



General principles of Earth's crust policy until 2050



Introduction

The rapid growth of world population, intense urbanisation (the population in cities is increasing by approx. 60–80 million people per year), and people's expectations for the improvement of living conditions causes an ever-increasing demand for mineral resources, drinking and domestic water, and energy. Non-conventional mineral and natural resources of inferior quality are being introduced more and more often, and novel technologies are being implemented.

The shortage of local raw materials is getting increasingly worse also in the European Union (EU), and the economy is becoming more dependent on imported minerals. That is why the EU has, in recent years, paid a lot of attention to the situation of mineral resources, their availability, and quality. In 2008, the Raw Materials Initiative was created under the leadership of the Directorate General for Enterprise and Industry of the European Commission.

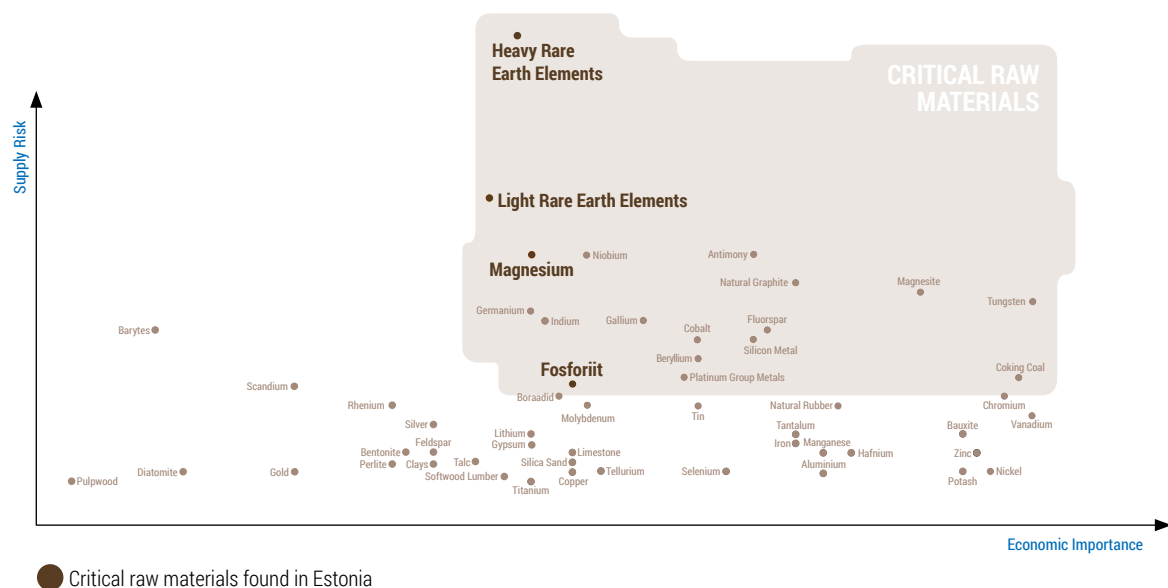
With the help of experts, a report was prepared for 2010 which contained a list of critical raw materials¹. These raw materials are indispensable for the EU's industry and they are currently

mainly imported from China, Russia, Congo, and Brazil. The list was updated in 2013 and it currently contains 20 raw materials², most of which are metal ores. A number of suggestions has also been made in the report for developing the field, and the main proposals of the European Commission to the Member States are as follows:

- 1) develop a national mineral resources policy;
- 2) develop a national spatial planning policy related to the use of mineral resources;
- 3) apply clear and understandable procedures for granting permits for geological exploration and the extraction of mineral resources.

The use of Earth's crust³ is, on the one hand, the basis for many branches of economic activity, but on the other hand, it is often accompanied by a significant environmental disruption. Mineral resources are extracted, groundwater is abstracted and geothermal energy is absorbed from the Earth's crust. The Earth's crust supports buildings and may, as the source of environmentally hazardous elements, substances and processes (landslides and falls, floods, pollution), affect our living

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1 https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_et

2 Antimony, beryllium, borates, chromium, cobalt, coking coal, fluorite, gallium, germanium, indium, magnesite, magnesium, natural graphite, niobium, platinum group metals, phosphorite, heavy rare earths, light rare earths, silicon metal, tungsten.

3 The Earth's crust means the upper part of the crust which people use and affect with its activities on dry land, inland and transboundary water bodies, and territorial and inland seas.

The policy directions address the full potential of the Earth's crust



environment. Hence, the science-based and sustainable management of extractable land resources, which aims to develop the national economic growth, is a complex task.

The efficient use and protection of Earth's crust is organised and the possibilities of avoiding environmental disturbances are evaluated on the basis of relevant research, and its efficiency depends on the skill of implementing the specific methods and methodologies, the level of databases, and the experience of the trained specialists. Generally, national geological surveys are responsible for specific applied research on Earth's crust in European countries, and their task is to lead the research concerning the state's dry land and aquatorium (geological mapping and exploration, monitoring, georisk assessment, data collection, database management, etc.), and insure information on the exploitation of Earth's crust for government and educational institutions, businesses, and individuals.

