in 1,000 t unless otherwise indicated.

Illustration 15: Raw material production in Germany in 2020 by quantity (source: BGR 2020)

ration of raw materials". From Saxony's point of view, this important **Measure 4** to secure raw materials urgently requires a uniform content design, especially since there is already a concrete Saxon need for this. Another measure to secure raw materials is the Federal Republic's appeal to the federal states for sufficient staffing of the approval authorities and the anchoring of the aim to secure raw materials in regional and state planning, which is what the program to be developed should serve, and which is to be supported from Saxony's point of view.

In accordance with **Measure 5**, the BGR is currently building an international Research and Development Centre for Mining Impacts (FEZB) in Cottbus. The aim of the FEZB is to pool the existing competencies from 30 years of mining rehabilitation, but also to support the process of transforming the mining regions that still exist today.

The Free State of Saxony has proportionately financed the rehabilitation and revitalisation of the non-privatised legacies of East German lignite mining from the outset and is actively involved in shaping the post-mining landscape. The true competencies that already exist for this must therefore be taken into account in the work of the research centre. However, cooperation in the transformation process of the mining regions in Germany and through the bodies in the EU seems to be even more important, as this represents the basis for the further economic development of mining regions.

The Federal Republic of Germany uses untied financial loans to "secure raw material projects abroad against economic and political credit default risks" (Measure 9). Domestic new raw material projects, especially on critical raw materials, have not yet received such protection. Even if Germany has political stability as an advantage for project sites, new domestic mining projects also need financial security as a prerequisite for easier access to the financial markets. This protection should not be a task for the federal states alone but should be supported by the Federal Government.

In recent years, a number of legal changes and new laws have been passed, which have strengthened circular economy and allowed valuable raw materials to be extracted from production chains as secondary raw materials. With full awareness of the complexity of these projects, for example in the recovery of special metals, including e.g. lithium and a number of by-products of carrier metals such as tin and lead (with some of these presenting a toxicity that is the subject of ever stricter regulations by the EU), there is obviously a need to further develop processing technology and "new metallurgical processes". Consequently, in **Measure 12**, the offer to fund "research and development projects in the areas of processing technology and metallurgy" is suggested. The BMBF research project on resource-efficient circular economy will run until 2023.

Saxon industrial research and academic research is well positioned in this respect too, in addition to the not inconsiderable participation in European research programs. The Geo-Competence centre of Freiberg was able

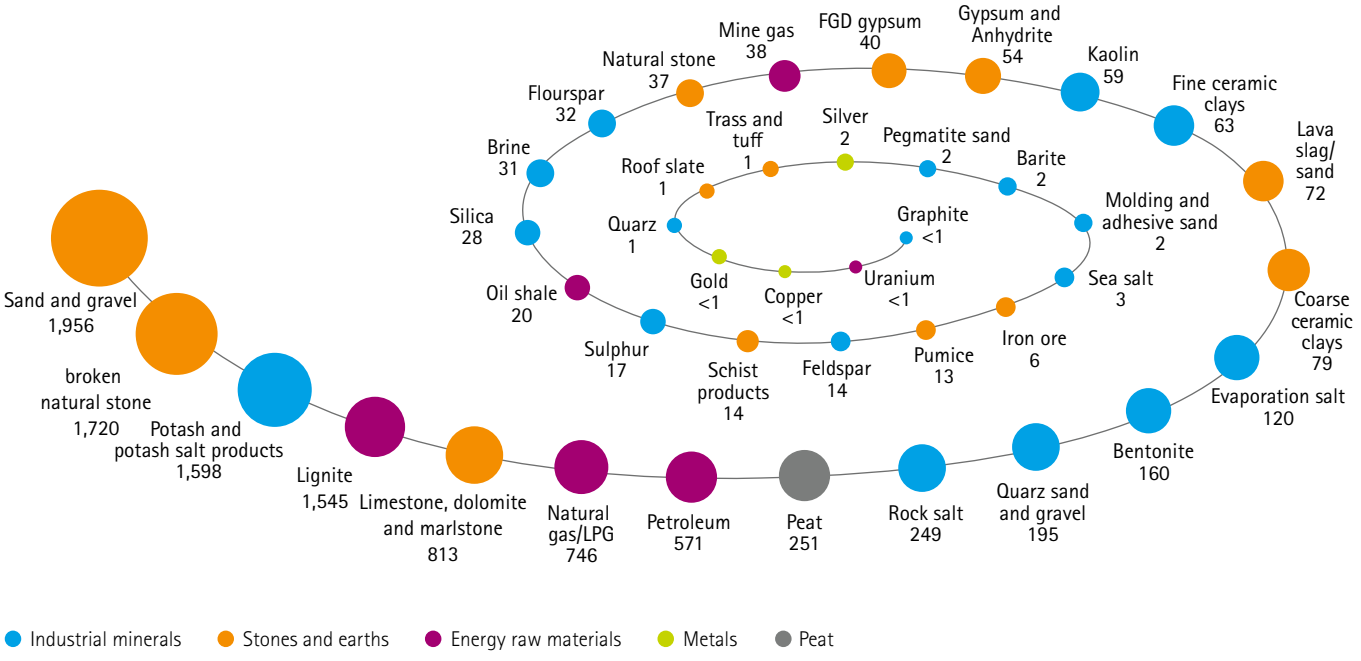


Illustration 16: Raw material production in Germany in 2020 by value (Source: BGR 2020)

Illustration 17: Kahnsdorf lagoon at the Hainer Lake – former Witznitz opencast mine (Source: LMBV/Christian Bedeschinski)

to optimise the framework conditions for this, as co-author of the new European SRIA (Strategic Research and Innovation Agenda) on circular economy.

With the founding of the Helmholtz Institute Freiberg for Resource Technology (HIF) in 2011, the Federal Republic of Germany made a decisive contribution to strengthening the mining location of Freiberg. Located in the middle of Saxony, the HIF is to develop technologies for a more sustainable use of mineral and metalliferous raw materials, in view of circular economy, in connection with the TU Bergakademie Freiberg and partners from industry and other academic institutions. The Free State of Saxony expressly supports this approach. In addition, as outlined in the Saxon Innovation Strategy, the market launch of new processes and technologies to valorise research and development results should be promoted. Further technologies will also have to be developed, due to, for example, the use of high-tech raw materials in the field of energy storage, but they will only be needed when these materials return to the cycle after a few years. For this reason, the commitment of the Federal Government to the location should be continued and expanded. The opening of the Metallurgy Technical Centre at the HIF on 9 September 2021 was another milestone in this chapter.

With its Raw Materials Strategy, the Free State of Saxony ties in with the goals of the federal Raw Materials Strategy.

With the founding of the HIF in Freiberg, the Federal Republic of Germany has made an excellent contribution to the development of technologies for sustainable circular economy.

With the new Saxon Raw Materials Strategy, cooperation with the federal authorities and ministries is to be expanded and intensified. The measures offered by the Federal Raw Materials Strategy are to be brought to life.

Critical raw materials					
Antimony	Cobalt	Hafnium	Natural graphite	Phosphorus	Vanadium
Barite	Coking coal	Heavy rare earths	Natural rubber	Scandium	Bauxit
Beryllium	Fluorspar	Light rare earths	Niobium	Silicon metal	Lithium
Bismuth	Gallium	Indium	Metals of the platinum group	Tantalum	Titan
Borate	Germanium	Magnesium	Phosphorite	Tungsten	Strontium

Illustration 18: Critical Raw Materials Overview (Source: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions; Critical Raw Materials Resilience: Charting a Path towards greater Security and Sustainability; COM 03.09.2020)

Illustration 19: Schleben-Crellenhain opencast kaolin mine (source: SMWA/Ronald Bonss 2022)

The Saxon raw material economy in a European and international context

Climate protection, energy transition and digitisation require sustainable, innovative and environmentally friendly mining as well as the massive expansion of circular economy and the use of renewable raw materials with regard to the necessary provision of resources. There is the same understanding of these objectives at European, national and regional level.

European awareness of international mining standards has grown. European standards form the benchmark for action and are integrated into corporate responsibility.

With the Supply Chain Act, Europe has imposed rules that should also have an effect outside of Europe. Sustainable and responsible corporate action is required in all global value chains. Negative impacts on human rights, environmental pollution and the loss of biological diversity should be prevented. As international mining is often associated with degrading and life-threatening working conditions, child labour and environmental destruction, there is a special need for action here.

Internationally, it is also apparent that the strategic raw material framework conditions have continued to change. China plays a prominent role on the raw materials market. The Chinese two-pillar raw materials policy includes the efficient expansion of the extraction and use of domestic raw materials and the improvement of access to foreign resources (Asia and especially Africa) through direct investments.[10] The current importance of China for industrial metals in the global raw materials sector is enormous, as China is the most important producer of 19 of the 30 raw materials classified as critical by the EU.

The extraction of critical raw materials is concentrated in a few countries. In addition to China, South Africa (metals from the platinum group), the Democratic Republic of the Congo (cobalt), Brazil (niobium) and Australia (lithium) are of particular importance. It is still unclear whether it will be possible to recover these critical raw materials as secondary raw materials on an industrial scale and in an economically viable way in the future.

In view of this situation, the European and also national positions on the question of the origin of the raw materials of the future must be critically reconsidered. With the existing and known raw material deposits in the Free State of Saxony and the progress towards circular economy, the Saxon raw materials industry can make a significant contribution to pushing back the procurement of "critical raw materials" on predominantly international markets. However, this requires active proceedings and the support described at European and national level, not a copy of state geopolitics such as in China's case. A consistent and bold application of the European three-pillar strategy is required as a win-win arrangement for everyone involved.

In this understanding, the new raw materials strategy of the Free State of Saxony fits into the European and national context, striving towards the goal of sustainable, modern and competitive raw material extraction and use, in the areas of both primary and secondary raw materials. In addition, the new Saxon Raw Materials Strategy also addresses the future challenges of renewable raw materials, raw material efficiency and raw material substitution.

10 DERA (2019): Insights into the Chinese raw materials economy.

4 Goals of the New Saxon Raw Materials Strategy

Due to the superordinate European and national guidelines for raw material extraction and use as well as modified geopolitical framework conditions, that have changed, the Saxon Raw Material Strategy needed to be redesigned. The strategy pursues five main goals, taking into account future challenges in terms of raw material requirements, raw material availability and raw material access, but in particular also for climate protection and the reduction of greenhouse gas emissions.

