



European Economic and Social Committee

CCMI/028
Supply of raw materials

Brussels, 5 July 2006

OPINION
of the
European Economic and Social Committee
on
Risks and problems associated with the supply of raw materials to European industry
(own-initiative opinion)

On 14 July 2005 the European Economic and Social Committee, acting under Rule 29(2) of its Rules of Procedure, decided to draw up an own-initiative opinion on:

Risks and problems associated with the supply of raw materials to European industry.

The Consultative Commission on Industrial Change, which was responsible for preparing the Committee's work on the subject, adopted its opinion on 22 May 2006. The rapporteur was Mr Voss. The co-rapporteur was Mr Gibellieri.

At its 428th plenary session, held on 5 and 6 July 2006 (meeting of 5 July), the European Economic and Social Committee adopted the following opinion by 157 votes with seven abstentions.

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1. **Summary and recommendations**

- 1.1 The recommendations must be seen as guidelines for political decisions to implement forward-looking resource, research and development, and external policy at both EU and national level. Achieving the Lisbon objectives, which are designed to make the European Union the most competitive and dynamic economy in the world by the end of the decade, requires an innovative industrial policy, that is in tune with social and environmental conditions and on which the readiness to embrace structural change is contingent. The necessary industrial change must be shaped proactively and in a way that reflects a coherent strategy for sustainable development. This means making the value-added process more materials-efficient and ensuring the sparing use of all resources, as well as progressively replacing finite resources by renewable ones. As part of both these strategies, a new industrial outlook is developing based on technological innovation. The result will be high-quality and secure jobs in industry and industry-related services.
- 1.2 In market economies, the private sector bears primary responsibility for ensuring the supply of raw materials, although governments must help to establish the basis for high security of supply and work towards achieving a sustainable supply of raw materials through industrial, research, employment and environmental policies. More effective promotion of new technologies will not only boost competitiveness and have a favourable impact on jobs, but will also further the switch to a sustainable economy.
- 1.3 As the basis for a sustainable raw materials policy, life-cycle analyses help to ensure that mineral and metallic raw materials are extracted and processed efficiently and with a low environmental impact, that recycling processes are further developed, and that raw materials whose availability is limited and which aggravate the greenhouse effect are – where

technologically possible – increasingly and gradually replaced by low-carbon, renewable and climate-neutral energy sources, or are consumed using efficient technologies with low carbon emission, so as to protect the environment. This can be achieved above all by a targeted policy both by the EU and by Member State governments. The Committee feels that both strategies – efficiency improvement and replacement – offer an opportunity to cut the import dependency of raw materials supply.

- 1.4 The significant growth in worldwide raw materials consumption may lead to supply bottlenecks in the future, at least in the case of certain raw materials. Changes on the world market require a proactive policy on the part of industry in the EU and its Member States. The EU institutions can help to guarantee the supply of raw materials, which is managed mainly by industry, through pro-active trade, research and external policies, while the Member States can also help in this regard through their national raw materials and energy policies, with the aim of preventing production from moving outside the Union. The Committee calls on the Member States to help frame the basic tenets of a European raw materials and energy policy and to shoulder their responsibility for a sustainable raw materials policy in Europe.
- 1.5 The Committee believes that the EU, working closely with the Member States and all stakeholder groups, must ensure that the supply of raw materials to European industry does not come under threat and that raw materials are available on the world market at reasonable prices. To achieve these objectives, the European Union should take action to counter unfair competitive practices and any moves towards protectionism, both through multilateral organisations such as the WTO, OECD and ILO, and bilaterally. A key part of attaining these objectives is intensive dialogue with the political and industrial players that exert an influence over the raw materials market.
- 1.6 The Committee firmly believes that European industry meets all the conditions necessary to tackle with determination the challenges – both present and future – arising from structural changes against the backdrop of global competition. Europe is and will remain a competitive location for industry, while at the same time developing into a sustainable economic area, if a comprehensive innovative policy is pursued that places equal weight on economic prosperity and social and environmental effects.
- 1.7 In conclusion, it must be stressed that, because Europe is so highly industrialised, raw materials supply is of key importance for achieving the Lisbon objectives. Europe's relatively high dependence on imports of fossil, metallic and mineral materials jeopardises not just security of supply but also raw materials prices, given global consumption levels. Industry and policy-makers can make provision by ensuring that measures are actively taken to increase resource efficiency, promote technological innovation in the raw materials and recycling sectors, substitute renewable for non-renewable raw materials, and diversify the supply of raw materials by promoting sources within Europe. With respect to coal it also has to be seen whether a climate-neutral "clean coal" approach can be implemented. Merely taking steps to ensure that enough raw materials are available at competitive prices would, in

contrast, fall short of the mark. As to the external dimension, significant curbs on the growing use of fossil fuels must be a global political objective. The EU's role in this process will have to be determined over the next few months.