The development document regarding the general principles of Earth's crust policy in Estonia provides a long-term vision and direction for managing the field, and it addresses the full potential of Earth's crust, including:

- 1) mineral resources;
- 2) the Earth's crust as base;

- 3) the Earth's crust as a construction environment;
- 4) groundwater;
- 5) geothermal energy.

If the document refers to the Earth's crust or extractable land resources, all of the above components are always meant.

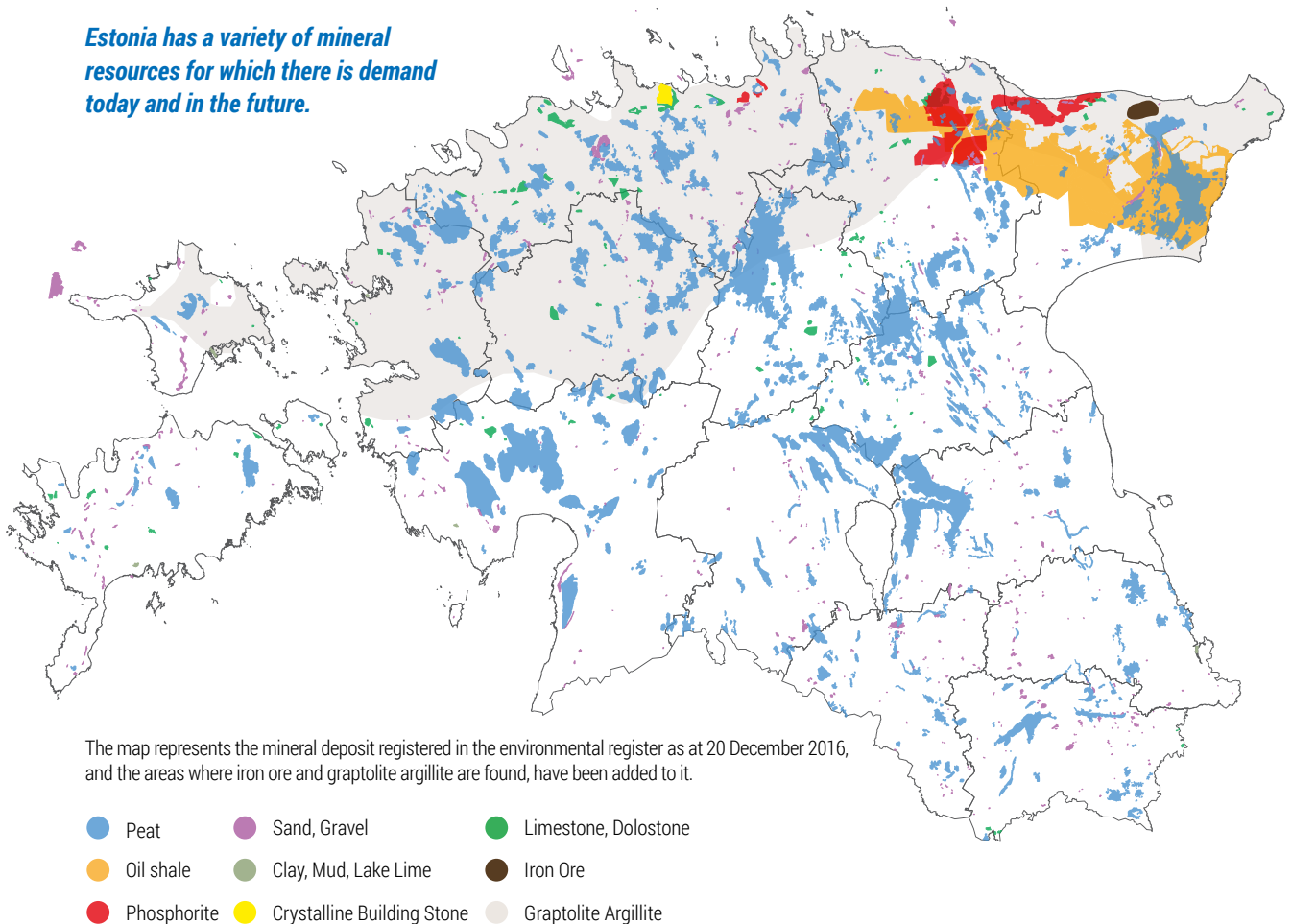
The general principles of Earth's crust policy are the framework strategy for the development plans and legislation related to the field, and the basis for issues related to Earth's crust in preparing the development documents and legislation related to other fields. Horizontally, the general principles of Earth's crust policy most affect the planning and development of areas of economic development, education (including environmental education), and spatial planning. Regularly updating the development document and reporting on its implementation help ensure the relevancy and implementation of the agreed policies.

I Vision of Earth's crust policy and a nationwide goal

Earth's crust and the natural resources found there are explored and used in a way which creates as much value for Estonia as possible, at the same time considering the environmental, social, economic, geological, and security aspects of these activities.

Estonia's long-term goal in terms of Earth's crust is to ensure the science-based management and use of extractable land resources, which is directed at national economic growth and resource efficiency, is eco-friendly, and maintains human health. At the same time, it is important to reduce dependence on non-renewable resources.

Estonia has a variety of mineral resources for which there is demand today and in the future.



