FOUNDATIONS OF ECONOMIC CALCULATION OF RESOURCES LIMITED IN THE SUSTAINABLE DEVELOPMENT

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ABSTRACT

The concept of sustainable development of society is rooted in the idea that human activities are dependent on the environment and that resources are not inexhaustible.

Extraction of natural resources particularly influence economic and social development of many countries. Through proper management it can play a key role in achieving prosperity, stimulating development and generating sustainable benefits to local communities and the general population while under the protection of the natural environment.

Due to the actions carried out over time by the EU, sustainable development has become a political objective, the concept being contained in the Maastricht Treaty. The last version of the European Strategy for Sustainable Development was adopted in 2005, with the general purpose of continuous improvement of the quality of life for present and future generations by creating sustainable communities able to manage and use resources efficiently and to capitalize the potential for innovation of the environmental and social economy so as to ensure prosperity, environmental protection and social cohesion.

Keywords: economic calculation, limited resources, , sustainable development, needs

1. Introduction

New market principles of environmental factors should lead to ways and levers to stimulate attraction, superior capitalization and at the same time preserving the natural resources of the environment.

We can say that, "between natural resources, human civilization and social order cyclic connections entropic nature and reciprocity, which is why the company has an obligation to respect the ring closure under social and ecological balance"[4].

Establish norms of behavior in economic and ecological resource necessitated their classification, both in terms of social and economic utility, property and the terms of natural ability to restore and renew in time.

Analyzed through the last criterion natural resources are divided into renewable and non-renewable resources.

Renewable resources are characterized by power permanent restoration such as biological resources (forest products, fish, wood, flowers), energy (firewood, water, geothermal) and not least environmental resources (groundwater, air).

At the opposite pole are **non-renewable resources** which once consumed can not recover, or the pace of reproduction and recover amounts that are insignificant for growth. The category of non-renewable resources are included in the special energy minerals (coal, oil, natural gas, oil etc) in relation to the current level of consumption and leverage became limited.

Environmental awareness and indispensable resource depletion related to it, has an impact on economic activity in all areas.

Thus, it is envisaged the design and implementation of an economic environment that, through its activities, to be in permanent harmony with the natural environment, but also with the needs and interests of present and future generations of coexist and succeed.

In this regard , the United Nations established the World Commission on Environment and Development which, under the leadership of former Norwegian Prime Minister Harlem Brundtland , published in 1987 a report entitled " Our Common Future " . This report defined sustainable development as " development that meets present needs without compromising the ability of future generations to meet their own needs" .

Initially , sustainable development was meant to be a solution to the environmental crisis caused by intense industrial exploitation of resources and the continued degradation of the environment and sought primarily preservation of environmental quality . Today , the concept has expanded the quality of life in its complexity and socio-economic aspect . Object of sustainable development is now concern for justice and equity between countries , not only between generations. Generally , the theme of sustainability refers to renewable natural resources , ie those who have the ability to reproduce or regenerate : oceanic fauna , forest , soil, etc. . Resources that do not have this feature , such as coal mineral resources are defined as finite . For this, we can speak rather : when and optimal

operation conditions , the search for new deposits or artificial looking . To assess the absence of finite resources, often taken as a benchmark ratio of consumption and reserves. This type of evaluation neglects its capacity discovery of new deposits , thus projecting forward in time problem**.**

The Convention on Biodiversity is said : "Sustainable use is the use of components of biological diversity in a way and at a rate that does not lead to long-term decline of biological resources , thus maintaining their potential to meet the needs and aspirations of present and future ."

According to Principle 5 of the conference in Stockholm, the concept of sustainability is easier to understand if renewable resources , but it has major implications for non-renewable resources , " the planet's non-renewable resources must be exploited in such a way as to avoid the danger of exhaustion their future and ensure that the benefits of this type of operation are shared by all humanity ."

Sustainable management of natural resources requires, among other things, an assessment of the real , so be precise in fixing cost criteria and ranking of resources in the national economies of the countries holding .

Rational use of natural resources is the most important way to increase production efficiency that can be achieved mainly by saving inputs in the process of extracting and processing them. In this sense , scientific and technical progress is the main tool in solving the contradictions between social requirements continual increase resources and limited opportunities they offer the environment.

