WORLD NATURAL RESOURCES POLICY (WITH FOCUS ON MINERAL RESOURCES)

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Contents

Summary

All countries—not only the mining and mineral exporting countries, but also the industrialized ones who have to buy and import their raw materials—are responsible for the environment and for maintaining a relatively intact world for future generations. The current annual world consumption of mineral and energy resources is about 25 x 10^9 tons with a value of about 1.6×10^{12} DM.

The future availability of resources is usually estimated using the expression: reserves lifetime = known reserves divided by current annual consumption. In practice, reserves

lifetime is a completely inappropriate measure of future availability—it is nothing more than a statistical "snapshot" of a dynamic system, which says much more about the need for innovation than about the true future availability. Innovations are essential to ensure that functionally equivalent substitutes are continually found for scarce resources.

If one really wishes to understand the future supply of mineral resources, one must consider the supply-and-demand cycle for mineral resources. However, it is essential to consider it in connection with one further resource—human creativity: increasing the efficiency of the resource by means of enhanced recovery from mineral deposits, by improved recycling, or by reduction of consumption by more efficient utilization.

Mining always has an environmental impact, but there are appropriate methods to reduce such impacts. Mining laws and good miner's practice today incorporate measures for restoration of the mined-out land.

There is no need to fear that in our market economy the supply-and-demand cycle will not in the long term always guarantee an adequate supply of mineral resources.

1. Introduction

All countries, not only the mining and mineral-exporting countries but also the industrialized ones who have to buy and import most of their raw materials, are responsible for the environment and for maintaining a world as intact as possible for future generations. Together they are responsible for working out a strategy for exploiting mineral resources that fulfils the requirements of sustainable development.

Sand and gravel	316	Gypsum	7.0
Petroleum	109	Phosphate	1.2
Aggregates	143	Sulphur	0.5
Brown coal	133	Peat	1.3
Limestone	94	Dimension stone	1.8
Dolomite	66	Potash	0.6
Hard coal	33	Aluminium	1.5
Steel	33	Kaolin	2.0
Cement	22	Steel alloying metals	1.0
Clays	11	Copper	1.0
Industrial sands	11		
Rock salt	--		

Table 1: Effective per capita consumption of mineral commodities per 70-year life span in Germany

Even highly-industrialized countries such as those of western Europe, which import all their metallic mineral resources and a large proportion of their energy resources, produce the greater part of the mineral resources they require in their own country, i.e. construction raw materials and many of the industrial minerals (in Germany, for example, these amount to about 80 percent of mineral resources consumption). Table 1 shows the total mineral consumption of a person over a life span of 70 years. It illustrates the predominance of the aggregates and non-metallic minerals in man's consumption pattern. The lifetime curve of non-metallic resources production shows a time lag relative to that of metal ore production and attains a maximum considerably later than the peak of metal ore production; in fact the non-metallic mineral resources maximum occurs when the metal mines in the same country have almost all been abandoned. Finland is a good example illustrating this typical development (Figure 1).

It follows that the industrial countries, which are major importers of mineral resources and are thus the customers of the rest of the world, must have a vested interest in the sustainable development of mineral resources exploitation, not only from a global point of view, but also in a local context.