II Principles for developing the field and priority development directions

1. Research and exploitation

Having high-quality geological information is important in planning, assessing the risks of, and implementing almost every environmental activity. The most important ones include the introduction of new mineral resources, nature conservation and groundwater protection, planning water supply, waste management, buildings, and assessing environmental impact. Much of the information is collected during geological mapping. Based on earlier geological mapping and research, it is known that Estonia has competitive extractable land resources (for example, oil shale, peat, and technological dolostone and limestone), which can be used to produce products for which there is, both currently and in the future, demand domestically and on the global market. Continuing research is important for knowing both the opportunities and threats, and for making decisions based on them.

Most of the extractable land resources in Estonia belong to the state, which is why it is appropriate for the state to benefit from their use. At the same time, the use of the resources also affects, to a greater or lesser extent, the local governments and population, which is why it is fair to share the benefits with them. Based on the above, the policy guidelines related to the research and exploitation of Earth's crust have been formulated.

1.1. The research work necessary for collecting geological information, and using and creating maximum value for extractable land resources, is executed in the volume and with the directions which at least maintain the existing knowledge base and keep it updated. The knowledge base is preferably enhanced with information characterising extractable land resources with economic potential.

1.1.1 To complement the background information necessary for planning environmental activities and assessing their risks, the state will prepare a plan for a geological mapping (scale 1 : 50,000) and organise the mapping of the whole territory of Estonia.

1.1.2 The potential of Earth's crust in Estonia is specified and the applied research on Earth's crust is organised systematically, based on the state-prepared and periodically updated

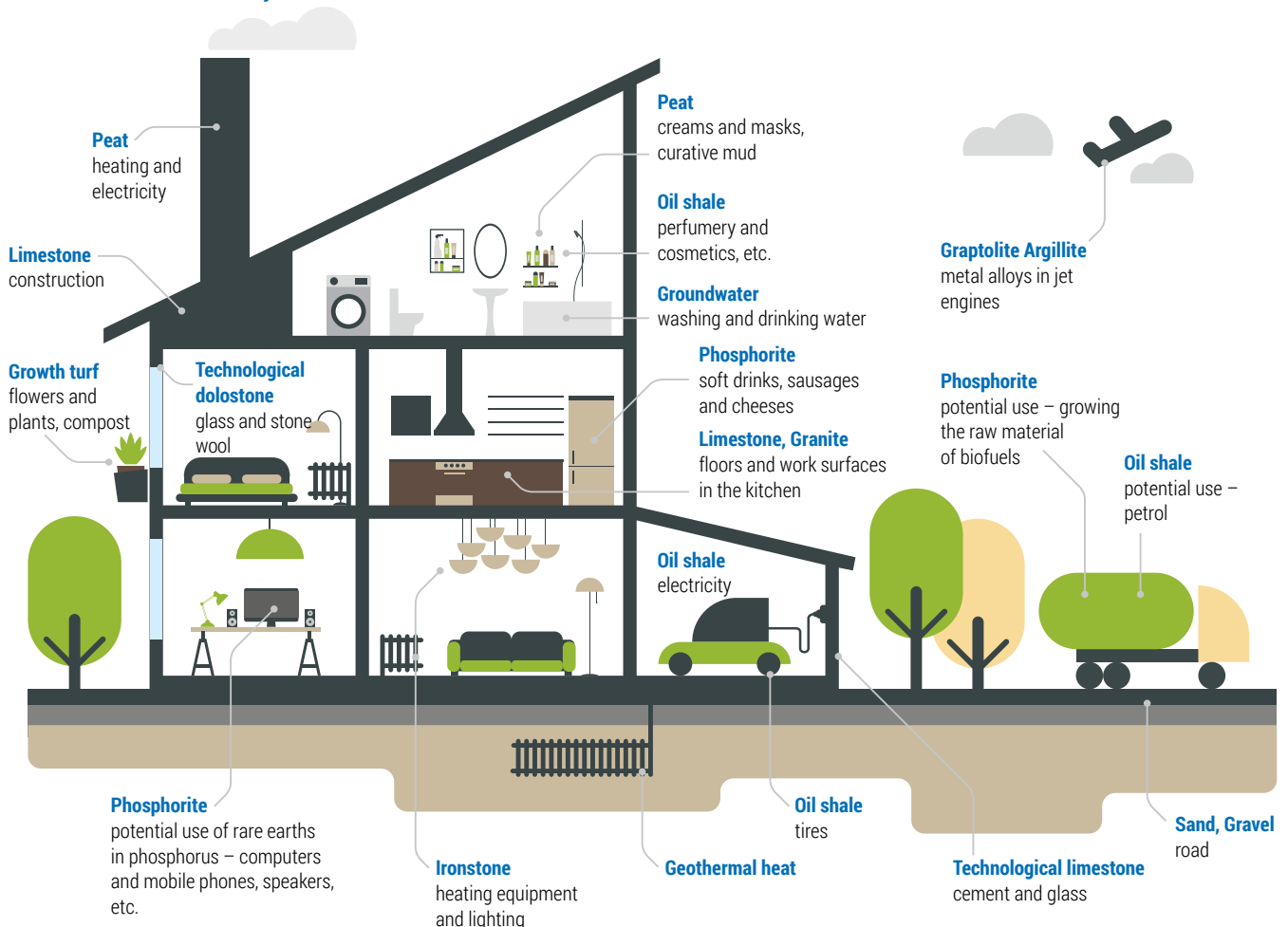
plan for research work, research, and development, which is related to extractable land resources.