Production technologies used today does not allow full exploitation of natural resources such as coal extraction remains rock about 30% of useful material. An improvement of the technologies used should take into account, on the one hand, the elimination of these losses , on the other hand profitable exploitation of potential resources . Any technological innovation must henceforth consider the size of the ecological assessment , taking into account energy consumption, efficiency of recovery of raw materials and the impact of the use of the finished product .

Among the important contributions to rationalize the consumption of natural resources plays an important role in *finding technological* solutions such as the more complete extraction of mineral resources total extracted materials processing and use of all products that are produced and and reduce losses during transport and recovery of waste resulting from production and consumption processes .

Sustainable development as a ***principle*** that the mining industry in general, the coal mining industry in particular, need to use resources rationally and taking into account the health, social security and economic stability are essential in defining quality of life.

In such a situation, only modern technologies , efficient and clean , can provide a way to survive even the development of the mining and energy crisis deepening .

Sustainable development of scarce natural resources such as coal beds has been considered for a long enough period contradiction . Even if the focus is on the physical side resources , mining activity was viewed as unsustainable by nature it makes a number of influences on the environment and social and economic life .

The coal industry sustainable development requires design work closely with environmental impacts and risks that may arise from the social, economic and environmental , and institutions needed to manage these impacts . It also requires understanding the positive contribution that mining may have on sustainable development.

Romania is a country with a tradition of mining as ordered and still has significant deposits of coal , iron ore, building materials , salt, etc. .

Energy coal reserves available in Romania amounts to approximately 2.8 billion tons of which were mined over 800 million tons . The deposit is hosted mainly in the hilly area of Oltenia and can provide the necessary energy coal for the next approximately 70 years of Romanian society .

Although the quality of coal energy in our country is relatively low (1.6 to 2.25 Gcal / ton for coal), it is part of the band as they were built power plants for energy , so about 96 % of domestic coal production sector is for electricity and heat .

2. General principles regarding the content and economic calculation

In order to rehabilitate the economic efficiency of mining production , the main support nr.85/2003 Mining Law, the restructuring process is governed by the Development Program , Efficiency and Social accompaniment .

Continue restructuring on production volume to ensure market demand is made concurrently with the mine closure program and viable mining perimeters and ecological reconstruction and development of mining regions affected.

Program restructuring relates primarily to the domestic coal demand in the next period will be over 30 million tons / year coal and denial of subsidies for coal production .

Economic and social reality thus forcing a new behavior to natural resources and the environment to achieve sustainable development in the new conditions of modern market economy transition .

Any person who, acting in the economic life, has to choose between the meeting of two needs, of which only one can be satisfied, makes value judgments, the equivalent of what the specialized literature calls economic calculation.

Although economic calculation was applied well before being theorized, the year 1920 brings to the fore a lively debate on the significance or lack of significance of the term. In this sense we stress the essay of Ludwig von

Mises (1919) [8], a work that is part of a wider range of contradictory debates between the capitalist and socialist economy. The problem posed by Mises's essay is how to achieve a rational distribution of resources in the economy. In his view the proposed solution is a free market pricing mechanism under which individuals are meant to determine how the goods or services are distributed in society by their desire to pay money for them. Friedrich Hayek joined his approach, the most important socialist opponent being Oskar Lange.

The Austrian School argued that the only solution is free market and not having this information available (prices) socialism lacks a rational method of resource allocation.

Mises's assertion angered supporters of the planned economy and generated a large number of replies, mostly from Italian and German theorists. But the largest work of this kind belongs to Oskar Lange (1936) [6]. This, agreeing that the price is the core of a rational calculation, says that prices are not necessarily formed in the free market, proposing a solution for decision (Planning Committee) to establish "quasi-prices" for state companies. The method that he proposed for the Committee was composing a model with "n" Walrasian auctions, leading to the simulation of a competitive economy.

The method had also been proposed by Henry D. Dickinson (1933) [3]. Later, Hayek (1945) [5] criticized the proposed solution raising questions about the mathematical solution, the main obstacles being: the large amount of information that would be gathered, the correct choice of equations and solving thousands of equations, continuously compared to the changes in the economic environment.

