

Critical raw materials for the EU

Report of the Ad-hoc Working Group on defining critical raw materials

The *ad-hoc* Working Group is a sub-group of the Raw Materials Supply Group and is chaired by the European Commission

Note: The full report will be available on the Enterprise and Industry Directorate General website http://ec.europa.eu/enterprise/policies/raw-materials/documents/index_en.htm



European Commission
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Executive summary

Although raw materials are essential for the EU economy, their availability is increasingly under pressure. Within the framework of the EU Raw Materials Initiative, it was decided to identify a list of critical raw materials at EU level, in close cooperation with Member States and stakeholders. The attached report presents the outcome of this cooperation achieved through an expert working group ("the Group") which was active between April 2009 and June 2010 under the umbrella of the Raw Materials Supply Group.

With regards to geological availability, the Group observes that, as geological scarcity is not considered as an issue for determining criticality of raw materials within the considered time horizon of the study, e.g. ten years, global reserve figures are not reliable indicators of long term availability.

Of greater relevance are changes in the geopolitical-economic framework that impact on the supply and demand of raw materials. These changes relate to the growing demand for raw materials, which in turn is driven by the growth of developing economies and new emerging technologies. Moreover, many emerging economies are pursuing industrial development strategies by means of trade, taxation and investment instruments aimed at reserving their resource base for their exclusive use. This trend has become apparent through an increasing number of government measures such as export taxes, quotas, subsidies etc. In some cases, the situation is further compounded by a high level of concentration of the production in a few countries.

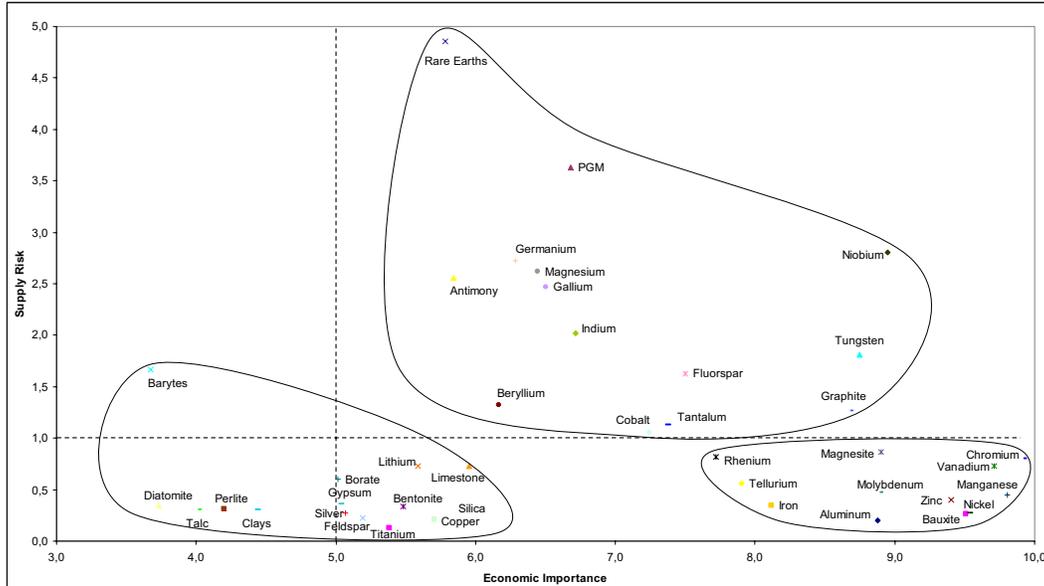
This report analyses a selection of 41 minerals and metals. In line with other studies, the report puts forward a relative concept of criticality. This means that raw material is labelled "critical" when the risks of supply shortage and their impacts on the economy are higher compared with most of the other raw materials. Two types of risks are considered: a) the "supply risk" taking into account the political-economic stability of the producing countries, the level of concentration of production, the potential for substitution and the recycling rate; and b) the "environmental country risk" assessing the risks that measures might be taken by countries with weak environmental performance in order to protect the environment and, in doing so, endanger the supply of raw materials to the EU. Building on existing approaches, this report sets out an innovative and pragmatic approach to determining criticality.