1.2. The state will receive fair income from the use of extractable land resources.

1.2.1 To ensure that the state receives maximum benefit from the use of extractable land resources, the state will implement mechanisms for permitting the exploration and exploitation of resources, and receiving state revenue. These mechanisms must take into account the specificities of the activities and allow the state to receive benefits in the greatest extent possible and without unfoundedly endangering the sustainability of the activities.

1.2.2 To attract investments necessary for stimulating the development of Earth's crust field and the economy, the state will actively introduce the Estonian extractable land resources and the related data and studies to potential investors.

Mineral resources are as important for human life as food and air. In addition to groundwater, which is used as drinking water, our everyday life also depends on mineral resources which we use, for example, to produce electrical and thermal energy, building and road building materials, in horticulture, and for the necessary materials for paper and the chemical and electronics industry.



1.3. The management of extractable land resources will support positive socio-economic changes and mitigate the related negative socio-economic impacts.

1.3.1 To create the greatest value for society, the state will implement mechanisms which guarantee the use of public revenues from the exploitation of extractable land resources which is most practical and has the highest long-term beneficial effect.

1.3.2 To make the use of extractable land resources more socially acceptable, the state will implement solutions for the distribution of public revenues from the exploitation of extractable land

resources which share the revenue with the local authorities directly affected by the exploitation of extractable land resources, and ensure that the positive impact from the public revenue also reaches the persons directly negatively affected by the activity.

1.3.3 The negative external costs related to the use of extractable land resources will be compensated based on the principle that the user pays, and the determination of the extent of financial compensation for negative external costs will take into account, on the basis of reliable data, the overall actual impact on the people, the economy, and the natural environment.

2. Environmental impact and effectiveness

When making a high-quality decision on permitting the exploitation of Earth's crust, the permit grantor will require sufficient up-to-date information regarding the effects of the activity (including the impacts on the nature, economy, and social environment), and reliable assessment methods for making predictions. The decision-making process must, at the same time, aim to balance different interests and reduce nuisances.

When terminating the exploitation of Earth's crust, it is important that the user of the environment always reclaims the land and Earth's crust to be consumable and fit for future use. Problems with this issue cause damage to the reputation of the use of extractable land resources and often entail additional costs to the state.

Extractable land resources must be used efficiently, and the excessive and wasteful use of them must be eliminated, which is why it would be wise to produce as much output as possible with a high added value per each unit of resource. At the same time, waste generation must be minimised and the re-use of generated waste must be maximised. Based on the above, the policy guidelines related to the research and exploitation of Earth's crust have been formulated.

2.1. The important environmental, economic, and social impacts related to the use of Earth's crust will always have been previously analysed and in the operation, the most suitable solutions will always be selected. The state will promote the implementation of the most environmentally friendly and innovative technologies in organising the activities.

2.1.1. To avoid unexpected negative consequences and obtain the information necessary for decision-making, the impact of the use of Earth's crust on the environment will always be anticipated, in reasonable detail, before executing the activity. The state will support the development and deployment of the general models and systems, as well as the collection of input for them, necessary for this.

2.1.2. To balance economic development and environmental protection, permits for exploring and exploiting Earth's crust will always take into account the factors and effects of the natural environment, the society, and the economy.

2.1.3. Extractable land resources must be used without endangering human health and permanently undermining their well-being. Additionally, mitigation measures will be implemented in the extent which ensures the sustainability of the activity, with effects which are within the limit value, but which disturb the surrounding population.

2.1.4. To obtain a comprehensive overview of the impacts of the use of Earth's crust, the industrial complex logistics, social acceptance, and environmental impacts related to these resources will also be taken into account when introducing new resources at the general level, and these results will be taken into account in allowing or prohibiting the activity.

2.1.5. To reduce the undesirable effects from the use of Earth's crust, the state will encourage the development of new technologies, which are environmentally friendly and innovative, or alternative green technologies providing the same result, the development of the best practices, and contributes to their dissemination.

2.2. The reclamation of land disturbed by extraction and Earth's crust will be ensured, and the best practises and experiences will be implemented for this purpose, while considering the complete and most appropriate solution, and the development of the region.

2.2.1. To ensure the reclamation of land disturbed by extraction and reduce environmental disturbances related to quarries, the state will adopt a legal or economic mechanism which reduces the number of quarries without a clear demand in material.

2.2.2. To make the reclamation provision meet the actual needs, the state will differentiate and implement requirements for the proper reclamation of Earth's crust and land disturbed by extraction, based on the size of the quarries and mines, their complexity, hazardousness, and other circumstances, while using proportional requirements. In addition, the requirements will be based on the principle that the reclamation of land and Earth's crust will start at the earliest stage of extraction, and take place, to the greatest extent possible, parallel to the extraction.