2. **Outline of the issue**

- 2.1 Raw materials are the first stage of a complex value-added chain. In a time of increasing globalisation they are essential to the performance and to the development and growth potential of a country's economy. This applies to energy sources and to many metallic, mineral and biological raw materials, which are essential primary inputs for industry. Europe depends on imports for a large number of its raw materials, a fact to which too little attention has been paid to date, though now that raw materials prices are rising, there is greater awareness of this. Price explosions in fossil fuels and coke and steel are notable examples.
- 2.2 The importance of specific raw materials is often only vaguely realised. This may be due to the fact that raw materials are less important than factor allocation as a whole, even though raw materials cannot usually be substituted in the short term, unlike other factors of production. This means that supply shortages, or even interruptions, often lead to production cuts. Price trends on raw materials markets have an almost immediate knock-on effect on the costs of downstream production sectors, and therefore affect the whole economy. Nor should the social aspects of this issue be neglected.
- 2.3 Rampant economic growth in other parts of the world (China, India, etc.) has caused the consumption of energy sources and industrial raw materials to soar over the past decade.
- 2.4 It is also important to mention the regional distribution of raw materials and the discrepancy between the location of reserves and place of consumption. Europe in particular is a region that already shows high import needs for raw materials and fossil fuels, and whose dependence on imports will rise even further in the future.
- 2.5 Energy supply is the driving force behind the European economy. For a number of reasons - the finite nature of many energy sources; dramatic price rises; the impact of military conflicts and political events on security of supply; and the fact that the national "energy policies" in place are, from a global standpoint often ineffectual – supply is, in Europe, under a very high threat.

3. **Global situation**

- 3.1 The situation with regard to energy sources is analysed below by way of example (although the comments also apply to many raw materials) since critical developments are now taking place in this area (oil price fluctuations, suspension of Russian natural gas deliveries), particularly good data are available and political measures are already being discussed.

- 3.2 In 2004 world crude oil production reached 3 847 megatonnes. By the end of 2004 a total of around 139 gigatonnes of oil had been extracted since the start of industrial crude oil production, half of it during the last 22 years. This means that over 46% of proven reserves of conventional crude oil have already been extracted.
- 3.3 China's role in this context requires particular mention, since that country has changed in the last 20 years from a net exporter of crude oil to a net importer, and will draw increasingly on worldwide available oil resources in the future to support its meteoric economic growth.
- 3.4 In addition, other events such as the Iraq war, the hurricanes in America, stagnating investment leading to bottlenecks in production and transport capacity, temporary supply breakdowns due to strikes, and speculation have contributed to significant increases in the price of crude oil and – with a time lag – natural gas. Despite this, real prices, i.e. prices corrected for inflation, are still lower now than at the beginning of the 1980s.
- 3.5 As well as these price movements, the question of fossil fuel availability obviously also arises. At the end of 2004, total conventional crude oil potential was around 381 gigatonnes. The countries of the Middle East have about 62% of global reserves, America 13% and the CIS just under 10%. It should be noted that in North America almost two thirds of total expected potential has already been recovered, whereas in the CIS the figure is a little over one third and in the Middle East just under a quarter.
- 3.6 The situation is not very different for natural gas. The total global potential of conventional natural gas is about 461 trillion cubic metres, which in energy terms corresponds more or less to the total potential of crude oil. Over one half of natural gas reserves are concentrated in three countries (Russia, Iran and Qatar). An additional 207 trillion cubic metres of natural gas reserves are expected. This means that so far almost 18% of proven natural gas reserves have been extracted. In 2004 natural gas consumption reached a historic high at 2.8 trillion cubic metres. The biggest consumers of natural gas were the United States, followed by Russia, Germany, the United Kingdom, Canada, Iran and Italy.
- 3.7 The largest reserves are still those of coal. Estimating from global coal consumption in 2004, reserves of hard coal should last another 172 years from the beginning of 2005, and reserves of lignite another 218 years. In 2004, coal accounted for 27% of global primary energy consumption. Only crude oil consumption was higher. 24% of this was accounted for by hard coal and 3% by lignite. Coal was the most important energy feedstock for electricity production, with a worldwide share of around 37%.
- 3.8 The distribution of hard coal deposits is more even than that of crude oil and natural gas. Although here, too, Russia has a considerable share of global reserves, North America, Asia, Australia and South Africa, which have significantly less crude oil and natural gas, possess large coal deposits. But global coal reserves are highly concentrated. Almost three quarters of reserves are found in just four countries: the United States, Russia, China and India. The EU