In a study based on specialized literature, on the content and principles of economic calculation, a series of questions about the distribution of resources in the economy are raised:

- while the programming of production and consumption determines a well-established rate of consumption of resources, is their use efficient? Is it sufficient to reduce consumption through standardization and reporting to resources? Does economic policy encourages innovation in the production and use of exhaustible resources?
- is free market strong enough to allow the use of resources, especially non-renewable ones?
- Where should government intervention stop in this area? How to relate a country's strategic interests with the desire for sustainable development?

Summarizing those drawn from the specialized literature, **one can express the following viewpoints**. Whatever the nature of the property, starting from the man-society interaction postulate, triple determined technically, economically and socially, it appears that any activity that takes place in order to satisfy a social need requires some economic effort and on the other hand, is producing social [By social effects we understand in fact the assembly of technical, exonomic and social effects and the maintaining of ecological equilibrium.] and environmental effects. This interaction is thus a global system divided into several man-made subsystems, including inter-relationships that are manifested throughout the cycle that begins and ends in nature (Figure no. 1).

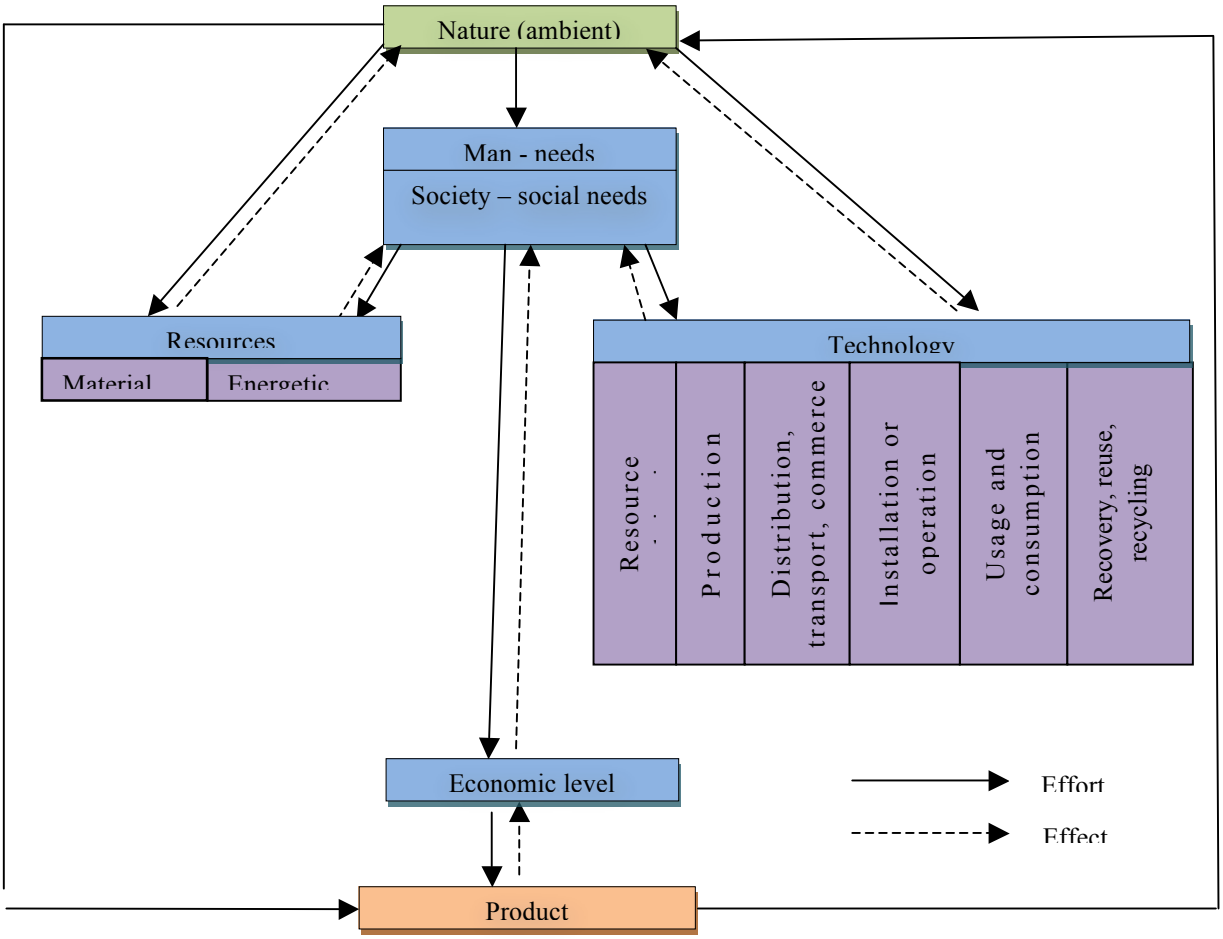

Fig. no. 1. *Relationship nature – man – nature*

The effort involves consumption of resources, both entropic and non-entropic - which ultimately means work time - and the social and environmental effects are represented by the useful functions of man and society on the path of the six stages of the technological subsystem, including the level of influence of the ecological balance through pollution qith waste materials, recycling and reintroduction into the natural cycle.