2.2.3. To make it impossible for holders of extraction permits to abandon not reclaimed quarries and mines, the state will adopt legal or economic mechanisms which ensure the reclamation of land disturbed by extraction and Earth's crust in all cases. The state will organise the reclamation of previously abandoned quarries and mines, starting with objects which pose a danger to humans and animals or have a direct negative impact on the natural environment.

2.2.4. To utilise the land disturbed by extraction and Earth's crust in the best way, the establishment of the reclamation requirements will consider the area and the surrounding landscape as a whole. The development of the reclamation requirements will involve local residents and take into account regional

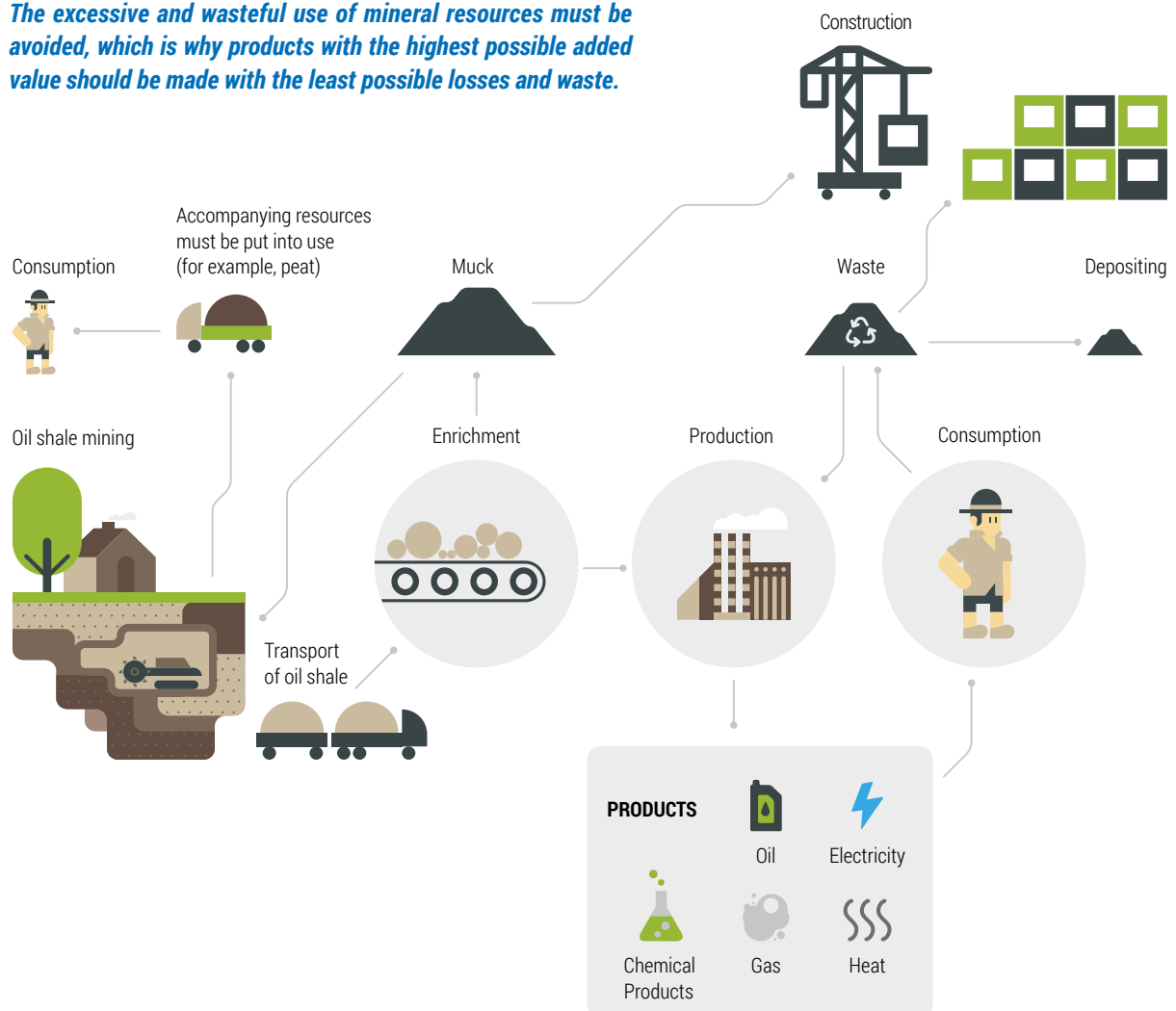
development plans and the trends specified in the spatial plans. The best practises for reclaiming land disturbed by extraction and Earth's crust will be identified and propagated.

2.3. The targeting of the use of extractable land resources will ensure, in accordance with the principles of circular economy, the sustainable use of resources with the highest possible added value, minimum losses, and minimal waste. Additionally, renewable land resources will not be consumed beyond the rate of recovery, and options for replacing non-renewable extractable land resources with renewable resources, and for making the use of resources more efficient, will be explored.

2.3.1. To ensure the sustainable use of mineral resources, buildings of the state and local government units will be built with local mineral resources in the maximum possible extent, and such construction technologies will be implemented which use the products derived from the production of building materials, mining by-products, and mining waste to the maximum possible extent.

