Problems Connected with the Utilisation of Mineral Resources in Advanced and Developing Countries. Their Impacts on the Teaching Process at VŠ B – Technical University of Ostrava (Czech Republic)

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Abstract: Mineral raw materials form a part of the economic foundation of each state. Their share in creating the gross national product is usually inversely proportional to the economic development of the state. At present fundamental differences exist between industrial and developing countries in the consumption of mineral raw materials per habitant.This manifests itself especially in fuels and energy minerals. These differences will reduce in next years. The question is whether this will be a result of decreasing the consumption in the advanced countries or increasing that in the developing countries or a result of combining both the trends, or a result of a little growth in the advanced countries And a significant one in the developing countries. For many developing countries, the intensive exploitation of domestic mineral resources and mineral raw materials generally is main source of their economic growth, which can be seen in the environmental deterioration. On the other hand, the advanced countries at least partly reduce negative effects on the environment primarily thank to intensive hi – tech development, mieral raw materials recycling and, in general, owing to waste – less technologies. VŠ B – Technical University of Ostrava, which is situated in the centre of one of the most industrial areas of the Czech republic has good experience of developing the envi ronment – friendly technologies. Simultaneously it is concerned with issues of rational utilisation of mineral resources and , in this connection, also with problems of the mineral policy. Those problems are an integral part to the teaching of home student s and students from foreign countries as well.

Key words: raw materials, consumption, environment, technologies

Mineral raw materials as a part of sources of raw materials of the country contribute significantly to the natural endowment of each state. The amount of mineral raw materials utilized in the present world economy is proved by the fact that there are 150 fundamental raw materials, with which world prices are monitored continuously.

The main importance of mineral raw materials for the economy of each state rests upon their position at the very beginning of the manufacturing process. In other words, they are the fundamental component of the faultless course of its economy. The mineral raw materials are many times revalued during the process of production and the process of their reprocessing. The rate of the revaluation of the mineral raw material is given by the degree of its enrichment and the degree of utilization of its end-use properties. Of course, the rate is

different for various raw materials and particular countries. For instance, in the U.S.A. about the 17-fold revaluation of mineral raw materials occurs, whereas for the Czech Republic's economy, roughly the half value is valid. This difference is given by the difference in the development of processing industries from the beneficiation, metallurgical treatment to its utilisation in the mechanical and other industries. It is not random that all these fields are included in the subjects of VŠ B – Technical University of Ostrava (henceforth referred to as VŠ B-TUO) and in research activity of its staff.

There is no doubt that mineral raw materials will be a significant part of the world and national economies also in the third millennium. However, in contrast with the sixties, when the study by Meadows and Meadows named The Limits to the Growth was published, their importance can be seen in another way. In no case the world production of mineral raw materials reaches and will reach values predicted for the present time and for next 25 years. The total shortage in the majority of mineral raw materials is not expected either. In spite of this, it is necessary, on the basis of the obvious unbalance between the localization of exploitation and the consumption of mineral raw materials on the one hand and the striking unbalance between the consumption of developing countries and that of industrialized countries on the other hand, to put at least the following two questions to ourselves:

- What will be quantities of raw materials needful for the world as a whole and for individual national economies by the year 2025?
- What are and where can be found needful and economically acceptable mineral resources?

Probably the most important factors influencing the future world and national demands for particular mineral raw materials will be as follows:

- geographically differentiated population growths,
- common improvements of the technical level and the standard of living and the consumption of mineral raw materials per inhabitant connected with this in many cases,
- costs of their winning,
- more and more enforced demands on the protection and formation of the environment at least in advanced countries,
- mineral raw material recycling, utilization of wastes as secondary raw materials and as fuels and energy minerals and development in waste-less technologies,
- the utilization of new mineral raw materials leading often to a substantially decreased consumption of other mineral raw materials.

Their interacting is often contrary and often different for individual mineral raw materials and groups of mineral raw materials. Understanding this interacting and especially the assessment, as correct as possible, of the trends in its development can lead us to a more realistic estimate of the future importance of mineral raw materials for the world and the home economy as well as for the formulation of rational policies of mineral raw materials and energy under conditions, where the requirements of the sustainable development of the world as a whole and particular states as its parts are more and more considered to be justified. The importance of this understanding of the world developmental trends is emphasized by the more and more assertive globalisation in all the spheres of the life of each state, including the complex of mineral raw materials.

It is VŠ B – Technical University of Ostrava that pays long-term intensive attention to these issues. The University, as the only university in the Czech Republic, offers a wide spectrum of fields of study from geological exploration through mining and metallurgical professions to the fields dealing with the final treatment of mineral raw materials, e.g. in the mechanical and electrical industries. As for the development of its research-pedagogical profile, it is necessary to emphasize that the University has suitable geographical conditions being situated in the centre of hard coal mining, ferrous metallurgy, electricity generation and heavy engineering of the Czech Republic already since 1945.

Let us try to discuss very briefly at least some of the above-mentioned factors. Firstly it is the differentiated increase in the number of population especially in relation to the gross national product. It is the fact that a vast world unbalance exists in the degree of achieved economic development primarily between highly developed countries having a small number of populations on the one hand and less developed countries with the high number of populations on the other hand. According to materials of World Development Report (1993), after

the amounts of gross national product per inhabitant all world countries can be divided into the following three groups:

- countries with a low income – less than USD634 (USD350 on an average),
- countries with a medium income – from USD635 to 791 (USD2480 on an average),
- countries with a high income – more than USD7911 (USD21050 on an average).

