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Natural Value and Basic Cost of Minerals Assessment Technique

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Abstract: Economic assessment of fields as a rule is defined by the potential income which can be received as a result of field exploitation for date of assessment. By the nature, it is a difference between the use value of mineral reserves (taking into account the average world price of a production unit) both total capital and operational expenditure for the entire period of preparation, development and sales of the field products. However, in the conditions of world instability the mineral's prices are volatile and unstable and for a number of minerals for example for peat there is no officially published world price of a production unit. Moreover, in the conditions of global ecological crisis increased requirements to scientific justification of economic assessment of fields are imposed. In this regard development of a technique of assessment of natural value and basic cost of minerals taking into account the components more precisely describing correlation of physical and cost indexes of the field became the purpose and a subject of the article; mineral deposits make researches bject (especially such valuable mineral as peat, techniques of assessment of natural value for which basic cost are mostly not worked and difficult). The methodological basis of scientific research projectated a method for the description of physical economy processes and methodology of project management by sustainable development in terms of energy sizes (International School of Sciences of Sustainable Development of P.G. Kuznetsov). With use of currencies energy model, the model of the formalized description of the field was created. On the basis of coefficient of converting connection between physical mineral reserves is established (expressed in various units (m^3, tons, J, kW) and monetary units (US dollar, tenge, ruble). Within the research definition of natural value of minerals is given and key indicators of basic cost of minerals are allocated. In study it is reasoned that assessment of natural value and basic cost of the field in physical and cost measures is necessary for assessment of a market price for minerals. The complex assessment model of natural value and basic cost of minerals taking into account the components more precisely describing correlation of physical and cost indexes of the field is developed. Results of a research are brought to a practical example which is presented on the example of assessment of the conditional peat field that creates prerequisites of introduction of a technique in the organizations of the extracting branch.

Key words: Mineral as natural value of the territory, physical price of minerals, basic cost of the field, system and energy analysis, monetary unit, cost

INTRODUCTION

In the conditions of crisis shocks and growth of a gap between the product provided with the actual energy, and a product poor actual energy (Stiglitz, 2002; Orucov *et al*., 2009; Bolshakov, 2010; Larouche, 2012) the problem of exact and steady estimation of cost of minerals taking into account the components more precisely describing correlation of physical and cost indexes of the field becomes key advantage of a development management of territories for the years ahead. The essence of a problem is that all objects of management (from nano to the global sizes), eventually, exchange energy streams (energy) and subjects of management (natural and legal entities) exchange streams of money (Bolshakov, 2010; LaRouche, 2012).

Correlation between streams of energy and streams of money is not obvious. Moreover, uncertainty of this correlation means that measures of objects and subjects of management are uncoordinated between them there is

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a gap which is a source of emergence of various “soap bubbles”, crises and the conflicts (LaRouche, 2012; Douglas, 2016).

For this reason naturally there is a question: “How to establish connection between energy streams (which all objects of management exchange) and streams of money (which all subjects of management exchange”?

In this regard this research is directed to elimination of the projectated shortcomings as qualitatively new measurement in methodologies of content assessment and fields cost.

Literature review: Any system cannot exist without interaction with the environment surrounding it and unites in itself two interfaced processes: the active stream of impacts on the environment defining possibilities (energy) of system and use by society of the stream of resources received as a result of this influence for satisfaction of requirements.

Process of accumulation and transformation of free energy in the biosphere is the doctrine about live substance or theory of the biosphere and it’s active functioning under the influence of work of the person is V.I. Vernadsky’s doctrine about a noosphere. V.I. Vernadsky considers all known forms of planetary life in their interconnection and interaction among themselves, as well as with the environment-the inert nature-a lithosphere, the hydrosphere, the atmosphere.

Live substance of V.I. Vernadsky unites all variety of the phenomena of planetary life, all its forms throughout all geological history of the planet and therefore, it is not so much a body but many process, geologically eternal process.

According to ervin simonovich bauer, fundamental difference of live matter from lifeless is characterized by the principle of a steady disbalance. This principle says: “All and only live systems never happen in equilibrium state”.

The fact that they due to the free energy perform work against the expected balance is characteristic of live systems and thus we deal not with a contradiction to laws of thermodynamics but with other laws consisting, by the way, in what resolved by thermodynamics naturally does not come.