has considerable coal reserves - in contrast with the oil and gas situation. But it is important to note that quality varies widely. In the case of coking coal, which is only supplied by a few regions and for which global demand is relatively steady, about 35% of total production is traded worldwide. Only 16% of all world coal produced is currently traded internationally. Exports also come from a small number of countries, and the industry is becoming increasingly consolidated. Export supplies of coking coal are particularly concentrated, with 60% coming from Australia alone; 50% of all coke exports come from China.

- 3.9 Price trends for coal over the past few decades have been similar to those for crude oil and natural gas, but at a considerably lower level per energy content. Thinking of raw materials especially, it is important not to forget that coal can be used not just as an energy source and essential reducing agent for pig iron production, but also in a whole series of ways as fuel in various chemical applications or in the construction industry. It must be borne in mind, however, that for environmental reasons coal is, as far as possible, used with modern, clean and efficient technologies, including, given the very high levels of greenhouse gas emissions, technologies to sequester and store CO₂.
- 3.10 The volatility of the supply situation is further illustrated by the continuing escalation in global energy consumption, as reported by the International Energy Agency (IEA) in its November 2005 *World Energy Outlook* report. If there is no change in consumer behaviour, worldwide energy demand will rise by more than 50% by 2030, to 16.3 billion tonnes of oil equivalent. Events at the beginning of 2006, when gas supply to central and western Europe was reduced because Russia cut off gas supplies to Ukraine, could be a harbinger of future supply scenarios if Europe's dependency on energy imports continues to increase. A key objective must therefore be to implement the Commission's two green papers on *security of energy supply* and *energy efficiency*, and to conduct a wide-ranging and constructive debate on the new Green Paper on *A European energy strategy*.
- 3.11 It should be noted that the IEA figures are incompatible with climate protection. Rather than the reduction in greenhouse gas emissions required for climate protection, the IEA projection would mean an increase in CO₂ emissions of at least 52% by the year 2030. Significant curbs on carbon emissions from the growing use of fossil fuels must therefore be a global political objective. The EU's role in this process will have to be determined over the next few months.
- 3.12 Nuclear energy is seen by very disparate groups as a possible solution to the greenhouse effect. In addition to the risks of the nuclear option, there is the question of supply security. The world's uranium reserves are found in a small number of countries. The most important regions of uranium extraction are currently Australia, North America, some African countries, and the CIS countries. It is also thought likely that deposits will be found in China and Mongolia. An expansion of nuclear energy for peaceful applications, especially in China, could lead to a shortage of uranium within 30 years.