The countries with a low income, medium and the highest incomes formed 58.4%, 26.2% and 14.2% of population, respectively. If no dramatic change in the worldwide-supposed population growth occurs, the situation will change in the year 2025. The population of the countries with the present low income will form 62.8%, the population of countries with the present medium income will be 26.0% and the share of the countries with the high income will decline to mere 11.2%. The efforts of developing countries to come close to the degree of economic development at least less advanced countries with a medium income (measured by the GNP) will lead necessarily to an extensive growth of demands for mineral raw materials with emphasis put on fuels and energy minerals as raw materials globally conditioning the whole industrial production and securing all other activities necessary for the faultless development of human society. What is a fact is an extremely uneven consumption of resources of fuels and energy minerals in advanced countries on the one hand and developing countries on the other hand. We can say that 24% of the population of industrialized countries utilize 72% of energy sources of the world. If we apply the above-presented division according to the GNP amount, then the consumption of resources of fuels and energy minerals recalculated per inhabitant in 1 kg of oil equivalent is like that:

- countries with a low income 376 kg
- countries with a medium income 1351 kg
- countries with a high income 5106 kg
- the world in all 1343 kg.

If we compare the countries with a low income on the one hand with the countries with a high income on the other hand (primarily the OECD countries), we see that those countries consume 13.6-fold more fuels and energy sources per inhabitant than the countries with the lowest income having the high number of population. What is very interesting and very substantial for our considerations on the next development is the fact that, e.g. in the year 1970, this ratio was 1:27.5. That means that a gradual decline exists in the differences in energy consumption per head between the developing countries and the industrial countries.

What can be, in this connection, the expected development in demands on the sources of fuels and energy minerals? Many studies dealing with this issue have been worked out in the past and at present. It follows from their analysis that developing countries will not exactly copy, in their prognoses, any previous trends of advanced countries. This is, among other matters, linked up with the fact that also in the utilization of other mineral raw materials, their consumption per inhabitant will not reach first the maximum to decline subsequently due to technological development. The consumption of developing countries per inhabitant will grow, in comparison with industrialized countries, considerably more slowly. Despite of this, as a result of the high population growth, their absolute consumption will raise considerably obviously. The estimation of this level is rather a complicate task. The basic problem is a real estimate of the future worldwide economic development. Above all the present economic situation combined with the recent noticeable growth of world prices of oil points, however, to the exacting and, partly, also uncertain character of these prognoses.

One of possibilities how to present the prognoses of the world consumption of sources of fuels and energy minerals is the elaboration of three possible scenarios of its development:

1. the **reference** scenario resting upon the assumption of the worldwide annual economic growth in the amount of about 3.3%, which corresponds to the world situation of the beginning of the nineties,
2. the **growth** scenario based on the assumption that the economic growth in developing countries will be by 1% higher than the world average growth,
3. the **ecological** scenario built on the basis of applying the thesis of sustainable development in the world economy that should, in this area, mean dramatic increasing the energy efficiency of the world economy.

It is the reference scenario as a compromise between the two extreme alternatives that seems to be most probable.

The intensive utilization of domestic mineral resources and mineral raw materials generally is for many developing countries the main source of financing their economic growth, although the rate of revaluation of mineral raw materials is relatively low, which corresponds to the appropriate degree of achieved technological development. Apparent worsening the environment in individual countries and the world as a whole is often allied to this. Industrialized countries (or at least a part of them) eliminate negative impacts of this fierce utilization by intensive development in high technologies, increasing recycling of mineral raw materials and generally by development in waste-less technologies.

VŠB – Technical University of Ostrava located in the centre of one of the most industrialized areas of the Czech Republic has been concerned with various aspects of the rational utilization of mineral resources and also of the mineral and energy policies for a long time. For the reason of extensive ecological loads connected with intensive mining and manufacturing activity in Ostrava and its surroundings lasting tens of years, it pays considerable attention also to the issues of the environment. With reference to the total restructuring of the Czech economy being in progress that concerns very sensitively just regions with the previous orientation to the exploitation and primary processing of mineral raw materials, it puts stress on the complete solving of the transition of the whole region to the post-industrial stage. The curricula of both master and doctoral study of particular study fields and individual research programmes solved in the framework of particular faculties and the whole university as a whole deal with these problems. The fields of study that are concerned with the given problems most are Geological Engineering, Mining Engineering and Environmental Engineering. Within these fields, theoretical and practical teaching in subjects such as Prospective Materials for Modern Technology, Technogenic Deposits of Mineral Raw Materials, Landscape Ecology, Disposal of Wastes from Exploitation and Treatment of Raw Materials, Environmental Risks, Environmental Policy, Mineral and Energy Policies and World Mineral Resources is provided. The teaching in these subjects and other subjects is ensured by university teachers at the University and also by managers of co-operating industrial enterprises from the whole of the Czech Republic.

The Czech Republic has had long-term co-operation with many developing countries in the education of graduated specialists in master and postgraduate doctoral programmes for the whole area of the complex of mineral raw materials. On the basis of providing its positive and negative experience, it can significantly contribute to the solving of present and future problems of the countries that face or will face similar problems. Above all, it is developing countries that can be ranked among them.

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