By researchers Kuznetsov (2015) a hypothesis is stated: “The physical sense of the term entropy is the module of an exchange stream which holds open system in a condition of constant energy”.

The statement that entropy is the module of an exchange stream holding open system in a condition of constant energy is offered by the author in K.S. Trincher’s book “Biology and information” (1964-1965, the American edition 1965, the German edition of 1967). The term “module” can be applied to streams in the sense that we take “absolute value” of a stream and we ignore it’s direction. It is not less obvious that the term “module” can be applied in only case when both streams are equal and opposite on a sign (direction). Nevertheless, it is obvious that if both streams are not equal then, our term “module” is already inapplicable to this situation. Not all is evident that all thermodynamics is applicable only to balance conditions and application of its annexes to nonequilibrium systems is application of the theory behind limits of applicability.

The physical interpretation of the term entered by Kuznetsov (2015) entropy allows to say that a metabolism in wildlife and a metabolism in inanimate nature are characterized by various value of the module of an exchange stream (at the same temperature): the exchange stream keeping live system in balance with the environment, above than an exchange stream for inanimate nature.

Proceeding from the principle of a steady inequality the main property of the streams of energy circulating in live systems is their ability to make external useful work or in abbreviated form working capacity. The principle of a steady inequality checked by time and confirmed almost in all sections of sciences on life represents the basic principle of evolution of organic life, including also work of the person.

We want to pay special attention to researchers of Sergey Andreevich Podolinsky who the first saw this thermodynamic feature of historical development of mankind. We mean the whole series of publications 1880, 1881 and 1883 years. His publications were given in the Ukrainian, Russian, French, Italian and German languages. His publications in the French and German languages are provided by Vernadsky in his lectures on geochemistry given in Sorbonne in 1923-1924. In 1886, we meet such understanding of the phenomena of life by Boltzmann, in 1901 by Umov, in 1903 by Timiryazev.

Analyzing research of mankind, Podolinsky finds out what Carnot Saadi called the perfect machine capable of giving itself necessary thermal energy to a fire chamber and to turn heat of a fire chamber into work. Therefore, we have to conclude that the primitive person about has efficiency 1/5 as the machine is less perfect than the civilized person who has efficiency only 1/10. The primitive person uses only free gifts of the nature and the person civilized satisfies almost all the requirements by means of energyful technical means in which the scientific thought of the person is embodied. It gives the chance to mankind not only to accumulate energy on Earth which number in thousands of times surpasses force of his muscles but also to provide higher growth rates of free energy. We will not demand neither from Carnot, nor from Podolinsky that they allocated only simple reproduction of human society. They correctly pointed to a being of process of a metabolism between mankind and the nature. But, the mankind also develops this process also is change process Changes? What? What actually changes on the course of historical development of mankind?

Presently Vernadsky's doctrine about the Noosphere-the Biosphere continues to develop (Subbeto, Bobkov), representing significant applied results. Let's consider one of them.

MATERIALS AND METHODS

Analitic review: Any mineral is, first of all, a product of the nature and has two interconnected parties: As "transcendental object" as a product which is stored in a subsoil. No body consumes it but it has certain natural qualities: physical, chemical, biological and others which change in time but they can be measured and commensurated, expressed precisely in terms of the natural sizes defining qualitative and quantitative definiteness of a product-it's natural value ($E_Z^M(t)$).

As "a thing for us" as a product which has certain useful consumer properties which satisfy this or that individual or public requirement. But to use these properties and to satisfy this or that requirement it is necessary to find mineral to take a product from a subsoil to process deliver to the consumer to sell to the buyer to estimate the received result and its consequences. And each stage of this process demands expenses of the available various resources (labor, physical, information, financial).

Any mineral is a product of natural process and for this reason has to be expressed, first of all in natural measures.