- 3.13 About 12% of crude oil is used to make petrochemical products. Plastics are a major petrochemical product group. 224 million tonnes of plastic were produced worldwide in 2004, of which 23.6% came from western Europe. According to current forecasts, global consumption of plastics will continue to rise: per capita use is expected to increase by 4.5% per year up until 2010. Key growth markets are eastern Europe and south-east Asia.
- 3.14 As well as fossil fuels, ores are also an important raw material for the European economy. Iron ore is particularly important. Over 1 billion tonnes of steel were produced across the world in 2004. Steel production is thus considerably higher than that of other materials. Iron ore consumption was 1.25 billion tonnes in 2004 – one if not two orders of magnitude ahead of the next most widely used ores: bauxite (146 million tonnes), chrome ore (15.5 million tonnes), zinc ore (9 million tonnes) and manganese ore (8.2 million tonnes).
- 3.15 According to the US Geological Survey, in 2005 economically viable iron ore reserves stood at about 80 billion tonnes of iron equivalent, which is more than 100 times greater than current demand. If deposits that are not currently considered economically viable are included, the total volume of deposits increases to around 180 billion tonnes of iron. Despite these large deposits, it is assumed that iron ore prices will, in future, continue to be high. One reason for that is undoubtedly the dominant market position of three large firms (CVRD, BHP and Rio Tinto) which, together, have a good 75% market share of global iron ore production. Bottlenecks are also expected in maritime transport, leading to increased transport costs and thus to higher ore prices for the European steel industry.
- 3.16 The availability of coke and coking coal must also be seen as a factor in safeguarding European iron and steel production. Coking coal exports from the USA are set to drop; this will in turn expand the market position of Canada and Australia. To safeguard supplies worldwide, however, steady growth is needed in these countries' capacity. With the expansion of coking plants in China, that country too is set to become an increasingly important coke supplier, although other countries are also building up new coking capacity for the domestic market.
- 3.17 Another important raw material in steel production is scrap metal. The worldwide trade in scrap metal has expanded considerably over the past few years. Because of the durability of steel products, however, the supply of scrap metal cannot keep pace with demand, which means that the already tight market for scrap metal is set to expand considerably. Further still it is assumed that, despite the fact that the situation does appear to have eased over the past few months, scrap metal prices, which tripled between 2002 and 2004, will increase again in the longer term.
- 3.18 Other metallic raw materials such as manganese, chromium, nickel, copper, titanium and vanadium are important alloys which have a strong effect on the properties of the basic material. These metals – as well as palladium, which is an important raw material for high-tech applications – have to be imported into Europe.

- 3.19 The fact that the raw materials described, and many other raw materials, are still available in sufficient quantities means that the price rises now being observed do not signal the depletion of resources in the medium term. However, this does not rule out the possibility of demand and supply shifts, or make price movements random. In the short term, the supply of raw materials is not very flexible owing to the long lead times of capital-intensive exploration projects. When demand for raw materials is high, it is quite possible that shortages and price rises will occur. The same applies to transport capacity, which also limits the availability of (imported) raw materials. Sufficiency of global reserves and resources may limit the risk of quantitative supply disruptions, but they do not provide a guarantee against marked short-term and medium-term price rises. A complete evaluation of supplier and price risks on international raw materials markets means taking into account political measures, and monopolistic or oligopolistic behaviour of companies with a strong market position.
- 3.20 This is particularly important given that a considerable proportion not just of major energy sources, but also of metal raw materials are concentrated in certain regions of the world and with certain companies, and this concentration has increased significantly since the early 1990s, at least in the case of metals. Thus Chile has almost tripled its share of copper ore production since 1990, and almost 40% of the world's bauxite is produced in Australia. Brazil has also substantially increased its importance as a bauxite supplier, and is now the second-largest bauxite producer, highlighting South America's key role in the production of metal ores. The same goes for iron ores, about 30% of which are produced in Brazil. Of the EU Member States, only Sweden is of any importance as an iron-ore producer, but it accounts for only 1.6% of total world production.

4. **European industry**

- 4.1 Industry continues to be very important to the economy of the EU because of its contribution to employment and value added. It is the key link in the value-added chain for producing material goods. Without goods manufactured in the industrial sector many services are pointless. This means that industrial production will not lose its position as a source of wealth. A secure supply of raw materials for industry is therefore essential. There is an imbalance in the case of fossil and many metallic raw materials between reserves and consumption, which means that oligopolies among the supply countries can distort markets, including in Europe. Appropriate measures must be taken for all raw materials in order to reduce Europe's dependence on imports in the future, as set out in the Green Paper on security of energy supply.
- 4.2 Statistics show that substantial differences exist between European manufacturers with regard to both raw material and energy efficiency. Thus energy-saving potential can be said to exist across Europe, and savings should be pursued urgently so as to cut overall dependence and boost development activity.