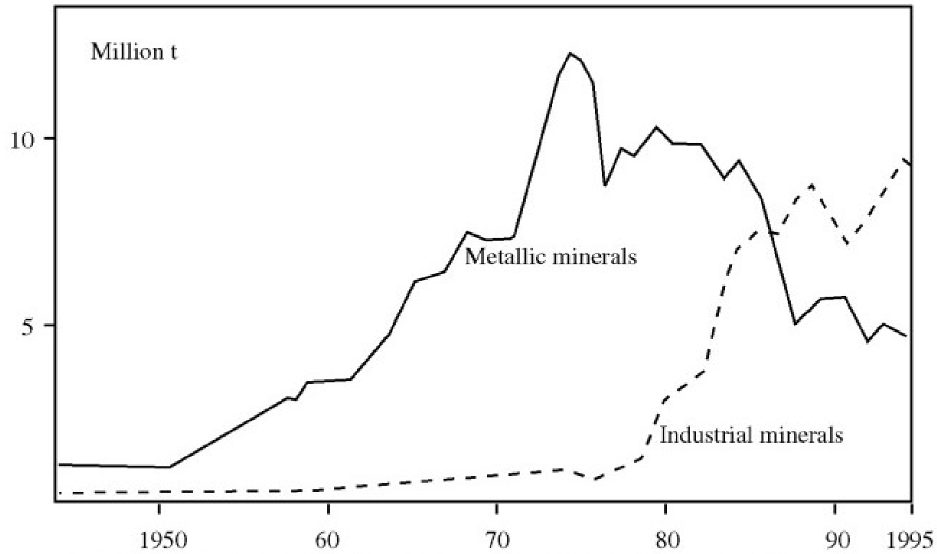

Figure 1: Comparison of the production trends of metallic ores and industrial minerals in Finland (after Pekkala 1995)

2. Sustainable Development

Sustainable development is a normative term, like liberty and equality. In the UN Report *Our Common Future*, normally called the Brundtland Report, sustainable development is defined as a development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland 1987). This has become the internationally most accepted definition. It has been expanded by the United Nations Environment Programme, which has added that this concept also requires the maintenance, rational use and enhancement of the natural resource base that underpins ecological resilience and economic growth and that it implies progress towards international equity (UNEP 1989). The next step was the Rio Declaration at the UN Conference on Environment and Development 1992 in Rio de Janeiro and Agenda 21, which stresses the three elements of sustainable development: To conserve the basic needs of life, to enable all people to achieve economic prosperity, and to strive towards social justice. All three objectives should initially be considered to have the same priority.

The first practical guidelines for sustainable development came from the German forestry administration. In the 18th century, the head of the mining administration in Freiberg in Saxony, Germany, Oberberghauptmann von Carlowitz (1713), who was also responsible for forestry in the Freiberg mining district, realized that the uncontrolled cutting of the forest for timber to use in mines and for smelting would lead to the collapse of forestry production. He was the first to spell out what sustainable development meant in forestry, i.e. that the amount of wood cut should not exceed the growth rate.

In 1993, the Enquete Commission on "Protection of Man and the Environment" set up by the German Bundestag (Federal Parliament) formulated four rules for implementing sustainable development that can be applied worldwide:
Rule 1: Use of renewable resources
The rate of consumption of renewable resources should not exceed the rate at which they can be regenerated.

Rule 2: Use of non-renewable resources
The consumption of non-renewable resources should not exceed the amount that can be substituted by functionally equivalent renewable resources or by attaining a higher efficiency in the use of renewable or non-renewable resources.

Rule 3: Concerns the resilience of the environments
Material and energy input into the environment should not exceed the capacity of the environment to absorb them with minimal detrimental effects.

Rule 4: Concerns the resilience of the environments
The rate of anthropogenic input and environmental interference should be measured against the time required for natural processes to react to and cope with the environmental damage.

3. Energy and Mineral Resources as Renewable Resources

Energy and metallic and non-metallic resources are normally considered to be non-renewable. However, in a few exceptional cases they can be viewed as renewable. Diatomite, which is used, for example, as a filter medium for beverages, is exploited in Lake Myvatn in Iceland. The diatoms are regenerating the deposit. Another example is gravel deposits in rivers draining mountains. These rivers bring a continuous supply of new gravel, which can be "harvested". If this is done in the spirit of Rule 1 mentioned above, gravel can be extracted from the riverbed without increasing the erosive power of the river and thus damaging embankments or bridges. In this way, for example, about 5 million tons of gravel is produced annually from rivers flowing from the Alps into Germany. Nevertheless, the annual demand for gravel in the southern part of Germany is substantially higher.

Substances dissolved in seawater must also be considered to be renewable resources. It is merely a matter of the price of sodium, potassium, bromine and magnesium salts, for example, that will determine when technologies will be developed for commercial extraction of these salts from the ocean. A list of marine salt producers is given in Table 2. About 16 percent of the salt produced at present is produced directly from seawater.

Peat—in northern and Eastern Europe locally used as a fuel, otherwise partly with additives as growing medium and fertilizer in horticulture—is another example. In some countries where virgin peatlands are still extensive and where the climatic conditions are favorable, natural accumulation of peat moss balances or even considerably exceeds the rate at which peat is harvested (Table 3). However, in other countries, mainly in Central Europe, there are few peatlands that have not been degraded. Thus, there is an urgent need to achieve a balance between further development and conservation. Although seen on a world scale, more peat is accumulating than is harvested, this fact cannot be the criterion for decisions concerning peat harvesting in any part of the world. This always has to be decided on the basis of knowledge of regional conditions.