It is accepted not to measure expenses in economic science (as natural properties of a product) and to calculate through quantitative assessment of the used diverse resources expressed in monetary units but not in physical measures (Kuznetsov and Bolshakov, 2002). When, it is about measurement there is an exact standard with which comparison of the measured object is conducted. The standard has certain attributes: a name, spatially-temporary borders (or LT dimension, according to Brown-Bartini) (Kuznetsov and Bolshakov, 2002), a unit of measure. In the absence of at least one of these attributes essentially it is impossible to carry out measurement of qualitative and quantitative properties of an object. Not incidentally the chairman of World Council of businessmen for sustainable development of the UN S. Shmidkheyni declared: "Everything that is measurable is achievable and all that is achievable or is measurable" (Kuznetsov, 2015).

Monetary units have nor the steady, nor changing, exact existential standard and for this reason when we speak about assessment of any economic objects expressed in monetary units it is necessary to understand that it is not about measurement but about calculation. The calculation which does not have an existential standard can overstep the bounds of admissible application and for this reason, yield false results (Bolshakov, 1988, 1990; Bowman, 1990).

We come up against such situation it is about assessment of the same object but presented in two projections: physical and economic.

It should be noted that as it is about the same object it is natural that financial expenses have to be correlated to the natural value of the field. If not to make it then, we will not be able correctly to estimate result and its consequences, we will not be able to give a reasonable assessment to the market value of the field.

How to commensurate diverse natural and financial measures: It, a so-called "damned" question of economic science and therefore we are forced to address the main equation of economy (Kuznetsov and Bolshakov, 2002):

$$T = D \qquad (1)$$

Where:
T = Real goods as a product with the price
D = Money as symbol of real goods

Follows from the main equation of economy that it is required to establish reasonably equality between a real object (T) and it's symbolical (monetary) replacement (D). For this purpose it is required to determine the price of monetary unit and quantity of monetary units which work defines quantity of goods. In this case, it is possible to speak about goods as the product with the price (Kuznetsov and Bolshakov, 2002).

If we can determine the price of product unit and quantity of units of a product (mineral) in the field then we can establish it's natural value and basic cost provided with physical mineral reserves.

On the basis of the carried-out analysis it is possible to submit requirements to the formalized description of the field which include parameters (Table 1): area of the field, average distance to the surface of the field (depth), average length of the field, average width of the field, average height (thickness) of the field, average volume of

Table 1: The formalized description of the peat field

Indicators	Symbol	Unit of measure
Area of the field, area of rooting out	$x_1 = S$	$1\ m^2 = 10^{-3} \times km^2$
Average distance to the surface of the field (depth)	$x_2 = L_0$	m
Average length of the field	$x_3 = L_x$	m
Average width	$x_4 = L_y$	m
Average height (thickness) of the field	$x_5 = L$	m
Average volume of content	$x_6 = V_L$	m^3
Average mass density	$x_7 = p$	kg/m^3
Average weight (kg)	$x_8 = M$	kg
Maximum energy content (heat of combustion)	$x_9 = E$	MJ
The maximum extent of dissipation of energy content in unit of mass (energy content with adjustment (1-0, 1))	$x_{10} = E_M$	MJ/kg
The average density of energy content is at 1 m^3	$x_{11} = E_{L3}$	$MJ*m^{-3}$
The a verage density of energy content is at 1 m^2	$x_{12} = E_{L2}$	$MJ*m^{-2}$
Average degree of moisture content	$x_{13} = W$	kg/kg
Dissipation levelsfor peat of low-lying type	$x_{14} = E_H$	J/kg
Dissipation levelsfor peat of transitional type	$x_{15} = E_p$	J/kg
Dissipation levelsfor peat of the top type	$x_{16} = E_B$	J/kg

content, average mass density and weight, the maximum energy content (heat of combustion) and extent of dissipation of energy content in unit of mass.

RESULTS AND DISCUSSION

Basis of a technique development is calculation of the physical price of mineral unit. The physical price of mineral unit (or natural value) is the relation of the content which are saved up in the field in energy expression (MJ) to it's mass content in tons. Unit of measure of the physical price of mineral unit: MJ/ton.

The physical price (Z_f) for reserves of peat is the work of the physical price of one ton of peat (MJ/ton) for its quantity (tons) in the field:

$$Z_f(t) = k\ ton \times \frac{M,\ J}{ton} = kMJ \qquad (2)$$

The physical price of the field is defined by amount of the reserved energy (MJ or MW×hour): the physical price of the field is a measure of its natural value but is not a measure of its basic cost. We have mineral as the product expressed in physical measures.