2.3.2. Upon the use of extractable land resources, resource productivity is constantly increased and waste generation reduced.

The excessive and wasteful use of mineral resources must be avoided, which is why products with the highest possible added value should be made with the least possible losses and waste.



2.3.3. Land resources associated with extracted land resources must be either used or preserved suitable for use in a quality as close to the unused state as possible.

2.3.4. The state will create conditions for a wider use of geothermal energy.

3. Education, research and development

In terms of higher education related to Earth's crust, it is important to ensure a close relationship between research and development work and the state's needs. To ensure the sustainability of the sector, the interest of the young people in acquiring a higher education in a field related to Earth's crust must be maintained.

An up-to-date teaching and research infrastructure has been set up in universities, and it is important to use this in solving the practical problems of state institutions and enterprises – among other things, for example, for the applied research carried out at the request of the public and private sector.

International cooperation occurs, in particular, both at the private and university level through various projects. This is very important for exchanging experiences and increasing the level of research output. The organisation of international scientific communication is guided by national priorities, which is also be taken into account in resource planning. Based on the above, the policy guidelines related to the research and exploitation of Earth's crust have been formulated.

3.1. The sectoral educational, research and developmental activities will be organised purposefully and effectively, and the needs and interests of the public and private sector will be taken into account.

3.1.1. In order to support the ability of Estonian researchers and students to find and apply the best technologies for using the extractable land resources in Estonia, the cooperation between research institutions investigating the extractable land resources and Estonian and foreign research institutions and technology companies will be intensified.

3.1.2. To improve the quality and orientation of the sectoral education, educational institutions will ensure practical coordination in training their specialists, by taking into account the assessments and analyses of employers and the state, and paying more attention to the applied direction, including technological areas of study.

3.1.3. To collect the necessary information to determine the priority directions of education in the field of Earth's crust, the state will regularly analyse educational statistics (including admission and dropouts), the graduates' employment and its forecast, and the correspondence of curricula with labour market needs. To popularise education in this field, the scientific disciplines related to the research and use of Earth's crust will be actively introduced to schoolchildren.

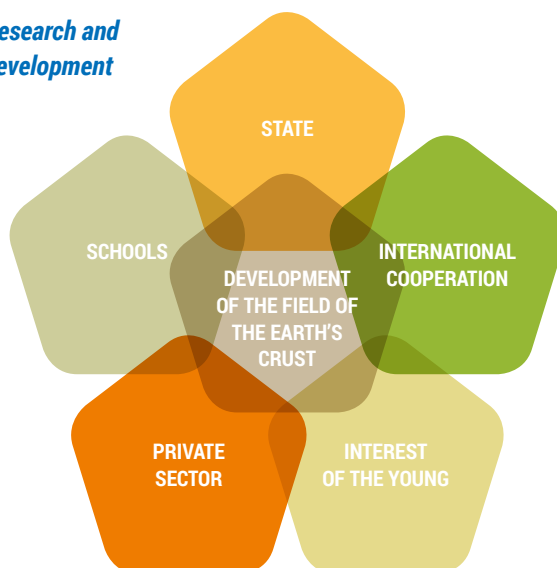
3.1.4. Additional opportunities will be sought for the practical use of the existing resources so that the scientific infrastructure of Estonian research institutions studying extractable land could be used in a practical manner. Universities must ensure better access for businesses and government customers to updated analytical infrastructure services established with the help of public funds. Private equity will be involved in applied research.

3.2. The need for international cooperation will have been defined, the responsibilities and objectives of the management of the co-operation will have been agreed upon, and the cooperation will be carried out effectively.

3.2.1. In order to ensure a high level of education and research, universities will enhance international cooperation by developing such appropriate networks, curricula, and study courses for this which complement fields that do not exist here or which are less researched but are important for the sake of sustainable and efficient use of Earth's crust in Estonia.

3.2.2. To foster international cooperation, the state will analyse, with universities, the need for and capabilities and opportunities of international cooperation in topics related to Earth's crust, and will develop the principles for supporting university participation in collaborative projects on the basis of the analysis, and take these principles into account in the planning of the support.

Research and development



3.2.3. To gain experience and increase financial capability, scientific and educational institutions, and the state's authority in geological surveys will participate in international

procurements for geological works, and find other options to enter the international market.

4. Collecting, storing, and disseminating information and raising awareness

Different institutions in Estonia possess many geological materials and much information which are very important, as they make carrying out research work easier and considerably cheaper. Geological material and information must be maintained in a sustainable manner and must be available to interested parties for a legitimate purpose and extent.

Having a substantive say in the field of Earth's crust presumes, at least to some extent, having professional knowledge. All parties must have enough knowledge of the use of Earth's crust so that they could take part in the discussions on finding more effective solutions.

Examples of monitoring related to Earth's crust include groundwater monitoring, seismic monitoring, and coastal monitoring. Results of adequate, properly targeted, and sustainable monitoring are also necessary, inter alia, to make informed decisions and assess the implications of these decisions. Based on the above, the policy guidelines related to the research and exploitation of Earth's crust have been formulated.