State	Production (thousand metric tons)
India	9500
Mexico	8200 [p]
Brazil	5350
USA	3170
Spain	1500
France	1460
Italy	700
Turkey	500
Tunisia	390
Venezuela	350
Total	31120

[p] = preliminary

Sources: BGS (1993 to 1997)
USGS (1997)
Own data (Federal Institute for Geosciences and Natural Resources, 1997

Table 2: The ten largest marine/solar salt producers in 1997

	Peat production	**Peat moss accumulation (in our times)**	**Peatlands used for harvesting (% of the total peatlands)**	
Canada	1.13 Mio tpa (9.39 Mio m^3 pa)	> 50 Mio tpa (416 Mio m^3 pa)	0.02 %	CANADIAN PEAT MOSS ASSOCIATION (Written information 05.01.2000)
Finland	8.9 Mio tpa	15 Mio tpa	0.7 %	SOPO (Written

	(26.8 Mio m³ pa)	(40-45 Mio m³ pa)		information 21.02.2000)
Sweden	1.5 - 1.8 Mio tpa(2) (4 - 5 Mio m³ pa)	6.0 - 7.5 Mio tpa(2) (16-20 Mio m³ pa)	0.1 % (1)	(1) LODE 1999 (2) PETTERSSON (Written information 29.12.1999)
Estonia	1.2 Mio tpa(2) (6.4 Mio m³ pa)	0.9 - 1.7 mm pa(1) 1.0 mm pa (2) 1 Mio tpa (10 Mio m³pa)	0.17 - 0.23 (2)	(1) LODE 1999 (2)REEDIK (Written information 21.02.2000; figures for 1999)
Russia	2.85 Mio tpa(1999)(2) 0.2 Mio tpa (1999) (2) Leningrad area 0.09 Mio tpa (1999) (2) Western Sibiria	(Western-}1-2 mm pa(1) Sibiria)} ~ 10 Mio tpa 0.55 - 0.8 mm pa(2) (Holocene)	3.3%(2) (1982, European Russia) 0.4 %(2) (1982, Western Sibiria)	(1) MARKOV et al. 1996 (GPR) (2)*PREISS (Written information 10.2.2000)
Latvia	0.6 Mio tpa (1997) in future up to 1.4 Mio tpa	0.6-1.2 mm pa (Max. 2.7 mm pa) 0.8 Mio tpa (6.2 Mio m³ pa)	0.6 % (1997)	SNORE (Written information 17.02.2000)

* No up to date data available
GPR = Global Peat Resources
tpa tons per year
m³pa m³ per year

Table 3: Peat production and peat moss accumulation in selected countries

The technology for regenerating peat-forming wetlands after peat cutting has advanced so much that in some parts of the world peat exploitation can be organized in such a way that the peat cutting can be sustained indefinitely, taking into account that a thick bog peat layer will probably take several centuries to accumulate again (Figure 2). Efforts are being made by an international working group of users and conservers of peatlands to develop management guidelines for their wise use.