However, we have yet no right to call mineral goods as it's price is not expressed in cost measures (monetary units). It is necessary to establish connection of physical and monetary measures of product unit.

Existence of this correlation will give the chance to pass to determination of natural value and basic cost of the field, expressed in physical and monetary units.

For the purpose of definition of this correlation the concept of the commodity price of mineral unit ($Z_T(t)$) as the relation of the actual market price of the commodity unit defined in the market is entered $Z_T(t)$ (local, national, international) ($Z_R(t)$) to the physical price of product unit ($Z_f(t)$):

$$Z_t(t)\frac{Z_R(t)}{Z_f(t)} = \frac{Z_R\left(\frac{dollar}{ton}\right)}{Z_F\left(\frac{MJ}{ton}\right)} = \frac{dollar}{J} \qquad (3)$$

The entered concept of the commodity price of useful product unit (Z_T(dollar/J) makes a certain physic-economic sense to energy efficiency of monetary unit. At the same time three situations in the relations of the market and physical price are possible:

$$Z_T(t) = \begin{cases} >1 \\ =1 \\ <1 \end{cases} \qquad (4)$$

In the first case ($Z_T(t)>1$) the actual market price of mineral unit is overstated. Not equivalent exchange which demands increase in energy efficiency of monetary unit takes place. In the second case ($Z_T(t) = 1$) equivalent exchange and security of the commodity price with a product, physical resource as the actual market price coincides with physical takes place. In the third case ($Z_T(t)<1$) nonequivalent exchange takes place-the actual price is underestimated and supports the parasitic exchange which is artificially accelerating process of depletion of deposits.

To the basic cost provided with the natural value, that is physical resources of mineral there corresponds the second situation when $Z_T(t) = 1$. Measure of basic cost of the field is the work of the single commodity price of mineral unit (Z_f(dollar/J) = 1) on the physical price of the k (MJ) field:

$$Z^M(t) = 1\ \frac{dollar}{J} \times kJ = k\ dollars \qquad (5)$$

Table 2: The generalized field assessment in physical measures

Indicators	Symbol	Formula	Units of measure	Example calculation
Average volume of peat reserves	V_L	$L_X \times L_Y \times L_Z$, where L_X = The average length of the field (m) L_Y = Average width (m) L_Z = The average thickness of the field (m)	m^3	$V_L = 1000 \times 500\ m \times 10\ m = 510^6\ m^3$ $L_X = 1000$ m $L_Y = 500$ m $L_Z = 10$ m
Average mass reserve of peat	M	$V_L \times \rho$, where $\rho = 1000\ (k^2/m^3)$ (For peat)	kg	$M = 510^6\ m^3 \times 1000\ (kg/m^3) = 510^9$ kg
Average reserve of peat in energy expression	E	$\alpha \times M \times p \times S$, where S = Area of the field $S = L_X \times L_Y$, m^2 $\alpha = 0.9$ correction conefficient of the content reliability	J	$E = 0.9 \times 510^9\ kg \times 10000 \times 500 \times 1000\ (kg/m^3) = 22.510^{17}\ J = 22.510^{11}$ MJ
Correlation of energy and mass content	E_M	E/M $\alpha \times T_u$, $\alpha = 0.7$	MJ/kg	$EM = 22.5 \times 10^{11}\ MJ/5 \times 10^9\ kg = 450$ MJ/kg
Correlation of energy content with volume content	E_{VL}	E/V^L	MJ/m^3	$EVL = 22.5 \times 10^{11}\ MJ/5 \times 10^6\ m^3 = 450000\ MJ/m^3$
Average energy of annual extraction of peat	P_d	E/365 days	MJ/days = MW	$P^d = 22.5 \times 10^{11}$ MJ/365 days = 6000 TW
Time of a starvation of content at annual production equal	T_u	E/P_d	days	$Tu = 22.5 \times 10^{17}\ J/6 \times 10^{15}\ W = 375$ days
Project time of production and realization of peat	T_P	$\alpha \times T_u$, $\alpha = 0.7$	days	$T_P = 0.7 \times 375$ days = 262 days
Project capacity of annual production and realization of peat	P_P	E/T_P	MW	$PP = 22.5 \times 10^{11}$ MJ/280 days = 8000 TW
Project time of preparatory work (overburden works)	T_{BP}	$\alpha \times T_P$, $\alpha = 0.25$-project cofficient	days	$T_{BP} = 0.25 \times 262$ days = 65.5 days
The project annual energy spent for overburden works	E_{BC}	$M \times q \times h$, where h = 1	MJ	$E_{BC} = 510_9\ kg \times 9.8\ M/C^2 \times 1\ M = 4910^9$ J = 49 MJ
The project energy spent for all preparatory period	E_{PP}	$E_{BC} \times 1.8$	MJ	$E_{pp} = 1.8 \times 49$ MJ = 88.2 MJ