1. Saxony's contribution to the European Green Deal

Europe wants to achieve climate neutrality by 2050 at the latest and drastically reduce greenhouse gas and pollutant emissions in various areas of life. Germany is already aiming for climate neutrality by 2045, and Saxony is also pursuing this goal (EKP 2021). The restructuring of the energy and mobility sector, ecologically sustainable construction and the digitisation and development of future technologies are in full swing. Significant high-tech raw materials and mineral raw materials required for this are available in the Free State of Saxony. Short delivery routes, closed value chains and increased resilience to supply bottlenecks strengthen their value. The basis of the local raw materials industry will represent a strong Saxon contribution to the implementation of the goals of the European Green Deal (including the biodiversity and restoration goals) and the Saxon sustainability strategy.

However, the cultivation or extraction of raw materials and their subsequent treatment as well as the transport itself release GHG emissions, and areas that could act as GHG sinks are subject to a change in land use.

2. Long-term securing of raw materials supply

Raw materials form a cornerstone of a modern and competitive economy and make a significant contribution to social prosperity. The aim is to secure the supply of raw materials in the long term. A firm and strong anchoring of this aim in state and regional planning, but also in the technical strategies of the Free State of Saxony, is therefore increasingly necessary for the future.

3. Mining extraction of local primary raw materials

The mining of primary raw materials is an important pillar of the raw material supply in Europe, Germany and Saxony. The aim of the Free State of Saxony is to provide even more support for the use of local raw materials through mining projects in order to develop and use raw material deposits. These include both existing and new mining projects, which take place in compliance with legal requirements and the highest environmental, quality and social standards. The raw materials are to be extracted using state-of-the-art technology, with minimal land use and, if possible, without new spoil heaps and waste dumps. Waste rock and processing residues should be returned underground as much as possible, unless they can be used in another way that is suitable from a sustainability point of view.

The use of near-surface geothermal energy as a domestic form of energy and as a contribution to the "heat transition" is to be expanded.

4. Use of secondary raw materials

The use of secondary raw materials is the second important pillar of a sustainable supply of raw materials in Europe, Germany and Saxony, the proportion of which must increase. The Free State of Saxony aims to further promote the recycling of raw materials that are already in economic circulation and to support the secondary raw materials industry and research with regard to innovations and investments. The primary and secondary raw material industries are mutually dependent and are part of a resource-efficient circular economy.

5. Use of renewable raw materials

The use of renewable raw materials will continue to gain in importance due to their potential to substitute mineral primary raw materials. Due to the limited availability of land, this requires an intelligent use of land resources that reconciles the goals of the Raw Materials Strategy with the goals of food security, the European Green Deal, the national biomass strategy and bio-economy (material/energy) as well as all other land uses.

In order to strengthen the potential of a raw materials economy with a solid base, the requirements, experiences and innovations of the mining and secondary raw materials industries must be combined with those of bio-economy in the areas of industry, trade, energy management, agriculture and forestry, as well as science. In addition to the production of raw materials using existing land resources, demonstration projects and real laboratories as well as an area-independent, industrial bio-raw material production will be established more strongly in the future.

5 Guidelines and key areas of action

In 2012, guidelines were developed for the first time as directions for the coming years in the "Raw Materials Strategy for Saxony, Raw Material Management – An Opportunity for the Free State of Saxony". Guidelines are also the central element of the new Saxon Raw Materials Strategy.

The guidelines are underpinned by key areas of action. Some of the key areas of action are already being implemented, while the content of others needs to be specified or updated. This is why the Free State of Saxony, headed by the Saxon State Ministry of Economy, Labour and Transport, will set up a Raw Materials Strategy working group with the task of deriving concrete tasks from guidelines and key areas of action, and of initiating and supporting their implementation. In addition to the affected departments of the state government, other actors and institutions from the field of raw materials management are to be involved for reinforcement and technical support.

Constant exchange with economic actors and companies is very important. They are the ones who seek out, extract, prepare, process and market raw materials under free market conditions. This secures the future of the Free State of Saxony as a mining state and is a prerequisite for further and effective expansion as a state of secondary and renewable raw materials.

A major innovation compared to the Raw Materials Strategy of 2012 will be the deep anchoring of digitisation that is present in the guidelines. In addition, the guidelines are consistently linked to one another.

In the Saxon raw materials strategy, the focus is on a secure and sustainable supply of raw materials, due to the still increasing demand. The execution of the associated tasks creates a pressure to innovate and invest, which can contribute to the emergence of new technologies and processes and tie in with the goals of the Saxon Innovation Strategy. Improving material efficiency, by saving raw materials in production processes for example, by changing product design and by avoiding waste, also represents an important building block for raw material security. However, these topics are reserved for other Saxon technical strategies with which the Raw Materials Strategy is interlinked, in particular the Sustainability Strategy, the Innovation Strategy and the EKP 2021.

The content of the Raw Materials Strategy and the measures derived from it do not constitute a precedent for the provision of budget funds by the Free State of Saxony. They cannot generate a claim for implementation, financing or financial support.

G1 – Saxony as a mining state

Saxony is a mining state and should continue as such in the future. The local framework conditions for the sustainable and responsible extraction of local primary raw materials characterise the Free State. They are an essential prerequisite for social prosperity and economic growth. The state's potential, in particular for critical raw materials and high-tech raw materials, but also arising from a strong domestic stone and earth mining industry, enables a significant Saxon contribution to the reinforcement of the economy and to the safeguarding of social prosperity and environmental protection, especially in the areas of energy supply, energy storage, electromobility and energy-focused building renovation. A secure supply of raw materials thus contributes to the success of the central fields for the future that are digitisation and the environment/Green Deal, in accordance with the Saxon Innovation Strategy.

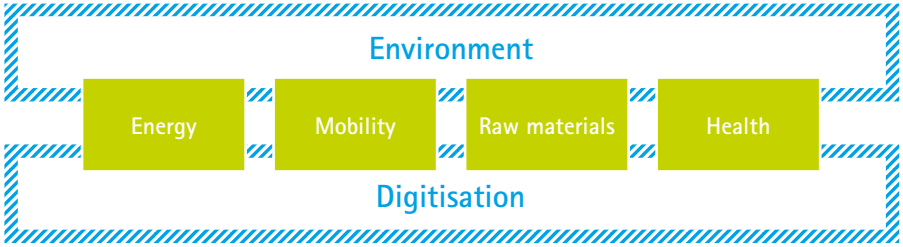
The past decade has brought many mining investors to Freiberg. Permissions and permits were generously granted. Nevertheless, this has not made it possible to develop new mines. This expressly entrepreneurial decision, which depends on various factors such as long-term demand, availability and the price development of raw materials, cannot be taken away from companies in the future either. However, they can be helped by further valorising Saxon "natural resources", for example through expanding knowledge of these Saxon raw material deposits. The possibilities of the Federal Raw Materials Strategy should also be used for this purpose.

If the primary data of a deposit is known and there are no fundamental reasons that prevent it, the results of a feasibility study are usually required for technological, permitting and financial progress. The Federal Raw Materials Strategy (Measure 3) aims to examine how companies can be given financial support in this regard. However, budgeting and a general procedure for this do not yet exist. The Free State of Saxony will request this from the Federal Government and will provide interested parties with appropriate assistance for applications.

A reliable valuation of Saxon deposits, especially with regard to the geology of the deposit and the degree of exploration according to uniform international standards, is another possibility to enable and increase attractiveness, especially with regard to the necessary external financing, also for non-specialist third parties. Such international standards have been defined in Australia and Canada, for example, but also in Europe (PERC = Pan European Reserves and Resources Reporting Committee). As most exploration and mining companies are publicly listed, they are required to report regularly and publicly on their resources and reserves in accordance with stock exchange principles.

For the greatest treasure yet to be uncovered, however, no further drilling exploration is required; the need is for viable and vigorous local connections between deposits and industrial sites. Last but not least, the effects of pandemics, wars and non-warlike political influences have clearly shown how valuable closed Saxon value-added and supply chains are. A successful example of this is the value-added chain through fluorspar and barite, from extraction to preparation and processing in Saxony. This connection potential for high-tech raw materials is also available for lithium, tin and other raw materials due to the proximity of raw material, metallurgical and processing locations in Saxony.

The age of digitisation has long since begun in mining. However, much effort is still needed to achieve a standard that will lead to noticeable relief and thus real added value in mining. The ROHSA 3 project is a very important step in this direction. The instruments created here must now be consistently maintained, updated and further developed in order to successfully valorise them. It has proven to be an advantage to make this geological data[11] publicly accessible. The qualification of the data can be used, for example, for the creation of 3D models in the planning and implementation of infrastructure projects, for the development of models for deposit formation and for improved deposit forecasts, for the determination of low-conflict raw material potential areas as well as for the aftercare and development of post-mining landscapes.



Trends: sustainability, connectivity, customization, advertising, intelligent products, infrastructure and systems, knowledge culture ...

Illustration 20: Saxon areas of the future (Source: Innovation Strategy of the Free State of Saxony)