4.1. The collection, storing, and availability of information about the Earth's crust will be organised in the best possible way. This means that user-friendly IT solutions will be used, and the information will be linked to different databases and publicly available to a reasonable extent.

4.1.1. To make geological information available, information managed by public authorities will be digitised in a reasonable volume, the geological database software will be linked and made compatible with the databases of research institutions, and the managing of databases will be organised on a unified basis. The development of existing databases and information systems will take into account the purposes of their use, their function, and the best practises of other countries. All state-owned research and data on Earth's crust will be made publicly available to a reasoned extent.

4.1.2. To ensure the purposeful use of existing and additional geological material (including drill cores), the state will guarantee a long-term and proper storage of geological materials, free access to them for research, and the possibility of storing the additional geological rock materials.

4.2. The public is adequately informed about the use of Earth's crust, and the industry's reputation is, based on objective circumstances, as good as possible.

4.2.1. To support knowledge-based debates with the Estonian people in making decisions in the field, systematic notifying for the public will be ensured, as well as raising awareness on the topics related to the Earth's crust. For this, efficient channels will be used and as many interest groups as possible will be involved.

4.3. Environmental monitoring ensures a dataset corresponding to the needs of organising the use of Earth's crust.

4.3.1. Environmental monitoring provides sufficient information to assess environmental resilience, the nationwide and regional impact of the use of resources to the natural environment and human health, the geo risks, and the successfulness of reclaiming Earth's crust and the land disturbed by the use. The monitoring is targeted at meeting certain strategic goals, and the monitoring programs are long-term and sustainable. All state-owned monitoring data related to the use of extractable land resources will be systematised, with the purposes of use in mind, associated, and made available to the public in a user-friendly way.

5. Management of use of Earth's crust

The state's interests related to the field of Earth's crust must be clearly defined to ensure that the sectoral competence of all the relevant institutions is at an adequate level, and to manage the field based on the relevant principles. The Earth's crust in Estonia contains several resources with considerable economic potential. Considering the environmental, social, and economic impacts related to the use of extractable land resources, the state should have the main competence and initiative in making decisions regarding the use of these resources. For this end, it is necessary to, at the national level, systematically and consistently plan, carry out, and fund research on extractable land resources and their valuation.

The relevance of the legislation must be regularly reviewed and, on the basis of the results, optimised and complemented, if necessary. The legal framework must be purposeful and proportionate, and its implementation for all concerned must be as little burdensome as possible. For example, a compatible co-effect of the norms of spatial planning and the use of Earth's crust must be ensured; it would be practical to make the decision-making process over restricted land use categories (including land use categories restricted by nature conservation, mineral deposits, national defence, as well as with other restricting objects); and the process of issuing activity licences must be as clear as possible. Additionally, during this process, approval by local residents for the proposed activity must be sought.

When the state is considering the introduction of a mechanism for guiding the use of Earth's crust in terms of location, it must be assessed whether and in what situation it would be reasonable. It might happen that under specific conditions or with specific resources, state intervention may be reasonable and justified. At the same time, it must be considered whether the intervention has a significant positive effect. In addition, it is important, when making decisions related to planning the use of extractable land resources and ensuring their security of supply, to have information about the need for resources, and this requires making reliable forecasts. Based on the above, the policy guidelines related to the research and exploitation of Earth's crust have been formulated.

5.1. The tasks of the public sector in managing the field of Earth's crust are clearly defined and support the vision of the development document and the achievement of the objectives established in the document. The tasks will be carried out effectively and efficiently in the relevant structures.

5.1.1. To ensure balanced development, the management of the field will involve, in reasonable volume, all of the most relevant national competences and interests.

5.1.2. To execute the tasks related to the field of Earth's crust in a more complete and efficient way, the management of applied research and the role of the competence centre of extractable land resources will be centralised under one public authority.

5.1.3. To take the interests of the locals into account and to ensure information exchange, local authorities will be involved at the earliest possible stage of the decision-making processes related to extractable land resources, and their reasoned opinions will be taken into account to the greatest extent possible.

5.2. The Estonian law on Earth's crust will be purposeful, proportionate, and directed towards the use of the Earth's crust in a way which creates the most value.

5.2.1. The Estonian law on Earth's crust will avoid under or overregulation, value the exploitation of the economic potential of Earth's crust, and reduce bureaucracy to provide an appropriate framework for achieving the goals related to the national field of Earth's crust.

5.2.2. The legislation related to the research and sustainable use of Earth's crust as a national treasure will be designed in a way that the Government of the Republic would have the right to make the final decision in the case of important public interest. At the same time, the authorisation procedure will include, to the greatest extent possible, all possible accompanying relevant aspects, which might require separate approval or authorization. Later additional procedures related to the activity must not prevent its implementation without reasonable excuse.

5.2.3. To make the procedures related to permitting the use of Earth's crust more efficient and to increase social acceptability, the state will implement measures to promote active communication and cooperation between the users of Earth's crust and the persons who are subject to the effects of the planned activity in a way which ensures that an agreement for implementing the activity is reached with the community in as many cases as possible.

The location of the use of earth's crust must be reasonable and spatially thought-through; after use, the site must be reclaimed in the light of the development of the entire region.