- 4.3 The future of one industrial sector does look positive, despite being dependent on imports of its raw material. Europe's steel industry can compete on the world market because it has already successfully restructured and drawn the right lessons from that process. This consolidation has achieved a structure that allows companies to make adequate profits, even during periods of economic difficulty. Countries like China and India still have to go through the necessary structural transition.
- 4.4 In the EU especially, the steel industry has sound, efficient value-added chains, in which steel plays a central role. There are also infrastructure and logistical advantages: on the European steel market producers and customers come together in a relatively small area with good transport connections to international rail, water and road networks, which in turn brings competitive advantages.
- 4.5 In addition, European steel companies have mounted a considerable effort and invested large sums in environmental protection and energy efficiency. They have the highest recycling rate after the United States, which means they use large quantities of scrap metal in their production and thus save on resources. Use of reducing agents in blast furnaces is also markedly lower than in many countries outside of Europe.
- 4.6 Despite this positive mood in the European steel industry, however, it should be borne in mind that as a result of the dependency on raw materials imports, high energy prices and enhanced environmental protection measures, the liquid phase in particular could, in the medium term be shifted from Europe to regions that can offer secure raw materials supplies and reasonably priced energy. As this phenomenon affects not only iron but also aluminium and other metals, a considerable number of European jobs may be lost that can only be recouped through research and development in the fields of resource and energy efficiency, and through innovative product development and industrial services. Nor does shifting the liquid phase to countries with lower environmental standards and lower energy prices help to further sustainable development across the world; it merely worsens the European position.

5. **Alternative raw materials scenarios and technological trends**

- 5.1 If, as in the past, the global economy continues to grow primarily through the use of fossil raw materials, then climate problems must also be expected to increase – even before the sources of these raw materials dry up – as a result of higher greenhouse gas emissions. Thus, in its *World Energy Outlook 2006*, the IEA expects global CO₂ emissions worldwide to be up more than 52% by 2030 over 2004 levels. Yet, according to other estimates, industrial countries' CO₂ emissions will have to be cut by 80% across the world by 2050 in order to be able, in the long term, to keep climate change at tolerable levels both for man and the environment. There is thus a demand for technologies that emit considerably lower levels of greenhouse gases than those used at present.

- 5.2 Increased use of renewable energy is often regarded as the first option for reducing greenhouse gases. The EU is a pioneer here: its White Paper on renewable energy sources¹ sets the objective that by 2010, 12% of primary energy should come from renewable energy sources. However, achieving this goal will require not just new biomass, wind and solar energy plants. It is also of prime importance to substantially reduce the present rate of growth in energy consumption. Energy-saving potential should be tapped at all levels of added value and consumption, as well as disposal. Targeted moves to foster technical progress thus provide an opportunity for securing lower greenhouse gas emissions in the future while at the same time boosting the competitiveness of European industry.
- 5.3 In 2005, the European Environment Agency concluded that by 2030 between 230 and 300 Mtoe per year (equivalent to 9.6 or 12.6 x 10¹⁹ joules) of biomass could be made available, without harming the environment and preventing the EU from being largely self-sufficient in agricultural products. This would be amount to about 20% of current primary energy use in the EU 25. A total 100 Mtoe per year will be obtained from waste, 40-60 Mtoe from forestry products, and 90-140 Mtoe from agricultural products. Biogenic raw materials could be used not just as energy sources, but also to make broad range of products that for price reasons are still only a niche business. Intelligent combinations of raw materials and processes, and new processing strategies, could soon make bioplastics competitive for example.
- 5.4 Use of regrowing raw materials must increase worldwide. In the context of promoting research and technology not enough attention has so far been paid yet to renewable energy and fuel sources. Current price-cost ratios mean that various market launch measures must be used to ensure broader market and technology development.
- 5.5 As regards the potential for agricultural biomass, it is important to bear in mind that the world's available per capita arable area is shrinking dramatically. Today about the same amount of land is available for grain cultivation as in 1970, but then there were almost three billion fewer people, which means that in 1970 around 0.18 hectares of arable land was being cultivated per capita, whereas now the figure is barely 0.11 hectares. This trend is increasing because some 7 million hectares of agricultural land are lost every year to erosion, salination or desiccation and over one quarter of all cultivated land is considered to be at risk.
- 5.6 According to FAO estimates, the developing countries will have to double their grain imports over the next 20 years. This means that grain will in future be scarce and more expensive. The feed requirements of productive livestock and demand for renewable raw materials in the industrialised world will therefore increasingly conflict with the food needs of the developing countries. Livestock feed requirements could be contained by reducing high meat consumption, which would make more calories available given that about 90% of food energy is lost through fodder consumption. It will thus be particularly important to promote better use

¹ Communication from the Commission – Energy for the future: renewable sources of energy – White Paper for a Community Strategy and Action Plan.

of plants, plant components and by-products containing lignocellulose (wood, straw and grasses being classic examples). The great need for research and development here also means that a sea change is urgently required in the EU research framework programme to promote a renewable energy and raw materials basis and to boost efficiency.