11 www.rohstoffdaten.sachsen.de

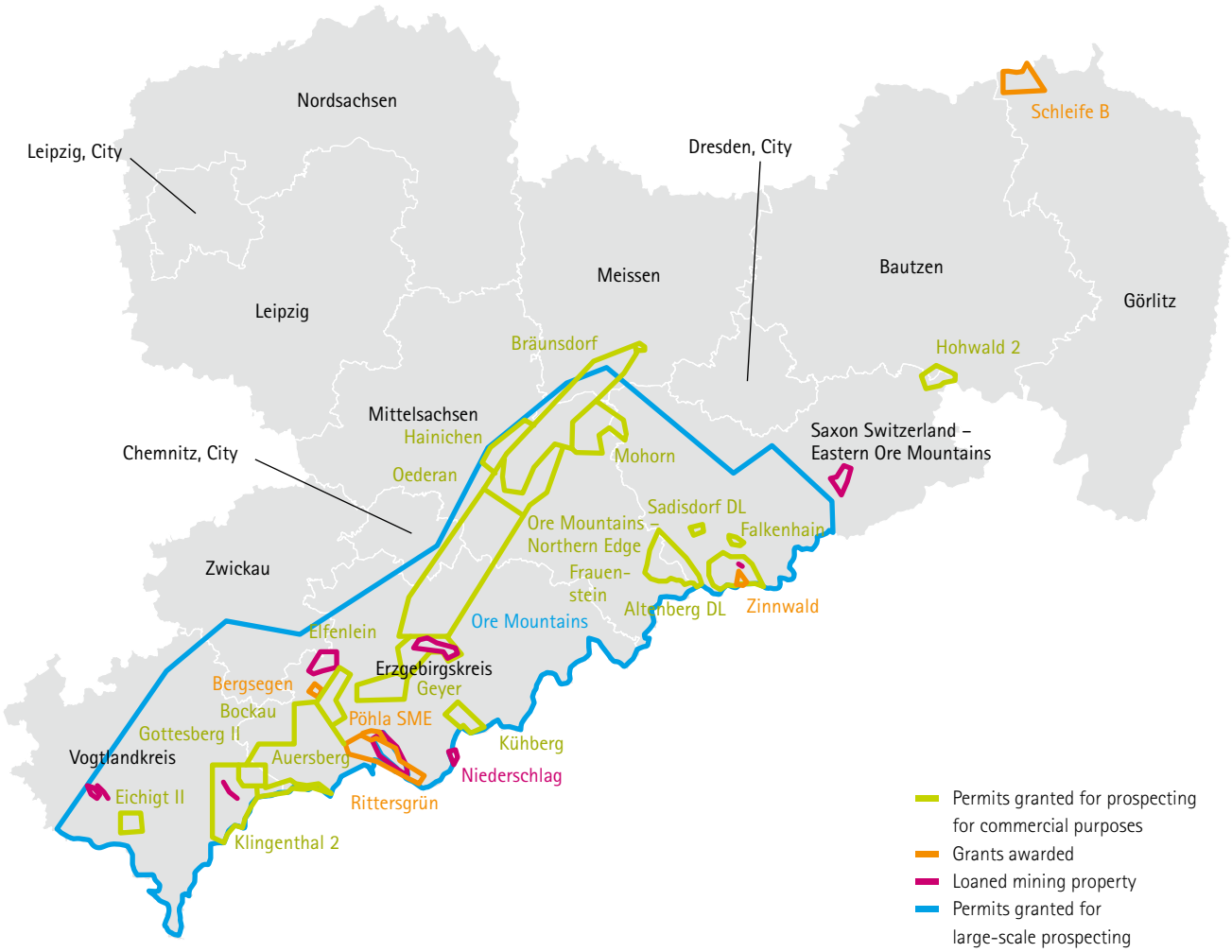


Illustration 21: Mining permits for ores and spars – as of 04/2022 (Source: OBA 2022)

Process management and the start of the digitisation of application and approval procedures are further successful building blocks, in which the Saxon mining administration has a pioneering role in Germany, along with the State of Lower Saxony, under the direction of the Rhineland-Palatinate region. They are to be achieved through the "EfA mining" project (One for All) as part of the implementation of the Online Access Act.

But what use are the best deposits and knowledge if extraction is not possible due to competing uses? Securing areas for raw material extraction and the long-term securing of raw material potential areas within the framework of regional planning will become even more important in the future. Investment decisions in mining projects apply to periods of several years. Their regional planning foundation must therefore be solid and balanced. It is in the overriding interest of the state to continue to secure Saxon mineral resources in the long term within the framework of regional planning.

Centuries-old mining in the Free State of Saxony has had a major impact on nature and the landscape. However, the Free State of Saxony and the companies responsible have made the rehabilitation of these legacies a task that is just as important as the dismantling phase. It is important to consistently continue these tasks even with changing framework conditions such as the phase-out of coal and the effects of climate change. Because only the complete fulfilment of all mining law obligations creates the trust that is needed in society to launch new projects.

INFOBOX Wind turbine foundations

The foundations of onshore wind turbines are predominantly made of reinforced concrete. Depending on the size and type of the system, the construction, the nature of the subsoil and other factors, approx. 1,400 to 2,600 tons of raw materials are required for a single foundation, of which around 94 to 96 percent are concrete and around four to six percent are steel.

Source: Federal Environment Agency 2021 – final report, update and evaluation of the life cycle assessments of wind energy and photovoltaic systems, taking into account current technological developments

Each extraction phase also has an aftercare phase. The improved public linking of these topics, but also open corporate communication are elements that create lasting trust. With the expansion of "Interim Nature" projects, companies can prove the seriousness of their increased commitment to nature conservation. When raw materials are mined, primary parts of the landscape and habitats for animal, plant and fungal species are irretrievably lost. In many places, however, secondary landscapes and habitats have emerged that temporarily offer very special living conditions for rare species. This creates opportunities for pioneer locations and pioneer species that benefit from the "Interim Nature" concept. In the future, the Saxon raw materials industry should therefore increasingly focus on possible synergies between the extraction of raw materials and the promotion of biodiversity.

The legal framework for mining is constantly changing. The Federal Mining Act is a solid basis for mining in Germany, which must be continually adapted to the requirements of the raw materials industry. The Free State of Saxony will therefore actively support the further development of mining law at the federal level in terms of sustainable raw material extraction and use. Similarly, the Free State will review and, if necessary, update the state law regulations of the Saxon Mining Ordinance with regard to raw material supply requirements.

When updating the Land and Extraction Fee Ordinance, the interests of domestic raw material use should be adequately taken into account. To this end, the scope of state law should be designed in such a way that a fair and appropriate balance between state and corporate interests is guaranteed. The aim is to support long-term investment decisions in the area of mining raw materials extraction and use with legally secure financial framework conditions.

In the field of geothermal energy, a continuous increase has been seen in the approval of geothermal systems in Saxony for many years. The main potential of these systems lies in the fact that the energy is generated locally, consistently and regardless of the weather. Due to its

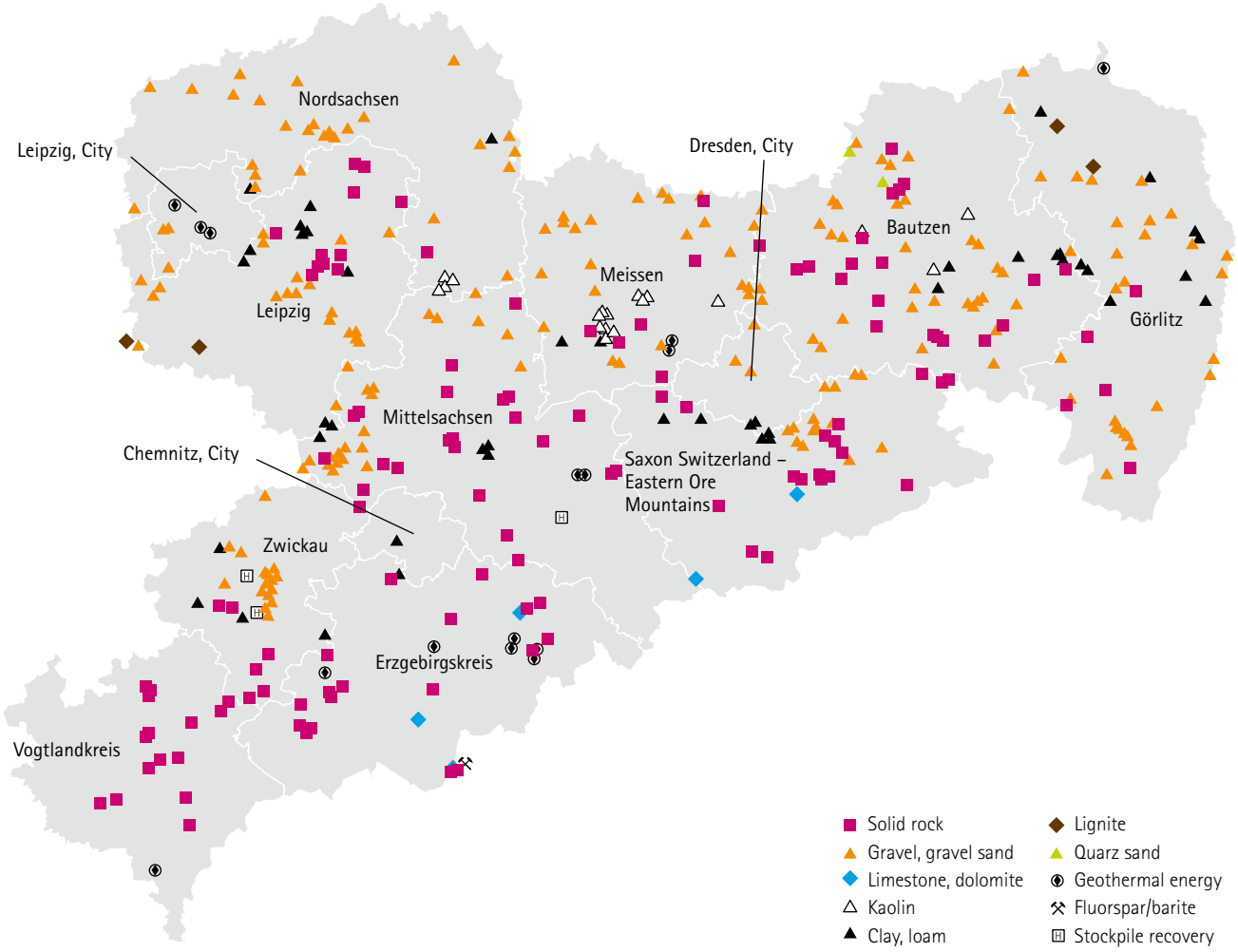


Illustration 22: Mining operations in Saxony – as of 04/2022 (source: OBA 2022)

Illustration 23: Interim nature – sand martins (Source: UVMB/Oliver Fox 2022)

geological conditions, Saxony is a predestined region for further research, development and use of geothermal systems both for heat use and for power generation as an important part of future energy supply.

Key areas of action G1:

- Continuation and expansion of digitisation and valorisation, especially in the areas of raw material data and approval procedures
- Uniform evaluation of the Saxon raw material deposits according to international standards
- Continuation of the raw material geological state survey in connection with the framework conditions of the federal raw material strategy
- Development of the Ore Mountains into a European model region for sustainable and modern mining
- Regional planning protection of areas for raw material extraction and long-term securing of raw material deposits, in particular by defining priority areas and defining a state interest
- Initiation of new closed Saxon value chains through connections between mining, raw material processing and industry
- Application and use of the Saxon natural and stone cadastre by Saxon contracting authorities (training/ consulting)
- Continuation/expansion of state guarantees for investments in the raw materials sector
- Intensification of target group-oriented public relations work, especially in the areas of aftercare, environmental protection and communication, also to increase acceptance
- Further development of mining law at federal level and review of state regulations in terms of sustainable raw material extraction and use
- Examination of state regulations on land and extraction fees with regard to mining investment decisions
- Continuation of exploration and research measures on potential uses of medium-deep and deep geothermal energy in Saxony
- Greater implementation of possible synergies between raw material extraction and biodiversity promotion over the entire project period (planning, extraction activities, rehabilitation).

G2 – Saxony as a state of secondary raw materials

In recent years, the Saxon secondary raw materials industry was able to further improve the recovery of raw materials from waste and their use in production, both qualitatively and quantitively. According to the coalition agreement from 2019 to 2024, Saxony is to become a location of excellence for recycling technologies and assume technological leadership in this area with the aim of developing innovative processes for use on an industrial scale. For this purpose, Saxony is to be further developed, as a state of secondary raw materials, into a strong pillar of the raw material supply for Saxon industrial and craft businesses in line with the Saxon Sustainability Strategy. The fundamental priority of reuse and further use (waste avoidance) over recycling remains unaffected. Every step towards increasing the substitution rate counts, especially against the background of increasing demand for raw materials.[12]

Improving the quality of secondary raw materials, for example through higher material purity, is a key objective. The extraction of recyclable materials that are only contained in traces and the management of material composites, hybrid component structures and a large number of materials during recycling require specific know-how, complex and expensive processes and systems and further innovations. System losses of secondary raw materials due to their irreversible change are to be avoided.