In particular,

- It takes into account the substitutability between materials, i.e. the potential for substitution of a restricted raw material by another that does not face similar restrictions.
- It deals with primary and secondary raw materials, the latter being considered as similar to an indigenous European resource.
- It introduces a logical way to aggregate indicators and makes use of widely-recognised indexes.

- It presents a transparent methodology.

Based on a criticality methodology, calculations are made regarding the economic importance and supply risk of the 41 materials.



The Group considers that those 14 raw materials falling within the top right cluster of the above diagram are critical. As noted, this is due to their high relative economic importance and to high relative supply risk. The 'environmental country risk' metric does not change this list of critical materials.

List of critical raw materials at EU level (in alphabetical order):

Antimony	Indium
Beryllium	Magnesium
Cobalt	Niobium
Fluorspar	PGMs (Platinum Group Metals) ¹
Gallium	Rare earths ²
Germanium	Tantalum
Graphite	Tungsten

¹ The Platinum Group Metals (PGMs) regroups platinum, palladium, iridium, rhodium, ruthenium and osmium.

² Rare earths include yttrium, scandium, and the so-called lanthanides (lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium and lutetium)

For the critical raw materials, their high supply risk is mainly due to the fact that a high share of the worldwide production comes from China (antimony, fluorspar, gallium, germanium, graphite, indium, magnesium, rare earths, tungsten), Russia (PGM), the Democratic Republic of Congo (cobalt, tantalum) and Brazil (niobium and tantalum). This production concentration, in many cases, is compounded by low substitutability and low recycling rates.

Concerning the materials positioned in the sub-cluster in the lower right corner, it has to be stressed that a small shift in one of the parameters of the supply risk metric may result in a sudden change upwards. In other words, a slight change in the underlying variables may result in one of these materials being reclassified as 'critical'. For several of the materials positioned in the sub-cluster in the lower left corner, notably the industrial minerals, the group considers that possible supply risks may occur within a longer time horizon should 'competition to land' continue to adversely affect production from quarries or mines in the EU.

One of the most powerful forces influencing the economic importance of raw materials in the future is technological change. In many cases, their rapid diffusion can drastically increase the demand for certain raw materials. Based on a study commissioned by the German Federal Ministry of Economics and Technology, the demand from driving emerging technologies is expected to evolve sometimes very rapidly by 2030.

Global demand of the emerging technologies analysed for raw materials in 2006 and 2030 related to today's total world production of the specific raw material (Updated by BGR April 2010).

Raw material	Production 2006 (t)	Demand from emerging technologies 2006 (t)	Demand from emerging technologies 2030 (t)	Indicator ¹ 2006	Indicator ¹ 2030
Gallium	152	28	603	0,18	3,97
Indium	581	234	1.911	0,40	3,29
Germanium	100	28	220	0,28	2,20
Neodymium (rare earth)	16.800	4.000	27.900	0,23	1,66
Platinum (PGM)	255	very small	345	0	1,35
Tantalum	1.384	551	1.410	0,40	1,02
Silver	19.051	5.342	15.823	0,28	0,83
Cobalt	62.279	12.820	26.860	0,21	0,43
Palladium (PGM)	267	23	77	0,09	0,29
Titanium	7.211.000 ²	15.397	58.148	0,08	0,29
Copper	15.093.000	1.410.000	3.696.070	0,09	0,24

¹ The indicator measures the share of the demand resulting from driving emerging technologies in total today's demand of each raw material in 2006 and 2030;

² Ore concentrate

The main driving emerging technologies for the critical raw materials are the following:

Raw material	Emerging technologies (selected)
Antimony	ATO, micro capacitors
Cobalt	Lithium-ion batteries, synthetic fuels
Gallium	Thin layer photovoltaics, IC, WLED
Germanium	Fibre optic cable, IR optical technologies
Indium	Displays, thin layer photovoltaics
Platinum (PGM)	Fuel cells, catalysts
Palladium (PGM)	Catalysts, seawater desalination
Niobium	Micro capacitors, ferroalloys
Neodymium (rare earth)	Permanent magnets, laser technology
Tantalum	Micro capacitors, medical technology

Recommendations

The recommendations are of two types: recommendations for follow-up and further support, and policy-oriented recommendations to secure access to and material efficiency of critical raw materials. The Group refrains from specifying detailed actions, but instead indicates areas where measures should be undertaken.