- 5.7 In these circumstances it is clear that switching to renewable energy sources and industrial raw materials can be only part of the solution. It will be essential to employ technologies that use substantially less energy and raw materials to deliver equivalent services. Thus, in the steel industry during the past four decades energy consumption and CO₂ emissions have been cut by around 50%. To permit further savings, the consortium ULCOS (*Ultra Low CO₂ Steelmaking*) launched by the European steel industry, working together with research bodies, is planning a considerable cut in emissions and thus a breakthrough on the road towards more energy-efficient steelmaking. A smelting reduction technique developed in the 1980s is already making it possible to use lower-grade coal and reduce CO₂ emissions by up to 30% compared with the blast-furnace process.
- 5.8 Efficiency improvement is a promising strategy to reduce costs, protect resources and ensure jobs. Raw materials costs account on average for 40% of total costs, and are thus the biggest cost factor. Without changing economic performance, efficient use of raw materials helps to reduce costs and, because resource consumption is lower, damage to the environment. Incentives to improve efficiency based on government initiatives and programmes, such as research projects and competitions, can motivate companies to use this potential. Small and medium-sized companies in particular should be made aware of possible efficiency and savings potential in raw materials use, by promoting appropriate management methods such as EMAS and ISO 14001.
- 5.9 Technical standards for the use of raw material stocks available in the European Union must be high. This applies in particular to coal. Backing may be given to the further expansion of capacity only if, also for reasons of climate protection, the "clean coal" option is actually implemented.
- 5.10 Higher recycling quotas, especially ones developed through technological innovation with improved properties as regards production, processing and use, provide a further solution to the problem of import dependency. Here substantial increases in raw material efficiency should be combined with innovative product development. This could bring about changes in market demand for various raw materials, creating an industrial growth potential, driven by research initiatives, that offers advantages over traditional processes in terms of both industrial and employment and environmental policies.
- 5.11 It is important to remember that, in addition to direct energy-saving in industry, major potential also exists for savings to be made in the home and in transport. Low-energy and passive-energy houses make it possible to save substantially on primary energy use in both heating and cooling. Combining such measures with efficient energy delivery technologies

such as condensing boilers or heat pumps could save up to 90% compared with the current average. Nor is it unrealistic to expect a fourfold reduction in energy consumption in private car transport by optimising propulsion technologies and user behaviour.

Brussels, 5 July 2006

The President
of the
European Economic and Social Committee

The Secretary General
of the
European Economic and Social Committee

Anne-Marie Sigmund

Patrick Venturini

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N.B.: Appendix overleaf.

APPENDIX

Worldwide distribution of major raw materials

Raw material	Largest reserves (by country) (countries with over 5% share of global reserves)	Share of global reserves
Crude oil	Saudi Arabia	21%
	Iran	10%
	Iraq	9%
	Kuwait	8%
	United Arab Emirates	8%
	Venezuela	6%
	Russia	5%
Natural gas	Russia	27%
	Iran	16%
	Qatar	15%
Coal	United States	27%
	Russia	17%
	China	13%
	India	10%
	Australia	9%
	South Africa	5%
Uranium	Australia	30%
	Kazakhstan	18%
	Canada	12%
	South Africa	8%
	Namibia	6%
Gold	South Africa	14%
	Australia	12%
	Peru	8%
	United States	7%
	Russia	7%
Diamonds	Congo	26%
	Botswana	23%
	Australia	16%
	South Africa	12%
	Russia	7%
Platinum-group metals	South Africa	88%
	Russia	9%

Iron ore	Ukraine	19%
	Russia	16%
	Brazil	14%
	Canada	14%
	China	13%
	Kazakhstan	5%
Bauxite	Guinea	30%
	Australia	23%
	Jamaica	8%
	Brazil	8%
Copper	Chile	30%
	Indonesia	7%
	United States	7%
	Poland	6%
	Peru	6%
	China	6%
	Mexico	6%