INFOBOX Metallurgy in Saxony

The metallurgical industry is an important branch of the raw materials industry. It is necessary for the production, conversion, processing and preparation of metallic raw materials (including iron ore) and non-metallic raw materials (including quartz sand). In addition to raw materials obtained from mining, scrap and recycling materials form the basic material for metallurgy, with steel and aluminium in particular being almost completely reusable. The Free State of Saxony has numerous companies, research and development facilities and training positions in the field of metallurgy.

The better the knowledge about the waste, co-products and by-products that occur, the better recycling processes can be optimised and feedback can be given in production to optimise product and process design. It therefore remains important to improve the knowledge base. To this end, data on material and waste flows from existing official statistics must be better used, but above all, gaps in knowledge must be closed through the voluntary provision of data and information by companies and associations. The goals of the raw materials industry would be served by a better use of information platforms such as the IHK recycling exchange and the company database ECO-Finder, the Green Tech Atlas or the official plant register for disposal and waste treatment plants "abensa",[13] as well as by the combination and further development of these information sources including marketing.

The networking of the players in the primary and secondary raw materials industry with processors and producers must be improved, as well as the connections within the hitherto multi-part network structure in the Saxon secondary raw materials industry. The central challenge remains to find structures and mechanisms that ensure committed participation by the companies themselves and make them the main drivers of the networks.

The currently strong spirit of optimism and the driving force behind voluntary commitment to new alliances and the use of synergies in the technical skills of all actors in the value-added networks (e.g. Circular Economy Initiative Germany and the dialogue platform for recycling raw materials) should be supported.

For the secondary raw materials industry, the increased use of digitisation for coding, sensor technology, robotics and other areas offers enormous opportunities for the automation of processes, for the improvement of secondary

12 According to current study results, the circular material use rate can be increased from the current 12 percent to a maximum of 18 percent by 2030 (Source: IFEU (2021): Secondary raw materials in Germany).

13 http://www.abensa.de/

Illustration 24: Alloy smelting (Source: Nickelhütte Aue 2022)

raw materials quality and to relieve employees of hazardous or stressful activities.

Circular economy plays a key role in becoming less dependent on raw material imports, strengthening regional value networks and closing regional chains. Saxony already has closed value chains for some secondary raw materials (e.g. lead, tin, fluorine, building materials). This is to be achieved for other raw materials by using existing structures and through the networking of branches and research competencies rooted in Saxony.

The comprehensive transformation of the economy to implement the EU Green Deal increases the need for specific raw materials. As a location for innovative technologies of the energy transition (lightweight construction, electromobility, photovoltaics), Saxony is particularly called upon and required to conceive the entire length of these chains in a sustainable way, including the development of recycling processes, for example for carbon concrete and batteries of all types.

The high ecological requirements of the EU Green Deal require "high-tech" solutions in many respects. Many measures lead to the limits of technical feasibility and very high costs. The instruments available for the financial support of corporate investments in climate and environmental protection, in particular Saxon support programs, must therefore be regularly checked for any need for adjustments.

High-quality recycling with removal of pollutants often results in a mirror-inverted concentration of pollutants in residues. There must be economically viable sinks for such residual waste (incineration, landfills). Old landfills, mining heaps and smelter residues often still contain valuable materials that cannot be recovered economically by today's standards. Until research finds ways in which secondary raw materials can be economically recovered from these sinks (e.g. by combining rehabilitation and resource recovery), this option must be kept open, including by setting up a cadastre.

The secondary raw materials industry must be acknowledged and valued even more in society as part of the raw materials industry and as part of the solution for environmental and climate protection goals. Circular economy can save significantly more GHG than it generates itself, through energy generation and savings and through savings at different stages of the value chain. Throughout the EU, Prognos assumes a CO_2 savings potential of at least 150 million tons CO_{2eq} by 2035.[14]

The public demand for services using recycled products is essential as a market stimulus and to promote acceptance. However, there are still unjustified exclusions by public clients simply through wording in tenders such as "natural" aggregate or "asphalt". In this regard, § 10 SächsKrWBodSchG (exclusion of recycling material only in exceptional cases and only with plausible justification) must become even more effective and corresponding training offers for contracting authorities are required, in the spirit of the work of the Saxon Environmental and Climate Alliance.

14 Source: https://www.bde.de/documents/411/2022-co2-saving-europe-waste-management-circular-economy.pdf

Illustration 25: Paper recycling (Source: Becker Umweltdienste GmbH 2022)

For better acceptance of secondary raw materials and recycling products on the market, it is also important to introduce or establish and strengthen appropriate quality assurance systems and end-of-waste criteria in accordance with § 5 of the Closed Substance Cycle Act. Recycled products with product status have better market opportunities than "certified waste". Related activities at EU and federal level should be supported.

As the construction and operation of plants for the secondary raw materials industry is also associated with environmental pollution, it makes sense to locate them on existing structures and sites with intensive previous industrial use. The Saxon lignite mining areas undergoing structural change are ideal for this. At the same time, the potential recycling industry opens up new perspectives for the change to future-oriented industrial locations. Many project applications are already focusing on Lusatia as a new focal point for research and the implementation of circular economy technologies.

In view of the very high regulatory density of EU and federal law on circular economy, which is expected to continue to increase, the Free State of Saxony intends to continue using its opportunities to help shape legislative processes in order to work towards designs and measures that are practicable, proportionate and as unbureaucratic as possible. This should continue without delay, in the interests of technology-openness and flexibility, and with the active participation of those affected.

The German economy continues to lose large quantities of raw materials through the export of waste abroad. This is particularly critical if they are not sent to a high-quality recycling process there (e.g. scrap). The secondary raw material recovery should therefore preferably take place domestically. Changes in waste shipment law can bring about improvements in this area.

Key areas of action G2:

- Further development of processes, e.g. to improve the quality of recovered secondary raw materials and the recoverability of critical raw materials
- Improvement of the knowledge base through better use and further development of existing information sources and exchange platforms and closing data gaps
- Intensification of the networking of the primary and secondary raw materials industry with active corporate participation
- Consistent digitisation of all areas of the secondary raw materials industry (including automation, digitisation and use of artificial intelligence)
- Strengthening regional value-added networks and closing regional economic cycles, especially closing material cycles for future-oriented technologies of the energy transition (e.g. electromobility, lightweight construction, photovoltaics)
- Development of a register of secondary raw materials potentials, similar to ROHSA for primary raw materials
- Encouragement of public demand for recycled products
- Introduction/strengthening of quality assurance systems for recycled products and end-of-waste criteria
- Strengthening of the social perception of the secondary raw materials industry as part of the raw materials industry and as a contribution to the achievement of environmental and climate goals

G3 – Saxony as a state of renewable raw materials

Renewable (biotic) raw materials form the basis for a fossil-free, biodiversity-friendly, actually sustainable, waste-free and thus viable economy and way of life. Bioeconomy, decarbonisation and bio-intelligent value creation are terms that are closely linked to renewable raw materials, co-products and their secondary raw materials. Bioeconomy, as a form of economic activity, relies on the efficient use of biological, renewable resources such as plants (including wood), animals and microorganisms. Saxony would also like to support and significantly expand this path, in line with the Sustainability Strategy.

In 2020, the Federal Government passed the "National Bioeconomy Strategy". Saxony has been able to to drive a first series of activities in the fields of action presented. In the future, new framework conditions, including those of the EKP 2021, are to promote the transformation to an economy that is also based on renewable raw materials.

There are many different ways of producing and using renewable raw materials and converting them into other biological products. However, the depth of technological implementation throughout the different links of the value chains is currently very heterogenous. The future orientation of bioeconomy must be open to various different substrates, utilisations and technologies.

Close cooperation between actors from politics, business, science, ecology and civil society is necessary for the development of bioeconomy. At both state and federal level as well as in science and business, there is usually an intensive networking of actors. An open culture of innovation and freedom for science and research are very important for restructuring the economy. Information and automation technology as well as digitisation support this process.

Fields of action for sustainable bioeconomy to improve the political framework

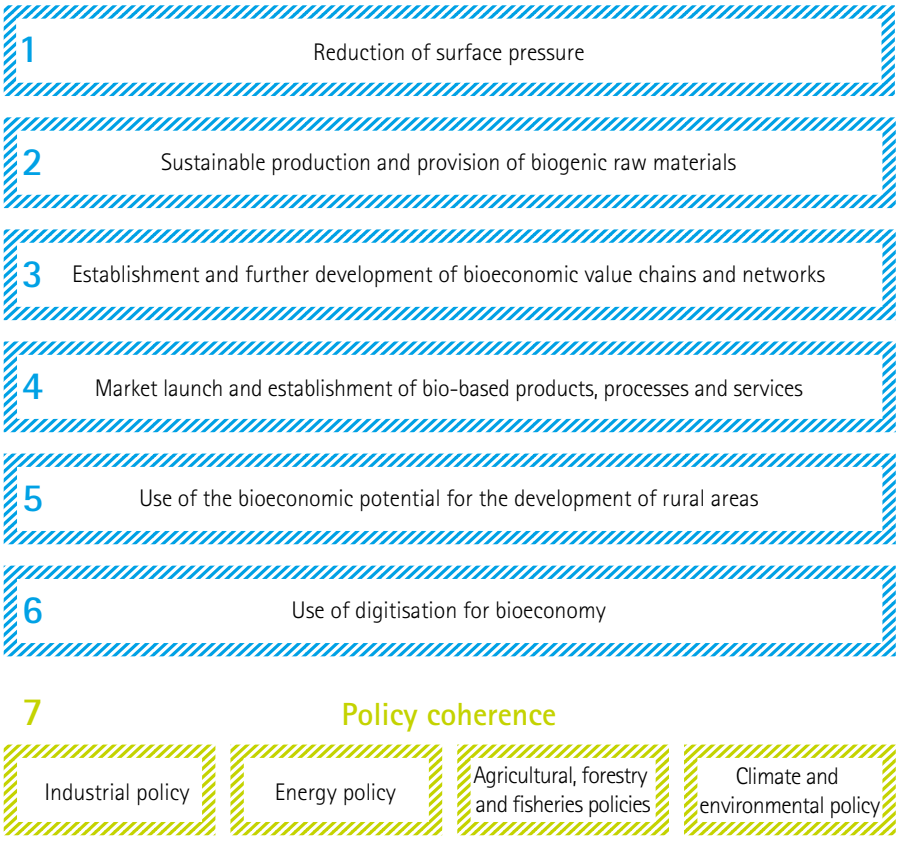


Illustration 26: Bioeconomy fields of action (Source: BMEL, National Bioeconomy Strategy)

The provision of biomass and energy from renewable raw materials and their further material and energetic use (cascade use) is associated with a large number of positive aspects in the cultivation regions, which can be implemented to a large degree with sustainably designed utilisation lines without intensifying the competition for land.