The problem that arises [4] is that of optimizing the overall system, in this case aimed at maximizing the social and environmental effects while minimizing the overall effort, including efficiency in a logical system all three sides of any man-made process: the technical side, technological, socio-human-environmental, and economic. In this view, overall economic efficiency is a dynamic character as it relates to the effects and economic efforts that are identified in the past, present and future.

Creating models of systemic approach must have as a function to raise the standard of material and spiritual life of man, and as a fundamental restriction, maintaining the technological balance. In terms of scope, it is necessary to include all socio-economic activities, meaning all organizational structures involved in the nature-production-consumption-nature circuit. In other words, **it is necessary to address the economic efficiency of macroeconomic positions - which requires a reconsideration of the bases of the calculation of economic efficiency, aiming at the resource efficiency priority assigned by the company and keeping the ecological balance**

Complex vision of economic calculation efficiency, focused on all categories of resources, does not exclude the calculation of efficiency based on resources consumed, but they transfer to a particular case. This feature implies, however, in current circumstances, the need to improve the content and functions of indicators used in the calculation and forecasting of economic efficiency, especially on the line of enhancing the relationship between these indicators, a greater use of factor analysis.

Analysis of economic efficiency should be made on the basis of differentiated criteria, given the many factors that influence it, to boost reserves recovery concerns, which implies a new vision of economic calculation.

The starting point in the restructuring of economic calculation is the classification of resources according to a set of criteria (the possibility of regeneration, destination, nature of the economic cycle) to answer the question "how to build mechanisms that analyze and decide the use of resources".

To reach the construction of building models it is necessary to consider the functions of economic calculation:

• assessment and providing commensurate comparability in all economic branches between effort and effect;

• development of the policy options criterion for selecting targets in different areas;

• tool for policy priority in the allocation of financial resources, tool for material incentives;

• tool in determining the contribution of work on economic calculation to the GDP growth and thus to the economic development.

All these functions are linked to an economic calculation tool, namely the price, seen from a double aspect: as a reflection of the value and as economic leverage.

The concept of economic calculation (Figure no. 2), points out that GDP is a key indicator in calculating the economic effects achieved against all categories of resources.