Sources: USGS, IAEA, BP

Total conventional crude oil potential (end 2003); production and consumption of mineral oil, 2003 (in Exajoules, EJ)

Region	Cumulated production	Production 2003	Reserves	Reserve base	Total potential	Consumption 2003
EJ						
Europe	313	13	130	152	595	32
CIS	864	21	642	882	2 389	7
Russia	723	18	398	565	1 686	5
Caspian region	121	4	236	236	593	1
Russia and Caspian region	844	21	634	800	2 279	6
Africa	479	16	590	413	1 482	5
Middle East	1 522	43	4 161	858	6 542	9
Australia-Asia	432	15	260	268	959	44
North America	1 525	28	330	561	2 415	46
Latin America	522	12	571	300	1 393	9
World	5 657	149	6 687	3 433	15 777	152
OECD	1 837	42	499	746	3 082	93
EU-15	163	6	56	61	280	26
EU-25	170	6	58	65	293	28
OPEC	2 247	56	5 034	1 142	8 423	12

Source: Matthes/Ziesing: Sicherheit der Rohstoffversorgung, Berlin 2005 (based on Rempel et al., 2004)

Total natural gas potential (end 2003); production and consumption of natural gas, 2003 (in Exajoules, EJ)

Region	Cumulated production	Production 2003	Reserves	Reserve base	Total potential	Consumption 2003
EJ						
Europe	384	14	267	298	948	22
CIS	866	32	2 366	4 019	7 251	25
Russia	618	26	1 992	3 473	6 083	18
Caspian region	172	6	324	498	994	3
Russia and Caspian region	790	31	2 316	3 971	7 076	21
Africa	86	6	564	468	1 118	3
Middle East	145	11	2 994	1 361	4 500	9
Australia-Asia	201	13	584	949	1 735	14
North America	1 374	32	359	1 142	2 875	32
Latin America	92	5	302	412	806	5
World	3 146	112	7 435	8 651	19 233	110
OECD	1 731	47	711	1 508	3 949	58
EU-15	275	10	142	130	547	18
EU-25	294	10	153	140	587	20
OPEC	287	18	3 656	1 782	5 725	13

Source: Matthes/Ziesing: Sicherheit der Rohstoffversorgung, Berlin 2005 (based on Rempel et al., 2004)

Reserves, reserve base, production and consumption of coal and uranium, 2001

Region	Hard coal and lignite				Uranium			
	Reserves	Reserve base	Production 2001	Consumption 2001	Reserves	Reserve base	Production 2001	Consumption 2001
	EJ							
Europe	1 623	13 742	8.7	14.4	1	259	0.3	9.5
CIS	4 604	48 892	8.9	7.5	146	1 304	3.4	2.0
Africa	917	5 052	5.3	3.7	78	859	2.4	0.1
Middle East	5	58	0.0	0.3	0	5	0.0	0.0
Australia-Asia	6 271	24 107	43.0	42.7	268	2 930	3.5	4.8
North America	5 720	23 187	24.6	24.7	133	1 372	5.6	8.5
Latin America	480	1 070	1.2	0.9	18	526	0.1	0.2
World	19 620	116 108	91.7	94.4	644	7 256	15.3	25.2
OECD	9 470	37 222	42.8	46.4	398	3 040	9.0	21.7
EU-15	1 148	9 952	4.0	8.9	12	184	0.1	8.4
OPEC	146	559	2.3	0.8	0	74	0.0	0.0

Source: Matthes/Ziesing: Sicherheit der Rohstoffversorgung, Berlin 2005 (cited in BGR, 2003)

Iron ore production, reserves and reserve base

	Production		Iron ore reserves		Iron ore reserve base	
	2003	2004*	Exploitable	Total	Exploitable	Total
	Million tonnes					
United States	46	54	6 900	15 000	2 100	4 600
Australia	187	220	18 000	40 000	11 000	25 000
Brazil	212	220	21 000	62 000	14 000	41 000
Canada	31	31	1 700	3 900	1 100	2 500
China	261	280	21 000	46 000	7 000	15 000
India	106	110	6 600	9 800	4 200	6 200
Iran	16	16	1 800	2 500	1 000	1 500
Kazakhstan	17	17	8 300	19 000	3 300	7 400
Mauritania	10	10	700	1 500	400	1 000
Mexico	11	12	700	1 500	400	900
Russia	92	95	25 000	56 000	14 000	31 000
South Africa	38	40	1 000	2 300	650	1 500
Sweden	22	22	3 500	7 800	2 200	5 000
Ukraine	62	66	30 000	68 000	9 000	20 000
Venezuela	18	18	4 000	6 000	2 400	3 600
Other countries	34	40	10 000	30 000	6 200	17 000
World (rounded up/down)	1 160	1 250	160 000	370 000	80 000	180 000
Estimate of reserve base			> 800 000		> 230 000	
* USGS estimate						