The energy-focused utilisation of renewable raw materials has so far been developed furthest with the generation of electricity by means of biogas production, with biogenic fuels and with heat generation. In the future, taking into account the competition for land and the Green Deal, it will be important to increase the efficiency of energy production from renewable raw materials and the interlocking of the sectors of electrical energy storage/use and chemicals/fuel production.

In order to avoid conflicts in the cultivation of renewable raw materials, intelligent use of scarce land resources is essential. Suitable areas for cultivation are to be identified and the discrepancy between the limited availability of land and a wide range of usage and protection requirements must be resolved. With a future aim to increase the use of wood for material, chemical and energy products, there are also other social goals with regard to increasing carbon storage as well as the protection and increase of biodiversity in forests.

Areas that are particularly important for nature conservation are fundamentally not to be used for the cultivation of renewable raw materials. In general, high environmental standards must also be observed when cultivating renewable raw materials in order to minimise negative effects on biodiversity, which can be achieved excellently, for example, through site-adapted energy crops, varied crop rotations, reduced use of pesticides, sufficient border structures and environmentally friendly harvesting methods. The cultivation of genetically modified plants should thereby be avoided.

In the case of renewable raw materials, a distinction must be made between cultivation on agricultural land and the production of wood on forest land. In particular, climatic changes, drought and the conversion to climate-stable, resilient mixed forests represent major challenges for forest areas. As a consequence of the scarcity of land and the change in social objectives, areas with multiple uses (multifunctionality) will continue to gain in importance in the future, such as through combinations of agricultural use and renewable energy

Illustration 27: Wood as a renewable raw material (Source: Lothar Sprenger 2020)

generation through agrophotovoltaics and agroforestry systems.

In the field of wood processing, the production of fossil-free consumer products already plays a major role. In the first processing stage, 84 percent of softwood and 30 percent of hardwood are destined for material use. In the timber industry, the cascade use of material, chemical and energetic uses is also particularly advanced. There are various processing stages, as well as by-products and waste products, that are already being used today. The aim for the next few years is to increase the use of wood, taking into account regional value chains, as a substitute for other energy-intensive building materials.

Due to the market conditions, material use in agriculture has so far only taken place to a small extent, although a lot of research work has been carried out in this area in the past. Examples of this are the use of agricultural fibres, 3D printing processes from ground renewable raw materials and the packaging of medical products.

The material, thermal and industrial utilisation of agricultural and forestry products has considerable development potential as part of a bio-based economy.

The use of wood and other renewable, ecological building materials, in particular recycled and reusable materials, should be promoted by the administration in the public building sector. Legal obstacles to the use of these materials must be overcome. For the implementation of public sector construction projects, Saxony wants to set a good example and make greater use of innovative and recyclable building materials and strengthen its own expertise and experience in this area.

Key areas of action G3:

- Expansion of decentralised material cycles based on renewable raw materials, including the use of waste materials, residual products, co-products and by-products as well as cascade use to conserve resources
- Development of strategic considerations to increase the availability of space for renewable raw materials, taking into account existing usage and protection requirements
- Identification of the potential for substituting mineral raw materials with renewable raw materials
- Increasing wood construction quota and the use of wood in the construction industry as well as reducing the discrimination against wood and other renewable raw materials in relevant regulations and guidelines
- Creation of ecological, economic and social value chains with renewable raw materials to strengthen the economic area of Saxony
- Establishment of a driving and coordinating committee, including policy advice on bio-based management

G4 – Reinforcement of the Saxon raw material economy

The networking of competencies was and is an essential basis and source for scientific and technical progress in the Saxon raw material economy as well as a goal of the Saxon Sustainability Strategy. For this reason, the networking of the actors should be intensified, including internationally, and the potential of the unique raw materials general expertise present in Saxony should be further expanded. Everyone contributes and everyone participates. The Free State of Saxony would like to stay in regular contact with all stakeholders on the topics of the Saxon Raw Materials Strategy.

The Saxon raw materials industry has long-standing international contacts with countries with raw materials and needs even more of them. It is important to expand international relationships and to improve the marketing of the complete range of existing competencies in Saxony.

It is a good investment for the future to establish firm and authentic contacts with the managers of tomorrow at an early stage and thus create a connection that will last in the long term. The connection of Saxon raw materials-relevant universities with foreign students also contributes to increasing the good reputation of Saxon universities, colleges and research institutes – in particular the TU Bergakademie Freiberg as the oldest mining university in the world and as a modern, internationally renowned resource university.

The Free State of Saxony would like to develop the Saxon Raw Materials Day into a new, internationally oriented Saxon conference format on topics relating to the Saxon Raw Materials Strategy, using it to report on changes and progress in the implementation of the raw materials industry's goals and to learn from national and international actors. At the European level, this is to be supported in particular by the committee work of the Geo-Competence Centre Freiberg.

It can be assumed that there will be further EU activities in the primary and secondary raw materials sector, such as the EIT Raw Materials. These activities are supported by the active cooperation of EU Member States.

The knowledge of raw material technologies and raw material-relevant research results acquired in the past few years in Saxony should be presented together on a web-based platform within the framework of the legal possibilities and also advertised in this way.

Illustration 28: Delegation from Mozambique in Saxony, visiting the Reiche Zeche Freiberg (Source: Dieter Hesse 2022)

Illustration 29: Wismut site in Königstein (source: Wismut 2022)

In addition to a closed Saxon presentation with all the possibilities of optimal public relations, this will also serve to network information and partners – almost as an open Saxon contact exchange ("Saxony Raw Material Dating") for the raw materials industry. This online presence should be supported by an up-to-date presentation of the expertise of the Saxon raw materials industry and Saxony as a location, in English and German.

The standard-setting results from the rehabilitation of the legacies of the GDR lignite mining and of the legacies of the Soviet-German uranium ore mining should also be advertised in this contact exchange. The expansion of the network with the large rehabilitation companies WISMUT and LMBV and the Saxon activities in the rehabilitation of hard coal and ore mining legacies round off the portfolio.

Key areas of action G4:

- Grouping and expansion of networking activities between science, business and society in the GeoKompetenzzentrum Freiberg e.V.
- Maintaining contacts with foreign graduates from Saxon colleges and universities related to the raw materials industry
- Expansion of relationships with potential partner countries for the Saxon raw materials industry with a focus on raw material partnerships
- Active participation in European raw material initiatives and development of their funding programs
- Establishment of a Saxon conference format on raw materials management in further development of the Saxon Raw Materials Day
- Continuous further development of raw materials management and scientific capacities and competencies in Saxony, especially at the Freiberg, Dresden and Leipzig locations
- Supporting partner countries in the creation of procedural and administrative framework conditions for their national raw materials economy
- Development and implementation of a concept for better national and international marketing of Saxony as a raw material location

INFOBOX ROHSA 3

ROHSA 3 emerged as a key project from the Saxon Raw Materials Strategy 2012. Raw material-related data is secured, digitised, evaluated and made available to business, science and administration. Approx. 45,000 individual documents have already been scanned, over 630 ore drillings have been digitised and approx. 500,000 geophysical and approx. 240,000 geochemical data sets have been secured and processed. This created a comprehensive and unique information base on Saxon raw material deposits. Raw material data can be searched for centrally, conveniently and quickly via the Saxony raw material database.

Source: LfULG 2022

G5 – Saxon raw materials research

Ongoing scientific monitoring and practice-oriented research can make a significant contribution to achieving a sustainable, modern and resource-efficient use of raw materials. They are aligned with the innovation fields of the Innovation Strategy of the Free State of Saxony. Connections between science, research and business are to be expanded and research resources in the university and non-university areas are to be strengthened. In addition to the further development of techniques and processes for the extraction, processing and smelting of local raw materials, research projects must also focus more on the extraction and use of secondary raw materials.

Illustration 31: Raw materials in a smartphone (Source: DERA 2022)

In the past, science and research have made a significant contribution to the development of new and more efficient instruments and technologies in the field of raw material mining exploration, raw material extraction and processing, but also in the rehabilitation of post-mining landscapes and in the field of renewable raw materials. The Free State of Saxony has developed a first-class reputation as a location with knowledge and technology know-how. However, further efforts are needed on the path to sustainable mining. Research aimed at the sustainable use of raw materials and resources can set new standards, which will also strengthen the flagship of the Free State in terms of raw material expertise. The orientation of this research is in all innovation fields of the Saxon Innovation Strategy. In particular, the valorisation of digitised raw material geological data supports research in the innovative field "Search and exploration".

The resource-efficient extraction and use of different components of a deposit (including waste products) is a requirement for sustainability and economy. The greater the recovery rate, the less unusable rock is produced. The more efficient the extraction and initial processing on site, the less transport is required. In line with the Saxon Sustainability Strategy, Saxon raw material research should and can make an important contribution to increasing resource efficiency.

In addition to extraction and processing, traffic and transport are the essential elements of a mine that are perceived by the public. In order to increase acceptance by the people and municipalities that are directly affected and as a noticeable contribution to reducing environmental pollution, coherent traffic concepts in particular should be developed. The stringent use of electrified rail plays a special role here.

The lack of raw materials, the dependence on global supply chains, the volatility of the raw materials market as a result of global crises and the goal of progressive decarbonisation of all areas of the economy and life also require further efforts to recycle the raw materials that are already available in the economic cycle. In particular in the field of secondary raw materials management, but also in the processing of primary raw materials, important bases are being developed at Saxon universities and research institutions, the results of which are used by companies in ongoing developments, products and services. The potential of this connection between practice and theory is still large, especially in the secondary raw materials industry.

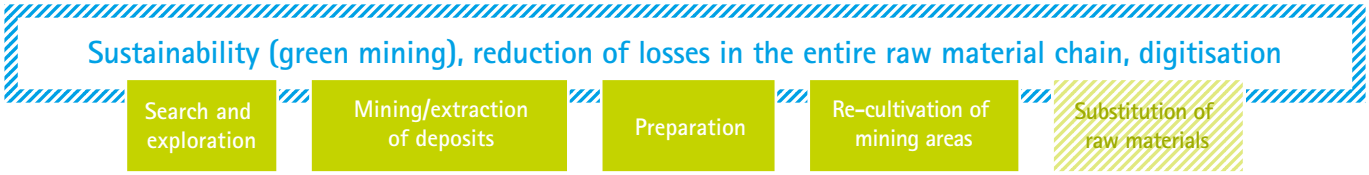


Illustration 30: Fields of innovation in the future field of raw materials (Source: Innovation Strategy Free State of Saxony)

Illustration 32: Pilot plant for the extraction of sulphides, cassiterite and magnetite from a bulk sample (Source: UVR-FIA GmbH 2018)

In addition, a large number of topics on the provision of raw materials and the use of renewable raw materials are being researched in Saxony. Saxony has been able to raise project funds from various federal project sponsors (FNR, Jülich, DBU, BLE) and achieve scientific knowledge throughout the entire length of various production and value chains. Intensive cooperation with institutions from other federal states and practice companies reflects a high degree of nationwide networking.