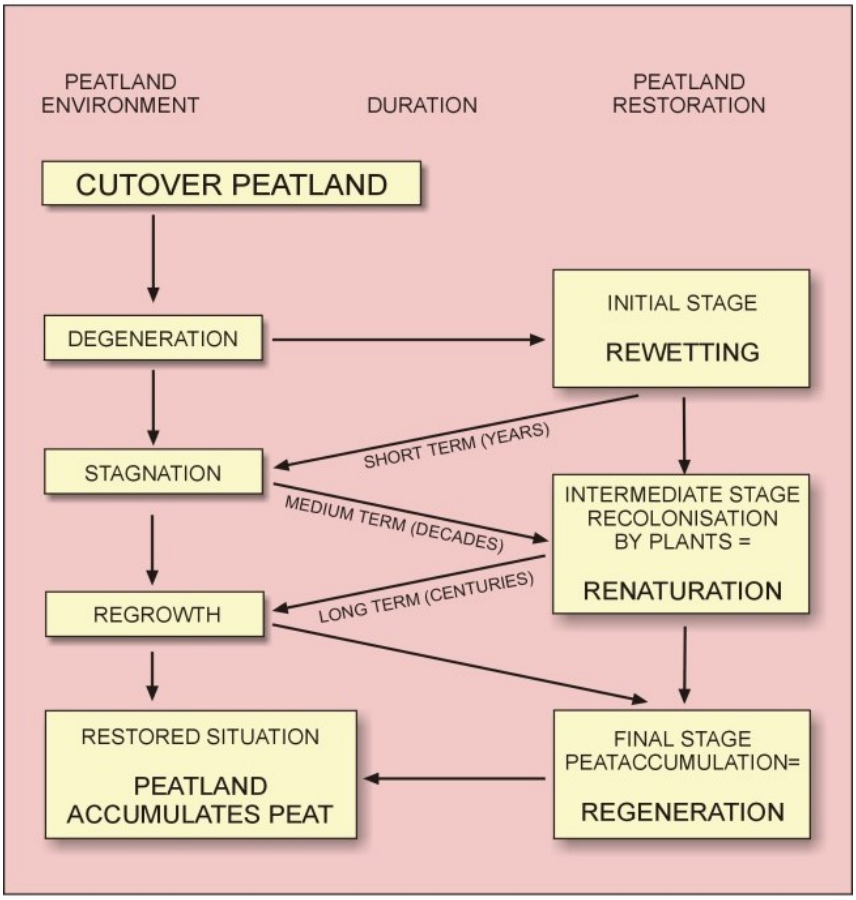

Figure 2: Stages of peatland restoration (after Lode 1999)

4. Energy and Mineral Resources as Non-renewable Resources

4.1 Statistical Data

4.1.1 Energy and Mineral Resources

Most of the fossil energy resources consumed are of course non-renewable. Ways have to be found, in the case of non-renewable resources, to meet the Brundtland Report requirement that future generations must be able “to meet their own needs.” Current annual world consumption of mineral and energy resources is about 25×10^9 tons, worth about DM 1.6×10^{12}. Figure 3 shows a bar diagram giving the annual consumption figures for all natural resources by quantity, and Figure 4 is the equivalent diagram based on value. In both cases, aggregates and energy resources required to meet our basic needs for housing, heating and transportation form the bases of the pyramids, whereas the metals occur more in the upper parts of the pyramids. The very top of the quantity pyramid is, of course, made up of the precious metals and semi-precious and precious stones, represented in Figure 3 by the most important precious stones, diamonds.

One can ask whether we can maintain this level of consumption and still fulfil the requirements of sustainable development, particularly in view of the fact that we have consumed more resources since World War II than during the whole of our history before that. Figure 5 shows the relative consumption trends of the “old” metals gold (Au), tin (Sn), copper (Cu) and iron (Fe), taking the total consumption up to today as 100 percent. It can be seen that in 1945 at the end of World War II, the total relative consumption of these metals was less than 50 percent of the total consumption up to the present day. Few people realize how much production and consumption of natural resources have accelerated.

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Biographical Sketch

F. W. Wellmer, President of BGR and NLfB in Hanover since 1996, studied mining geology and geology at the Technical Universities of Berlin and Clausthal and obtained his doctorate at Clausthal. He worked for the Metallgesellschaft and its Canadian and Australian subsidiaries and was concerned with mineral exploration in Europe, North Africa, North and South America, and the Far East, and was subsequently made Director of Exploration of the Australian subsidiary of Metallgesellschaft. In 1987, Prof. Wellmer joined BGR as Head of the Economic Geology and International Cooperation Division. He is Honorary Professor of Mineral Resources Policy and Economic Geology at the Technical University of Berlin. In 1999, he received an honorary doctorate from the Mining Academy at the Technical University of Freiberg.

J. D. Becker-Platen has been Vice-President of BGR and NLfB since 1992. Beginning in 1958, he studied geology at the Universities of Freiburg i. Br., Braunschweig, and Bonn. He received his doctorate from the University of Hanover. He was involved in Technical Cooperation projects concerned with lignite exploration in Greece and Turkey. He joined the NLfB and BGR in 1968 and since then he has held various management positions in NLfB, mainly in the mineral deposits and applied geology fields.