Source: Matthes/Ziesing: Sicherheit der Rohstoffversorgung, Berlin 2005 (based on USGS, 2005)

Largest reserves and price trends of other major raw materials

Raw materials	Production		Price trend 2000-2004	Largest reserves
	Reserves	Reserve base		
Antimony	16	35	+92%	China, Russia, Bolivia
Arsenic	19	29	+73%	China, Chile, Peru
Barite	29	107	+20%	China, India, US
Bauxite	147	212	-4%	Australia, Brazil, Guinea, China
Beryllium	n.a.	n.a.	+0%	US, Russia, China
Bismuth	87	179	-16%	China, Mexico, Peru
Boron	37	89	+10%	Turkey, Russia, US, China
Bromine	Virtually unlimited	Virtually unlimited	-22%	US, Israel
Cadmium	35	105	+275%	Japan, China, Korea, Kazakhstan
Chromium	48	106	+56%	South Africa, Kazakhstan, India
Cobalt	149	277	+62%	Congo, Zambia, Australia, Canada
Columbium (niobium)	134	159	-4%	Brazil, Canada
Copper	32	65	+56%	Chile, US, Peru, Australia
Diatomite	469	n.a.	+1%	US, China
Fluorspar	47	97	n.a.	China, Mexico
Germanium	n.a.	n.a.	-49%	US
Gold	17	36	+46%	South Africa, Australia, US
Graphite	114	384	+15%	China, India
Helium	n.a.	280	n.a.	US, Algeria, Qatar
Indium	8	18	+219%	China, Canada, France
Iodine	588	1 059	-12%	Chile, Japan
Lead	21	44	+89%	Australia, China, US, Peru
Lithium	265	710	n.a.	Chile, Australia, China
Magnesite	629	1 029	n.a.	China, Turkey, Russia, North Korea
Magnesium	n.a.	n.a.	+0%	China, Canada
Manganese	35	464	+17%	South Africa, Australia, Gabon, Brazil
Mercury	69	137	+126%	China, Algeria, Kyrgyzstan
Molybdenum	62	137	+426%	US, Chile, China, Peru, Canada
Nickel	44	100	+60%	Russia, Australia, Canada
Perlite	389	4 278	+4%	US, Greece, Japan
Phosphate rock	130	362	+12%	US, China, Morocco and West Sahara
Platinum metals	174	196	+55%	South Africa, Russia

Potash	277	567	+10%	Canada, Russia, Belarus, Germany
Rhenium	73	303	+5%	Chile, Peru, US, Canada
Selenium	55	113	+603%	Japan, Canada, Belgium
Silver	14	29	+29%	Mexico, Peru, China, Australia
Silicon	n.a.	n.a.	+48%	China, Russia, Norway
Strontium	13	24	-13%	Spain, Mexico, China, Turkey
Sulphur	n.a.	n.a.	+13%	US, Canada, Russia, China
Tantalum	34	118	-86%	Australia, Brazil
Tellurium	221	495	+140%	Canada, Japan, Peru
Thallium	25	43	+0%	Canada, US
Tin	24	44	+72%	Indonesia, China, Peru
Titanium concentrates	138	269	-11%	Australia, South Africa, Canada
Tungsten	48	103	+22%	China, Russia, Canada
Vanadium	295	864	+190%	South Africa, China, Russia
Vermiculite	n.a.	n.a.	+0%	South Africa
Yttrium	225	254	+0%	China
Zinc	24	51	-2%	Australia, China, Canada, Peru
Zirconium and hafnium	45	85	+18%	Australia, South Africa

Source: Matthes/Ziesing: Sicherheit der Rohstoffversorgung, Berlin 2005 (based on USGS, 2005)

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