Above all, it is important to transpose scientific expertise and research results into application-oriented processes and technologies and implement them in new products and services. In all of this, the use of digitisation is both a key point and an opportunity and can also help to promote innovations in the use of raw materials.

The further expansion of the teaching and research mine "Reiche Zeche" of the TU Bergakademie Freiberg into a leading international demonstration centre for the "mine of the future" represents an excellent reference measure for this.

Key areas of action G5:

- Support for the expansion of raw material-related research capacities and competencies as well as reinforcement of practical research, also with non-university institutions, as well as knowledge transfer at all levels of education
- Use of knowledge competence and technological know-how regarding the extraction, processing and utilisation of primary, secondary and renewable raw materials, also to promote corporate innovation potential
- Strengthening of application-oriented raw materials research, especially in the areas of high-tech raw materials, circular economy and resilient raw materials management
- Further integration of Saxon raw materials research into European and non-European networks and funding mechanisms
- Expansion of the teaching and research mine "Reiche Zeche" of the TU Bergakademie Freiberg into a leading international demonstration centre for the "mine of the future"

G6 – Education and transfer of knowledge to the raw materials industry

Well-founded raw material education, as well as modern training and further education opportunities in the field of raw material and resource use, form the basis for securing the required skilled workers of tomorrow in the sense of the Saxon Skilled Labour Strategy. The needs-based and long-term supply of the population and economy with raw materials will only succeed in harmony with the development and promotion of an appropriately qualified skilled worker potential. Therefore, the Free State of Saxony will combine the traditional strengths of the Saxon educational landscape with the requirements of a future-oriented and sustainable raw material economy and further expand its leading role in vocational training.

School education, which also addresses questions such as the availability of raw materials, their promotion and use, forms an important link for the basic understanding of the structure and functioning of the economy. It also helps arouse young people's interest in such topics and raise awareness regarding raw material management. The anchoring of appropriate learning content, the qualification of teachers and the provision of appealing teaching materials can make a significant contribution to strengthening knowledge and enthusiasm for the topic of raw materials.

In higher education and university education, Saxony is a leader in forestry and wood sciences and thus also in the material processing of all lignin-containing materials. The study "Bioeconomy Wood 2030" was approved by the Federal Government, which intends to analyse the current situation, identify obstacles and show innovations along the value chain. Saxony is one of three model regions for this study.

As in all sectors, the raw materials industry and raw material-related administration are dependent on well-trained specialists. Securing skilled workers is a significant challenge that can only be met with appealing vocational training and study opportunities and attractive working conditions. Teaching and training content must be continually adapted to the ongoing developments in raw materials research and raw materials management (e.g. knowledge transfer concerning the potential and management of secondary raw materials and recyclates), in technical, legal and professional terms. The possibilities of digitisation in training should be used even more intensively than before.

A good example is the traineeship in mining and mine surveying, which has a long tradition in the Free State of Saxony. The administrative regulation (VwV Beflissenenbildung), adapted

Illustration 33: Training of future skilled workers (Source: BSZ Julius Weißbach Freiberg/Ulrich Sebastian 2022)

for this purpose in 2021, is not only intended to strengthen the personal responsibility of the trainee teachers, but also to establish a close and early bond with companies and the administration. This educational capital is needed in Saxony and also ensures skills for the future. The aim must therefore be to submit a Saxon takeover offer to every trainee.

The shortage of skilled workers can also be felt in the raw materials industry. Alliances between young people and companies must be formed at an early stage. Attractive training packages, a wide range of excursions and performance-related remuneration must become the standard. The Free State of Saxony will continue to support the maintenance and expansion of attractive educational opportunities in the future and also supports practical training through courses offered by its own administrative staff.

The existing skilled workers in companies and specialist administrations are constantly confronted with further developments and innovations. These can be caused by technical processes as well as changes in legislation or an increase in professional knowledge. Continual training and further education is therefore essential in order to be able to meet the requirements of a modern raw materials economy in this respect as well.

Key areas of action G6:

- Stronger anchoring of raw material awareness and raw material knowledge in school education
- Development of information material for targeted career and study orientation for raw material-related professions and courses for the long-term securing of skilled workers
- Continuation of traineeships as well as skilled worker and technician training for the raw materials sector at the "Julius Weißbach" vocational school centre
- Analysis of the short and medium-term need for extra-occupational, raw material-related further training offers for companies, teachers, administration and service facilities, also in cooperation with colleges and universities
- Networking of educational institutions; support for the training and further education of local and international specialists and executives, further education and training institutions (national and international)
- University-led assessment of the possibility of offering additional English-language courses as part of the raw material definition of this strategy

G7 – Saxon administration

The Free State of Saxony has an efficient and willing administration, which actively participates in shaping the constantly changing national and European framework conditions. In the sense of the raw materials industry, the Saxon administration conducts the necessary administrative procedures with the highest level of expertise.

Based on a centuries-old tradition, especially in the field of mining, the raw materials industry can draw on well-founded knowledge and experience. The Saxon administration is in a constant process of renewal in order to meet new requirements and to ensure the necessary transfer of knowledge to the next generation.

With the Freiberg location, the Free State of Saxony has resource-related administrative competence that is unique in Germany. This position is to be further strengthened, for example in the form of the Saxon Mining Office as the central point of contact for mining companies that want to launch projects for raw material extraction and use in Saxony. Regular contact and professional advice from interested mining companies is becoming an increasingly important component, even before the actual approval process, which can be decisive for the success of mining projects. The Saxon Mining Office is currently in charge of overseeing over 220 active companies within the scope of its competency under the Federal Mining Act.

In addition to the Saxon Mining Office, the State Geological Service of Saxony is also based in the State Office for the Environment, Agriculture and Geology with its responsibilities and tasks in the raw materials sector at the Freiberg location. In addition, the State Office for the Environment, Agriculture and Geology and the state enterprise Sachsenforst bring expertise to bear in the field of renewable raw materials. The challenges facing administration as a result of digitisation and generational change, and in particular the legal requirements for modern mining, continue to increase and require additional staff capacities and highly qualified personnel as well as sufficient workplace capacities. The focal points for strengthening the administrative location are the expansion of the Saxon Mining Office and the construction of a modern Saxon drilling core and sample archive.

INFOBOX Federal Mining Act

The Federal Mining Act forms the legal basis for the exploration, extraction and processing of mineral resources in Germany. The aim is to ensure the provision of society and the economy with raw materials. It also establishes regulations to rehabilitate the areas used by mining, to avert dangers and to compensate for unavoidable damage. The Federal Mining Act distinguishes between land resources that are owned by property owners (e.g. roofing slate, feldspar and kaolin) and unmined mineral resources (e.g. iron, tin and lignite), which do not fall under private property ownership.

The employees and executives of the Saxon administration are experts in their specialist areas, developing and experiencing changes in the course of their professional development. Their experiences are treasures of information that must be passed on to young people as part of training offers, but also to all other interested parties. In particular, executives from the Saxon Mining Office are already supporting the range of lectures offered at the TU Bergakademie Freiberg. This offer is to be expanded and made available to other teaching institutions. This aims to bring together raw material training, networking and administration.

The Saxon administration is technically very well equipped. Extensive investments in hardware and software have paid off and digitalisation has also advanced within the administration. This process, which is already helping to simplify and speed up decision-making and approval procedures, is to be continued and further expanded.

Projects in the raw materials industry do not stop at state borders and also require cross-border coordination by the Saxon administration. The German-Polish MineLife project and the INTERREG cooperation project Bergbau-Hornictví SN-CZ under the direction of the Saxon Mining Office are excellent examples

Illustration 34: Raw materials of a quarry (Source: UVMB/Oliver Fox 2022)

of this. It is also helpful to take a look at other mining regions around the world that are facing comparable administrative challenges. Therefore, in addition to the opportunities that arise within the framework of European funding programs, new partnerships should also be initiated with countries outside Europe and used to exchange information and experience.

The Saxon administration sees itself as a service provider for all the actors involved and would like to stay in touch with them. For this purpose, a strategic raw materials strategy working group will be set up under the direction of the Saxon Ministry of Economic Affairs (SMWA), which will address the guidelines and main areas of action of the new Saxon Raw Materials Strategy in an ongoing process. In addition to the affected departments of the state government, the working group should also include other actors and institutions from the area of the raw materials industry. In addition to this, the actors in the raw materials industry, research and education as well as other interested parties are to be offered an additional opportunity to participate in and co-design the Raw Materials Strategy, via the establishment of a web-based communication platform. This will permit ideas and proposals for action to be fed directly into the work process of the Raw Materials Strategy working group.

Key areas of action G7:

- Strengthening of the competencies of the raw materials-related administration location in Freiberg; continuous further training on developments in raw materials management and science
- Active accompaniment and support of mining companies by the Saxon Mining Office as a central official service provider with maximum technical expertise
- Expansion of the property of the Saxon mining administration; construction and commissioning of the new Saxon drill core and sample archive
- Consistent conversion of raw material-related administration from analogue to digital, also with the aim of ensuring highly efficient and fast administrative procedures
- Elimination of legal obstacles to the use of renewable raw materials (e.g. in the Saxon building code), as well as the increase of domestic competence and experience in the public construction sector
- Increased communication, especially with potential investors
- Implementation of international cooperation projects
- Establishment of a Raw Materials Strategy working group to implement the Raw Materials Strategy, with the aim of concretising and initiating tasks derived from it; to this end, establishment of a web-based communication platform for actors in the raw materials industry, research and education
- Strengthening of the exemplary role of the administration in the context of the implementation of the Saxon Raw Materials Strategy and the use of renewable or recycled raw materials as well as savings and efficiency

G8 – Raw material awareness and raw material acceptance

Awareness and acceptance of raw materials are the keys to the future raw materials economy. Working towards an unbiased awareness of raw materials based on facts, knowledge and needs instead of on fears and ideological ideas is now more than ever a task for society as a whole.

People's awareness of the raw materials industry has changed over the years. The familiar becomes a matter of course, while new things often cause fears. The last great era of underground mining in the Ore Mountains came to an end with the peaceful revolution in 1990. And since then, even the inhabitants of the Ore Mountains, which are rich in raw materials, have known mining for more than 30 years almost exclusively as rehabilitation mining.