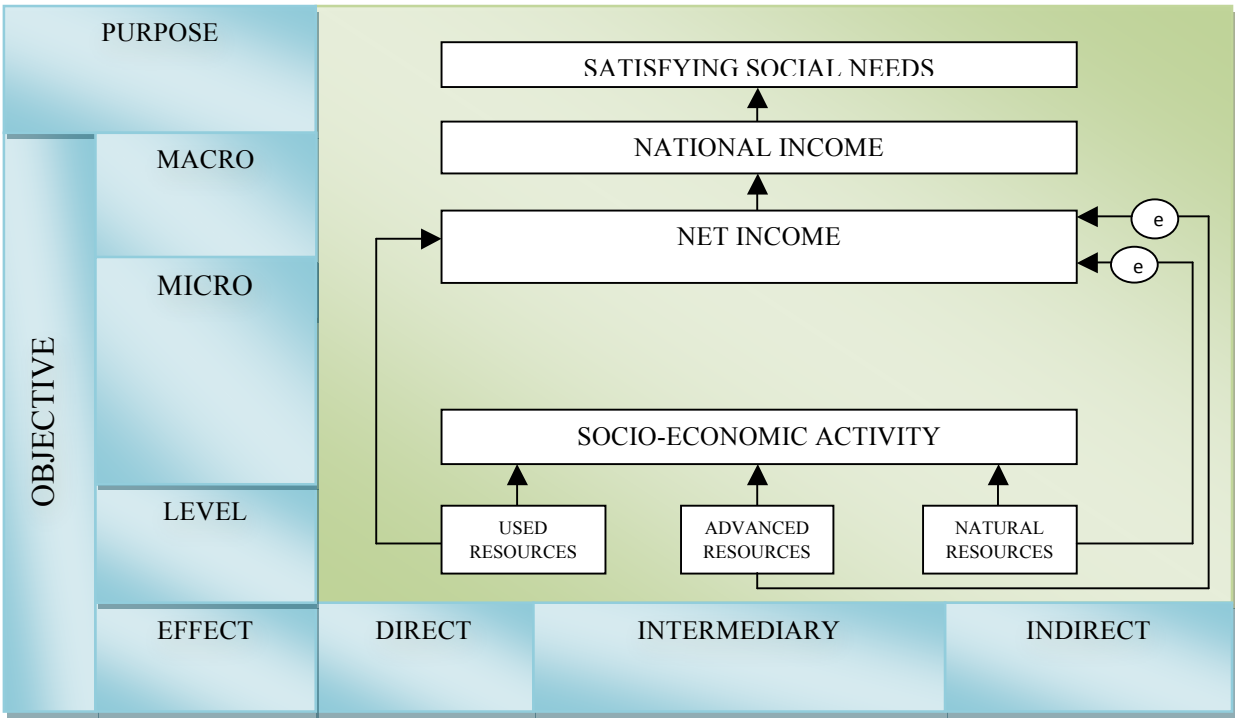

Fig. no. 2. *The concept of economic calculation*

Due to the complexity and interdependence of influence factors which manifest itself in the deeper substantiation of options for allocating and using available resources with maximum efficiency in the economy, the GDP - the generalizing indicator - can not exclude, however, the complex system of partial indicators and correlations between the effects and efforts specific to various types of resources or categories of activities.

In order to build partial indicators of economic efficiency it should be noted that, in substance, effective use of social work involves capturing the value of outstanding categories such as price, cost and benefit.

In this context, **in my opinion**, it seems appropriate to treat some aspects of the value of natural resources through the law of value, the content of useful substances and environmental protection, detaching the following aspects:

• one must take into account the differential and absolute rent in establishing the commodity pricing;

• environment protection leads necessarily to calculating the total cost which supposes the inclusion of the cost which encompasses a quota for the implementation of measures to combat environmental pollution;

• using an appropriate pricing policy for preserving the ecological balance and inclusion of technical and economic documentation required in the calculation of economic investment in the above mentioned optics;

• social usefulness should become a factor of price formation which actually means the need for broad application of marginal expenses in the formation of pricing.

Pricing - the monetary expression of value - based on costs, requires a lever near the trigger price mechanism of social work, which means precise determination of the level and development of the unit cost to achieve maximum value. Therefore, it requires continuous monitoring of grading within predetermined parameters, the efforts and effects (results) achieved.

Before setting a price, all the consequences arising from this must be taken into consideration, an objective condition to ensure economic efficiency due to the complexity and mutual interconditioning that exist between activities and between branches of national economy and within the same industry.

3. The fundaments of economic calculation concerning limited resources

In recent history, the first alert to the fact that economic and social development of the countries of the world and of humanity as a whole can not be separated from the consequences of human activity on the natural environment was made in the 1972 report of the Club of Rome entitled *Limits to Growth* (Meadows Report). The document summarized the data on the evolution of the five factors (population growth, the impact of industrialization, the effects of pollution, food production and natural resource depletion trends), suggesting the conclusion that the development model in that period can not be sustained long term [10]

The concept of sustainable development, first defined in 1985, the result of an integrated approach to policy and decision makers , the environment and long-term economic growth are seen as complementary and mutually dependent .

Due to the actions carried out over time in the EU sustainable development has become a political objective, the concept is contained in the Treaty of Maastricht. Latest European Strategy for Sustainable Development was adopted in 2005 , with the overall objective of continuously improving the quality of life for present and future generations through the creation of sustainable communities able to manage and use resources efficiently and to tap the potential of innovation environmental and social economy to ensure prosperity , environmental protection and social cohesion.

National Strategy for Sustainable Development, is based on the same findings :

- insufficient natural resources for sustainable development in existing operating rate today ;
- inefficiency of using non-renewable resources ;
- negative environmental impacts of the main economic activities.