5.2.4. To make the management of use of extractable land resources reasonable and sustainable, the restrictions and obligations imposed on the activities will be grounded, relevant, and up-to-date.

5.3. When directing the selection of a location for use of Earth's crust, practical, sensible, and economical solutions will be sought for Estonia on the basis of the best practises. The management of the use of Earth's crust and spatial planning will work in concert.

5.3.1. To better manage the use of Earth's crust and to realise the interests of the state, the state will direct the selection of a location for use of Earth's crust in situations where it contributes to the rational and sustainable use of resources, reduces significant negative environmental, social, and economic impacts, and facilitates the management of use of Earth's crust.

5.3.2. To create consistency in the regulatory provisions in the field of spatial planning and Earth's crust, the relationship between different levels of spatial planning will be clearly determined with the management of use of Earth's crust.

5.3.3. To better plan the use of extractable land resources and to ensure the security of supply, the state will regularly prepare and

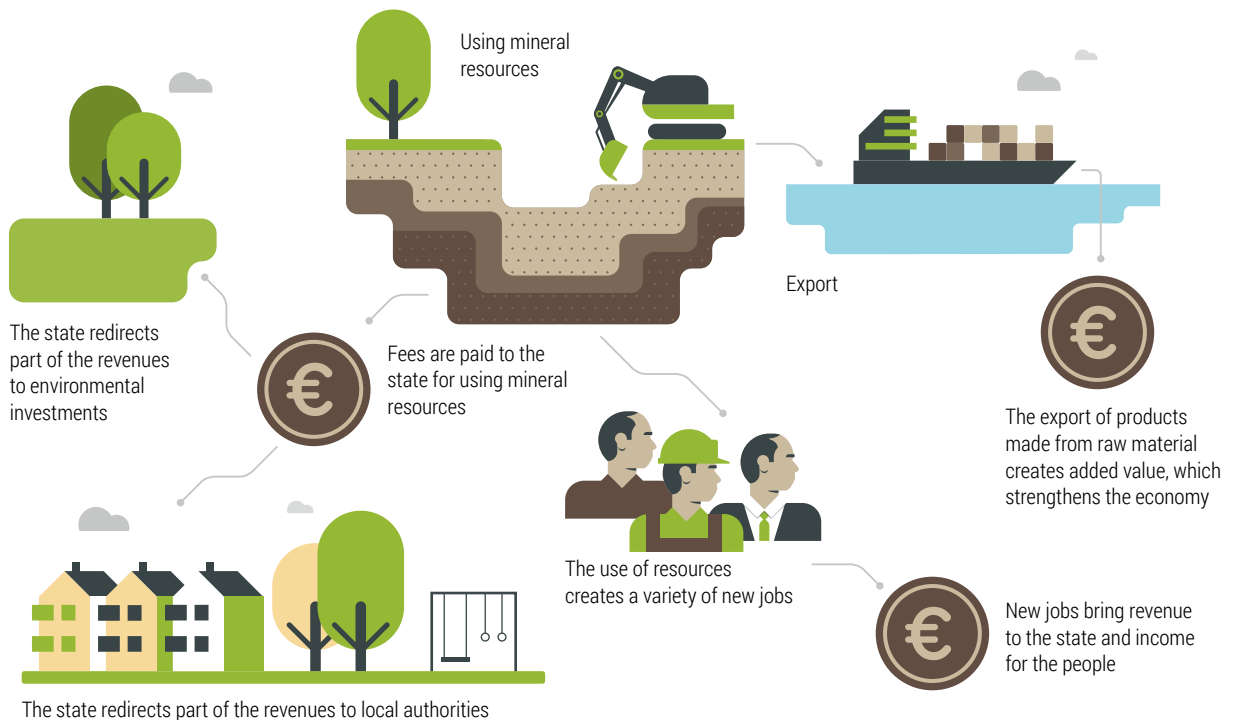
renew forecasts for the need of mineral resources and groundwater, which will bring out the need both temporally and geographically.

5.4. The choice between alternative land uses will be flexible, prudent, knowledge-based, and take into account different interests.

5.4.1. To ensure the availability of mineral resources, the state will organise the protection of mineral deposits and the land necessary for their exploitation from activities which aggravate or hinder the use of mineral resources, considering the importance of the protected mineral deposit and the alternative use of land for the state, the impact of the proposed activity on the use of mineral resources, and the likelihood of temporal overlap of the proposed activity and the use of mineral resources. The state will evaluate the importance of mineral deposits on the basis of criteria developed for this purpose.

5.4.2. To ensure the realisation of the state's interests to the maximum possible extent, the selection between different land uses will be based on the circumstances and priorities related to the particular case. The state will make the choice between alternative land uses flexible.

The use of mineral resources is aimed at promoting the state's economic growth, while compensating for the environmental impacts, and providing benefits to people directly affected by the operation and local governments.



III Reporting

The Government of the Republic will submit, from 2021, an overview of the implementation of the general principles of Earth's crust policy to the Riigikogu not less than every four years. The general principles of Earth's crust policy until 2050 will also be reviewed and updated every four years, if necessary.