INFOBOX Supply Chain Law

The Supply Chain Due Diligence Act, which was passed in 2021, will strengthen the protection of human rights along supply chains in the long term. There are also implications for the raw materials sector, as corporate due diligence requirements extend to the entire supply chain, from raw material extraction and processing in mines and factories at home and abroad to the finished product for sale. In particular, working conditions are to be noticeably improved through the introduction of minimum standards, such as the ban on forced labour and child labour.

Source: BMZ 2021

But the necessity of the development and expansion of quarries and gravel pits, of which the raw materials are naturally used in a variety of ways, must now find greater acceptance in people's minds again. An essential prerequisite for the approval of raw material-related projects is their acceptance by the population. Raw material acceptance requires raw material awareness – raw material awareness generates raw material acceptance. Early and comprehensive information for the population can make a significant contribution to minimising possible acceptance problems.

In this context, the Free State of Saxony supports the international transparency initiative EITI (Extractive Industries Transparency Initiative) with its regular reporting of raw material data. The creation of an ideally global raw material transparency not only contributes to the creation of a so-called "level playing field" (i.e. the same rules for all players in all areas) for companies, but it also creates transparency, which in turn can lead to more acceptance.

For the particularly sensitive area of lignite mining, the Saxon state government has spoken out in the current coalition agreement for the establishment of an arbitration board for mining damage. Preparations for this have already begun, and the arbitration board is scheduled to start work from 2023.

In order to increase social acceptance and appreciation of the already extensive commitment of many entrepreneurs, effective communication strategies, image campaigns and knowledge transfer measures are required. This can effectively contribute to the management of raw materials in general and secondary raw materials in particular. Defining the secondary raw materials industry in Saxony and regularly publishing key data on its services would largely contribute to better "visibility" of the Saxon secondary raw materials industry. This requires cooperation between official statistics and business.

For the past two years, the SMWA has been holding a raw materials theme day under the leadership of the Ministry for Economy. A key component is the presentation of value chains using concrete examples – whether in underground mining, in processing or in the production of raw materials. The closeness and connection of the top Saxon mine owners with the raw materials industry is essential for maintaining raw material awareness and increasing raw material acceptance.

The cultivation of the tradition of mining customs is firmly anchored in the cultural life of the Free State of Saxony as a connecting and awareness-raising element between history and the future. The Saxon state association of

miners', smelters' and miners' associations, but also the other associations make a significant contribution to maintaining raw material-awareness.

17 Saxon and five Czech areas make up the UNESCO World Heritage Erzgebirge/ Krušnohoří Mining Region. These areas as well as the protection and preservation of the technical objects of the old mining era testify to a historic period and can also support raw material acceptance in relation to the future mining of high-tech raw materials.

Key areas of action G8:

- Consistent presentation of the goals of the raw materials industry (primary, secondary and renewable raw materials) as an effective Saxon contribution to achieving the social goal of decarbonising society and the economy, and of the contribution of these goals to the 17 UN sustainability goals
- Increased digital dissemination of knowledge of the raw materials industry as one of the essential livelihoods of human society
- Implementation of a high-profile annual raw materials day under the leadership of the SMWA to present the importance of Saxon raw materials and to publicise local value chains
- Targeted dissemination of knowledge and practice on topics relevant to raw materials for all age groups and levels of education in simple and scientific language
- Establishment of an arbitration board for mining damage from lignite mining
- Target group-oriented information policy with regard to the requirements and opportunities of a modern raw materials economy, also for business and politics; expansion of public relations work in the municipalities for citizen participation and to increase acceptance
- Support for the maintenance of tradition in the Free State of Saxony
- High-profile presentation and valorisation of rehabilitated post-mining landscapes in the Free State of Saxony as a regional development opportunity with and after mining and as evidence of responsibility and sustainability (e.g. synergies of raw material extraction and biodiversity promotion)

Illustration 35: The "Saigerhütte" (smelting) delegation to a replica smelting furnace (Source: Kristian Hahn 2022/ Hermann Schmidt photographic studio)

Illustration 36: Experience raw materials up close – the four Saxon geoparks (Source: EVTZ mbH, Geopark Muskau Fold Arch, Geopark Porphyrland e.V., Geo-Environmental Park Vogtland, Geopark Sachsens Mitte e.V.)

Saxony as a state of raw materials – a vision

The Saxon industry has changed significantly since a raw materials strategy was established in Saxony in 2012. While the foundations were laid in the first stage of the Raw Materials Strategy for the Free State of Saxony, important reorientations took place in the new Saxon Raw Materials Strategy 2022. This was made necessary by the European decision to reorganise industry and in particular the energy sector. Some parts of the answer are: concentration on high-tech raw materials through targeted geological surveys of raw materials, the strengthening of our domestic building raw material supply through its long-term anchoring in state and regional planning, and a heat transition, e.g. by promoting near-surface geothermal energy as a safe domestic form of energy.

The motto of the strategy "Saxony is uncovering its treasure" is particularly valorised through digitisation.

Lithium, indium, fluorine, tungsten, tin, silver and nickel are abundant in the Free State. We supply ourselves with stones and earth in a sustainable manner and newly discovered quartz sand deposits are a real development building block for the semiconductor industry. An essential prerequisite for this success in the mining of raw materials in Saxon deposits was primarily the people on site, with their acceptance and their knowledge. That is why every new mine is also a visitor mine. In addition, it was a wise decision to adapt the responsible technical authorities to this situation in a timely manner and to strengthen them in terms of personnel and expertise.

The combination of high environmental standards and modern technology at a traditional location of "sustainability" is already generating international interest, which obliges Saxony to have a self-critical and innovative approach in a conjunction between business, administration and education.

Closed value chains, short delivery routes and a reliable supply of raw materials are increasingly decoupling local industry from the still immense fluctuations of the world market, at critical points. The resilience that the EU is striving for is drawing ever closer. The Free State of Saxony is thus making an important and measurable contribution to the implementation of the goals of the Green Deal. Our concept of the development of sustainable companies from local potential, from regional resources and the results of research and development has been effective. Sufficient venture capital for implementation can now be mobilised without any problems, also thanks to the update of the Federal Raw Materials Strategy.

Concurrently, the area of secondary raw materials continues to be developed and is now a solid pillar in the raw material supply. Thanks to years of constant research by Saxon universities, processing methods have been developed that are establishing themselves in the international competition. This important element of recycling economy, together with the extraction of primary raw materials, will also ensure the further economic development of our Free State in the future.

In connection with the extraction of primary and secondary raw materials, great importance is also attached to bio-based economy in Saxony. This enables the development of world-marketable products and technologies using renewable raw materials as well as co-products and by-products in the material and energy sectors. Rural areas in particular have benefited from this as a result of the implementation of necessary transformation processes and the associated settlement of young people in innovative start-up companies.

This is what should be remembered when the Free State of Saxony looks back on its new Raw Materials Strategy. Opinions in this regard will certainly be divided, but fundamentally, there is one main thing that counts: the Free State of Saxony has a raw materials strategy, it has a vision for it, and we are working on it!