Each of these negative aspects Romania is quantified through a series of specific indicators.

Thus, the rate of exploitation of natural resources (focusing on mining) we can mention the following indicators:

- *period of abundance* measured as global reserves and annual world consumption;
- *balance reserves* - are those reserves that can be mined geological and valued in economic [1]:

$$R_b = R_A + R_B + R_{C1} + R_{C2} \quad (1)$$

Indicators R_A, R_B, R_{C1} and R_{C2} are geological reserves for different types of reserves in categories A, B, C1 and C2 by the degree of exploration and studies.

- *exploitable reserve ratio* defines the amount of a deposit exploitable and can be calculated using the formula:

$$C_{re} = \frac{R_b - P}{R_b} = 1 - \frac{P}{R_b} \quad (2)$$

where*:* Rb – reserve balance,

P – losses or quantities are unworkable for different reasons.

To ensure true comparability between exploitable reserves of various countries, we consider useful extrapolation calculation relationship above all kinds of mineral resources and energy expressing quantities of reserves and losses toe (tonnes of oil equivalent). The formula becomes:

$$C_{re} = \frac{\sum_{j=1}^{n}\sum_{i=1}^{p}(R_{b_{ij}} - P_{ij})}{\sum_{j=1}^{n}\sum_{i=1}^{p}R_{b_{ij}}} \quad (3)$$

where: $R_{b_{ij}}$- Reserve balance sheet of the type of resource *j* in the deposit and *i*; P_{ij} - loss of resource *j* holding (deposit) *i.*

- *activity during mine:[1]*

$$T_e = \frac{R_i}{A} \quad (4)$$

- *net physical production [1]*:

$$Q_n = Q_b \cdot \frac{100 - U_r}{100 - U_p} \cdot \frac{100 - a_r}{100 - a_p} \quad (5)$$

Qb – gross physical production;

U – humidity expressed as a percentage;

a – amount of ash;

r – value achieved;

p – value scheduled.

The efficiency of natural resource use can take two forms:

- processing efficiency;
- energy efficiency of producer and consumer.

Processing efficiency is attributable to ferrous minerals, energy resources require a lesser degree of processing.

The main indicators that measure the efficiency of processing raw resource is:

- *Quantitative extraction of concentrate [9]:*

$$v = \frac{C}{A} \cdot 100; \quad (6)$$

C - the amount of concentrated;
A - amount of ore.

- *Quantitative extraction of metal in concentrate:*

$$Q_{ru} = \frac{C \cdot \alpha}{A \cdot \beta} \cdot 100; \quad (7)$$

α - The metal content in the raw ore;
β - The metal content in the concentrate;

- *Return preparation [9]:*

$$\eta = \frac{v(\alpha - \beta)}{\gamma(k - \beta)} \cdot 100; \quad (8)$$

γ - content in crude ore minerals;
k - metal content in minerals.

Another important element is the efficiency of energy producer, if we consider how energy resources are used. In this case the yield is different for each type of fuel is directly proportional to the technical level of energy producing plant.*Randamentul general* al unei centrale termice este: [2]

$$\eta_{gct} = \eta_c \cdot \eta_{cd} \cdot \eta_t \cdot \eta_{td} \cdot \eta_m \cdot \eta_g \cdot \eta_{tr} \cdot \frac{100}{100 + C_{si}}; \quad (9)$$

where:

η_c - is boiler efficiency;

η_{cd} - return pipes;

η_t - efficiency heat cycle;

η_{tr} - transformer efficiency;

C_{si} - internal services consumption.

- *Energy recovery index products:[2]*

$$I_v = \frac{W_c}{W_p}; \quad (10)$$

W_c - energy delivered to the consumer;
W_p - energy produced.

Negative effects on the environment of irrational use of resources or human activities are generally measured by a number of impact indicators, among which:

- *The greenhouse effect:* [Society of Environmental Toxicology and Chemistry SETAC]

$$GWP = \frac{\int_0^T A_i(t) \cdot C_i(t) dt}{\int_0^T A_{CO_2}(t) \cdot C_{CO_2}(t) dt}; \quad (11)$$

Where:
Ai - contribution of a constituent gas, *i,* due to the increase of its concentration unit;
Ci - gas concentration *"i"* be maintained for a period of time *"t"* after the transmission; A_{CO2}, C_{CO2} - are as defined above, is related to carbon dioxide.