The Group recommends that the list of EU critical raw materials should be updated every 5 years and that the scope of the criticality assessment should be increased.

The Group recommends that steps be taken to:

- *improve the availability of reliable, consistent statistical information in relation to raw materials;*
- *promote the dissemination of this information, notably by preparing a European Raw Materials Yearbook with the involvement of national geological surveys and mining/processing industries. It should focus on improving the knowledge on the availability of resources and on their flow into products through the value-added chains of the EU economies;*
- *establish indicators of competition to land in the Member States;*
- *encourage more research into life-cycle assessments for raw materials and their products on a "cradle-to-grave" basis;*
- *create a working group(s) to further analyse the impact of emerging technologies on demand of raw materials.*

The Group recommends that a sub-group of the Raw Material Supply Group of the European Commission should be set up to ensure follow-up of this report on critical raw materials.

The Group recommends policy actions to improve access to primary resources aiming at:

- *supporting the findings and recommendations resulting from the work carried out by the ad hoc working group on "Best practices in the area of land use planning and permitting" with a view to securing better access to land, fair treatment of extraction with other competing land uses and to developing a more streamlined permitting processes;*

- *promoting exploration, and ensuring that exploration by companies is regarded as research activity;*
- *promoting research on mineral processing, extraction from old mine dumps, mineral extraction from deep deposits, and mineral exploration in general, notably under EU RTD Framework Programmes;*
- *promoting good governance, capacity-building and transparency in relation to the extractive industries in developing countries, notably in the area of critical raw materials;*
- *promoting sustainable exploration and extraction within and outside of the EU.*

The Group recommends that the following policy actions, with regard to trade and investment as defined in the trade raw materials strategy, be pursued:

- *maintain current EU policy choices in the negotiation of bilateral and regional trade agreements;*
- *consider the merits of pursuing dispute settlement initiatives at WTO level so as to include in such initiatives more raw materials important for the EU industry; such actions may give rise to important case law so long as existing GATT rules lack clarity and are limited in scope;*
- *engage without reservation in consultations with third countries whose policies are causing distortions on international raw materials markets in order to discourage certain policy measures and to request adherence with market forces;*
- *foster an effective exchange-of-views on certain policies made within the institutional framework of EU economic cooperation agreements (e.g. with China on the latter country's NFM recycling plan to year 2015);*
- *continue to raise awareness on the economic impact of export restrictions on developing and developed countries in various multilateral fora, such as WTO or the OECD;*
- *consider shaping a new EU-wide policy on foreign investment agreements in such a manner as to better protect EU investments in raw materials abroad and ensure a level playing-field with other foreign investors who benefit from the backing of State funds;*
- *continue to increase coherence of EU policy with respect to raw materials supply, for example in the assessment of injurious dumping and subsidies.*

The Group recommends that policy actions are undertaken to make recycling of raw materials or raw material-containing products more efficient, in particular by:

- *mobilising End of Life products with critical raw materials for proper collection instead of stockpiling them in households (hibernating) or discarding them into landfill or incineration;*
- *improving overall organisation, logistics and efficiency of recycling chains focus on interfaces and system approach;*
- *preventing illegal exports of EoL products containing critical raw materials and increasing transparency in flow;*
- *promoting research on system optimisation and recycling of technically-challenging products and substances.*

The Group recommends that substitution should be encouraged, notably by promoting research on substitutes for critical raw materials in different applications and to increase opportunities under EU RTD Framework Programmes.

The Group recommends that the overall material efficiency of critical raw materials should be achieved by the combination of two fundamental measures:

- *by minimising the raw material used to obtain a specific product function; this covers every step from smart production with metals and minerals savings to substitution of potentially critical raw materials by less critical ones;*

- *by minimising raw material losses into residues from where they cannot be economically-recovered.*
- The measures should be evaluated with regard to impacts on environmental and economic performance over the entire value chain.*