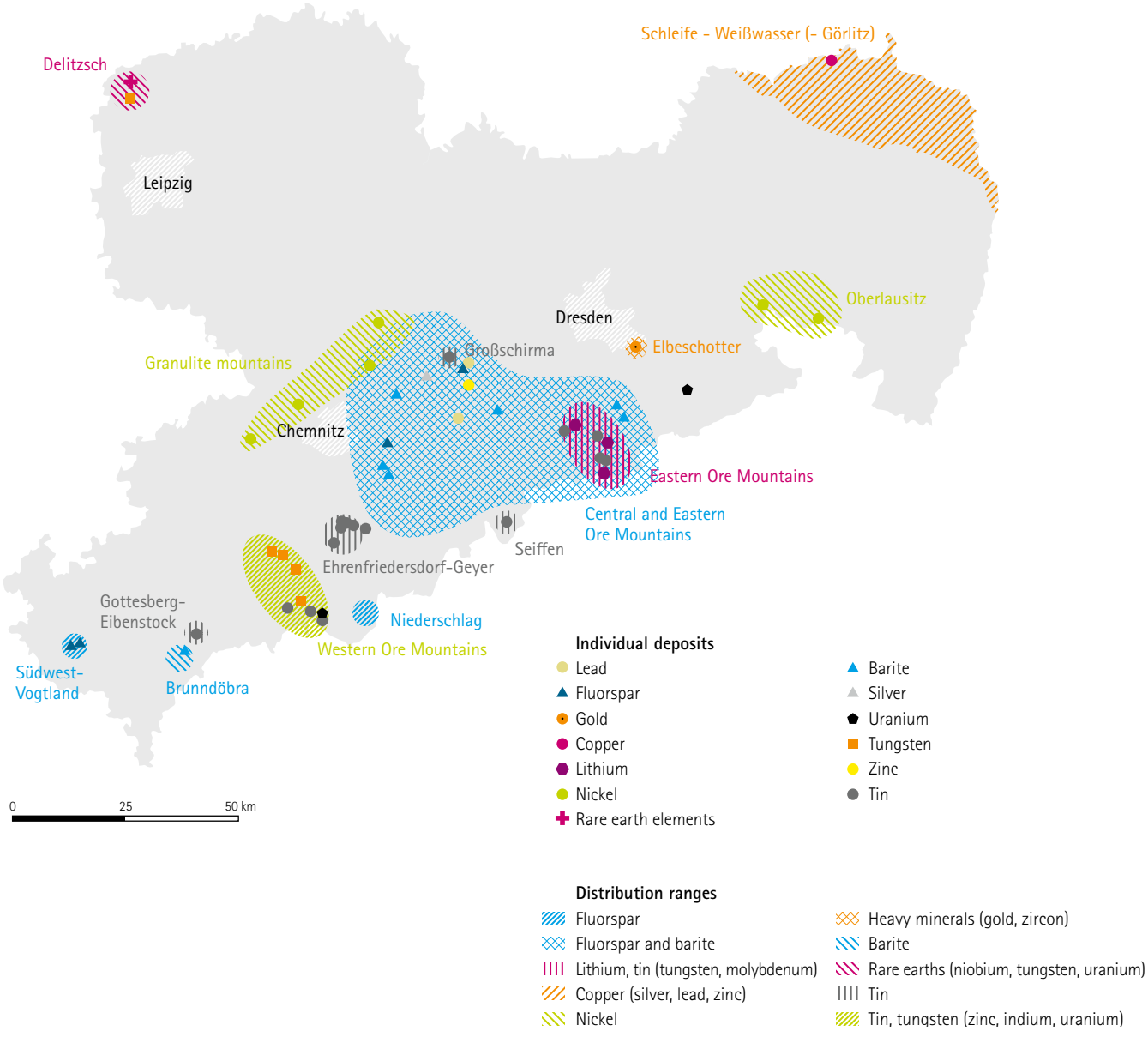
List of abbreviations

ABENSA	Register of waste disposal facilities
BGR	Federal Institute for Geosciences and Natural Resources
BLE	Federal Office for Agriculture and Food
BMBF	Federal Ministry of Education and Research
BMEL	Federal Ministry of Food and Agriculture
BMU	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
BMZ	Federal Ministry for Economic Cooperation and Development
BSZ	Vocational training centre
CO_2	Carbon dioxide
CO_{2eq}	Carbon dioxide equivalent
DBU	German Federal Foundation for Environment
DERA	German Mineral Resources Agency
EITI	Extractive Industries Transparency Initiative
EKP	Energy and Climate Program Saxony 2021
EU	European Union
EUR	Euro
e. V.	eingetragener Verein ("registered association")
FEZB	Research and Development Centre for Mining Impacts
FNR	Agency for Renewable Resources
GKZ	Geokompetenzzentrum Freiberg e. V. (Geo-Competence Centre of Freiberg)
HIF	Helmholtz Institute Freiberg for Resource Technology
KAA	Key area of action
IFEU	Institut für Energie- und Umweltforschung Heidelberg gGmbH (Heidelberg Institute for Energy and Environment Research)
IHK	Chamber of Commerce and Industry
KAG	Coal phase-out law
SRP	Short rotation plantation
KVBG	Act to Reduce and End Coal-Fired Power Generation
KWSB	Commission on Growth, Structural Development and Employment
G	Guideline
LEAG	Lausitz Energie Verwaltungs GmbH (Lusatia energy administration company)
LfULG	Saxony State Office for Environment, Agriculture and Geology
LIS-A	State information system for plants
LMBV	Lusatian and Central German Mining Administration Company
m^3	Cubic metre
OBA	Saxon Mining Office
PERC	Pan European Reserves and Resources Reporting Committee
FGD	Flue Gas Desulfurization
ROHSA	Raw material data for Saxony
SächsKrWBodSchG	Saxon Circular Economy and Soil Protection Law
SMEKUL	Saxon State Ministry of Energy, Climate Protection, Environment and Agriculture
SMWA	Saxon State Ministry of Economy, Labour and Transport
SRIA	Strategic Research and Innovation Agenda
t/y	Tons per year
GHG	Greenhouse gas
TU	Technical university
UN	United Nations
UVMB	Unternehmerverband Mineralische Baustoffe e. V. (business association for mineral building materials)
VwV	Administrative regulation

List of illustrations

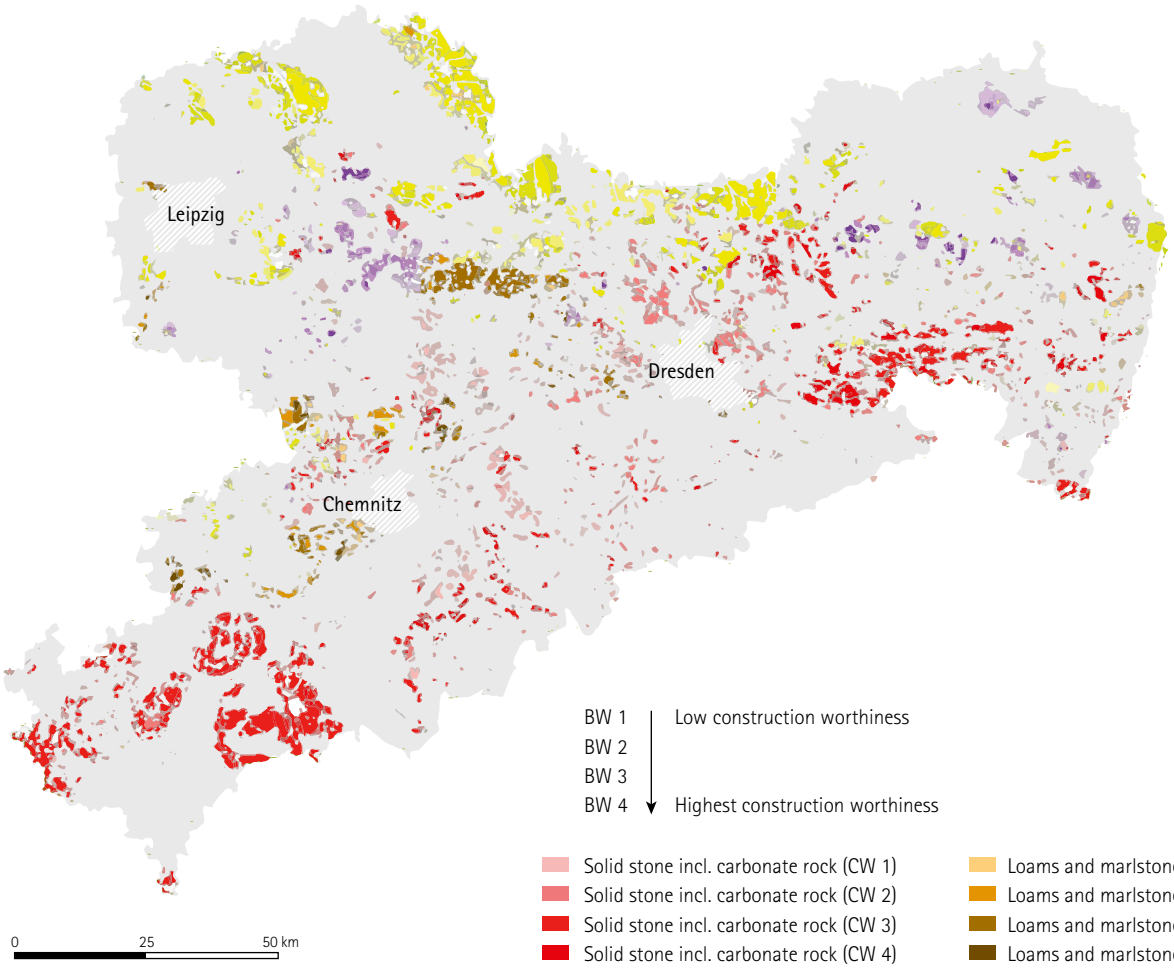
Annexes (overview maps)

Main raw materials of the most important ore and spar deposits in Saxony



Annex 1: Main raw materials of the most important ore and spar deposits in Saxony

Stone and earth deposits in Saxony – assessment of construction worthiness (CW)



Precisions on the definition of the construction worthiness:

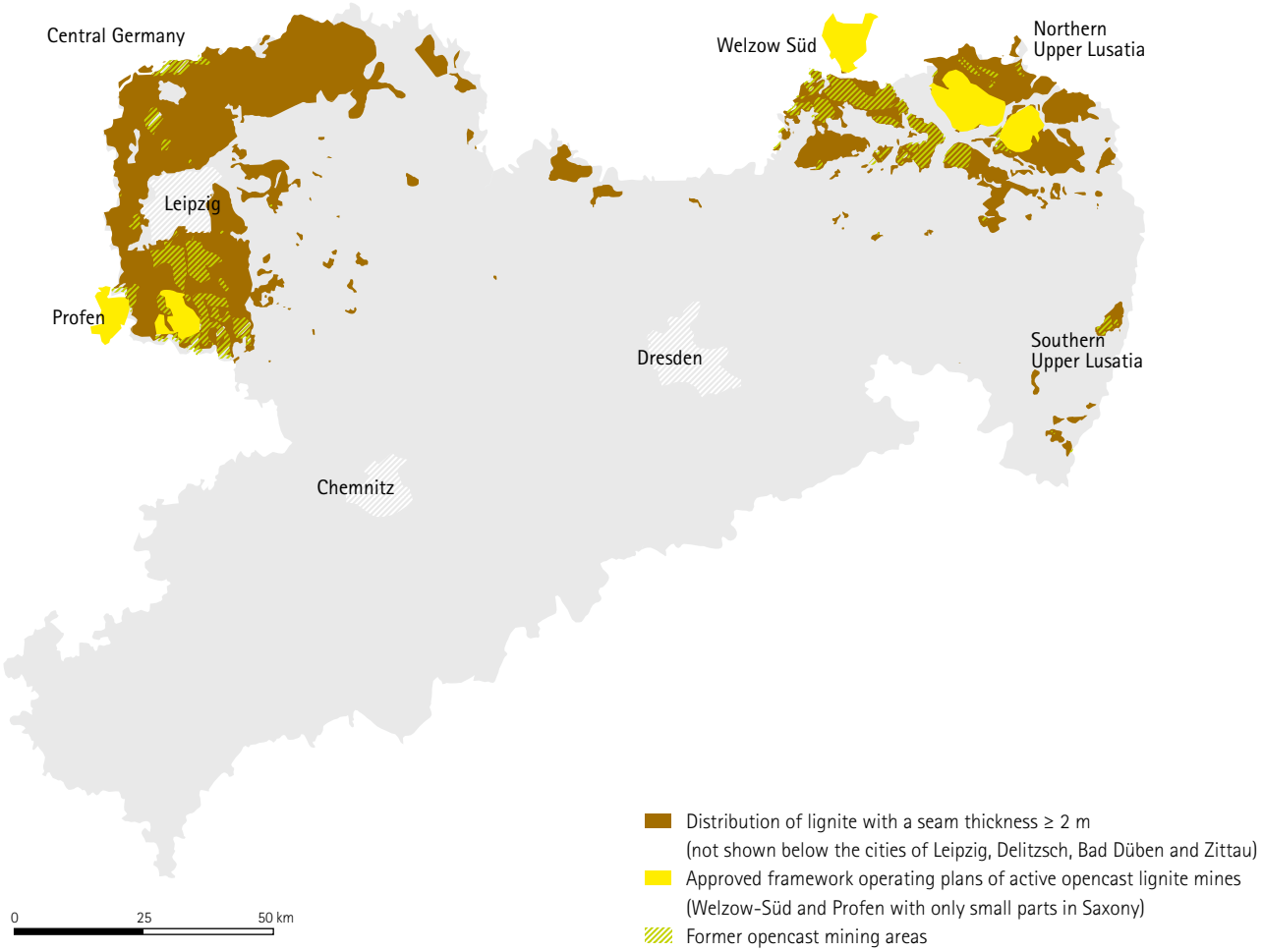
The raw material groups shown are the starting point for the evaluation of the stone and earth deposits. Each resource deposit is classified with rating points according to the parameters:

- "Amount of resource (reserves)"
- "Strength of the resource"
- "Seam/overburden ratio"
- "Raw material geological knowledge"
- "Raw material-specific quality"
- "Quality information certainty"

Four construction worthiness classes are determined on this basis, using statistical methods.

Annex 2: Stone and earth deposits in Saxony – assessment of construction worthiness

Lignite in Saxony – deposits and extraction



Annex 3: Lignite in Saxony – deposits and extraction

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