- *Compared with the equivalent acidity* S_{O2}: [7]

$$AP = \sum_i AP_i \cdot m_i; \quad (12)$$

Where :
AP [kg S_{O2} equivalent / u.f.] – acidification potential;
APi [kg S_{O2} equivalent / kg] – acidification potential of the substance „*i*";
mi [kg/ u.f.] - amount of substance *i* , issued to the functional unit.

Referring to the economic calculation of limited resources, we believe that a very complex and difficult problem is the determination of the sequence and pace of exploitation of mining deposits, due to restrictions appearing opposite: on the one hand increasing demand and on the Furthermore, the annual production capacity of restricted and limited cost me the marginal cost (since the entry into service of deposits must be in ascending order of their total average unit cost, the principle of attracting business in deposits in decreasing order their effectiveness).

The correlation between the reservoir and the cost efficiency of the forecast marginal [4] resulting in the following relations :

$$A = \frac{C_e \text{ x } R_i}{T_e (1 - D)} \quad (13)$$

and then,

$$C_e \text{ x } R_i = A \text{ x } T_e (1 - D) \longrightarrow f(A, T_e (1 - D)) \quad (14)$$

A - production capacity
C_e - extraction coefficient reserves
R_i - industrial reserve
T_e - duration of activity
D - dilution factor

If we denote by Q_m = annual production, in the:
Q - amount of ore extracted
m – actual content of the ore as a percentage of the amount withdrawn
and C_{an} – annual consumption coefficient reserve, resulting:

$$C_{an} = \frac{Q_m}{A \text{ x } T_e (1 - D)}; \; Q_m = C_{an} \text{ x } A \text{ x } T_e (1\text{-}D) \longrightarrow f(C_{an}, A, T_e (1\text{-}D) \quad (15)$$

reverse ratio of insurance accounting degree production with reserves (C_{as}), that:

$$C_{as} = \frac{A \text{ x } T_e (1\text{-}D)}{Q_m}; \; A \text{ x } T_e(1\text{-}D) = C_{as} \text{ x } Q_m \longrightarrow f(C_{as}, Q_m) \quad (16)$$

Substituting the relations mentioned above restrictions can determine the degree of satisfaction of the requirements of the national economy with resources from our own production ($N_{(c)}$) :

$N_{(c)}$	>	Q_m	- demand can not be satisfied
$N_{(c)}$	=	Q_m	- corresponding to the application is removed
$N_{(c)}$	<	Q_m	- resulting availabilities

If it has its function $Q_m = f(C_{an}, C_{mg})$, where C_{mg} is the marginal cost, the following:

$N_{(c)}$	≤	$Q_m(C_{an})$	- request is satisfied
$N_{(c)}$	≤	$Q_m(C_{mg})$	
$N_{(c)}$	≤	$Q_m(C_{an})$	- request is restricted to the marginal cost
$N_{(c)}$	>	$Q_m(C_{mg})$	
$N_{(c)}$	>	$Q_m(C_{an})$	- request is restricted by annual consumption coefficient reserve
$N_{(c)}$	≤	$Q_m(C_{mg})$	because it allows greater extraction
$N_{(c)}$	>	$Q_m(C_{an})$	- request is restricted so reserve coefficient annual consumption and
$N_{(c)}$	>	$Q_m(C_{mg})$	marginal cost. In these circumstances it is necessary to further improving production technologies and methods of operation, the discovery of new reserves, establishing several variants operating in compliance with the restrictions on each deposit.

The obvious trend of emphasizing on geological difficulties, while technology and equipment are not suitable for the difficult extraction conditions, determines that in practice it is not possible to achieve a full recovery of natural reserves, leading to reduced economic efficiency.

4. Conclusions

Advantageous conditions which usually starts oil recovery limited resources have led to the achievement of production levels and costs on which indicators were based plan, the investment and economic efficiency for subsequent exploitation.

Substantiation decisions in attracting business in natural resources based on current levels of economic efficiency indicators, knowingly accepts the loss of reserves and highlights the relative importance of the concept of economic efficiency.

Increasing the degree of recovery and in particular the problem of modifying the criteria for fixing changes and economic efficiency in the context of the current economy, requires a new vision on resources.

All these issues must be highlighted through the price which is at the base of cost.

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