Table 3: Calculation of natural value and basic cost of the field

Indicators	Symbol	Formula	Units of measure	Example calculation
The natural value of the field or total energy content in MJ	E^M_Z	$\alpha \times M \times p \times S$, where S = area of the field $S = L_X \times L_Y$, m^2 $\alpha = 0.9$ = correction coefficient of reliability content	MJ	$E^M_Z = 0.9 \times 510^9\ kg \times 1000\ kg/m^3 \times 500 \times 1000 = 22.510^{17}\ J = 22.5 \times 10^{11}$ MJ
Total content in tons	M	$VL \times p$, VL = volume, equals $5 \times 10^6\ m^3$, $p = 1000\ kg/m^3$	tons	$M = 5 \times 10^6\ m^3 \times 1000\ kg/m^3 = 5 \times 10^9 kg = 5 \times 10^6$ tons
Physical price of 1 ton	Z_f	E/M	MJ/tons	$Z_f = 22.5 \times 10^{11}\ MJ/5 \times 10^6$ tons = 450000 MJ/tons
Average market price of 1 ton (on the basis of internet marketing)	Z_R	It is calculated as average arithmetic on the basis of internet marketing	dollar/tons	Z_R = 430 dollar/tons (on the basis of internet marketing)
Commodity price of a commodity unit	Z_T	$Z_R(t)/Z_f(t)$	dollar/J	Z_T = 430 dollar/tons/450000 MJ tons = 0.956×10^{-12} dollar/J
The basic cost of a commodity unit in dollars	C^M_B (unit)	$Z_f \times 1$ dollar/J	dollar	45 MJ/tons×1 dollar/J = 45000000 dollar/tons = 45 mln. dollars/tons
The basic cost of the field in	C^M_B	E^M_Z(MJ)×1 dollar/J	dollar	$C^M_B = 22.5 \times 10^{17}\ J \times 1$ dollar/J = 225000 bln. dollars dollars

Thus, the basic cost of the field is expressed in monetary units (for example, US dollars, Euro or other) and is quantitatively equal to the natural value of the field.

Numerical calculation of natural value and basic cost of the field is given in Table 2 and 3 on the example of a conditional peat field. In the reviewed example (Table 2 and 3) the commodity price of mineral unit is much less than unit?, that is the actual price is underestimated and nonequivalent exchange takes place, supports the parasitic exchange which is artificially accelerating process of depletion of deposits. The natural value of the field equals: $E^M_Z = 22.5 \times 10^{17}$ J which corresponds to the basic cost of 225,000 trillion dollars. Any researcher can repeat the specified procedures, and the results of a research received by method of the processes description in the "nature-production-environment" system in terms of energy values can be checked. Thus, the technique of assessment of natural value and basic cost of a field illustrated on the example of the conditional field of peat, answering a question as how to estimate the established physical mineral reserves in the monetary units provided with a physical resource (mineral) is for the first time presented. For preservation of an environment the physical price of natural production unit cannot be changed. But it is possible to change market price. Introduction of new technologies provides increase in efficiency of monetary unit, together with it increase in efficiency of energy use and financial resources as well as reduction of a gap between the physical and market price of a production unit takes place. It is necessary to be able to determine the market value of the field taking into account it's quality and efficiency of use of energy and financial resources.

CONCLUSION

The conducted researches allowed to draw a conclusion that evidence-based assessment of market value of minerals with need has to consider the natural value and basic cost of the field. Without the natural value and basic cost of the field it is impossible to carry out evidence-based assessment of it's market value, including efficiency of physical and financial resources use. The technique of natural value and basic cost assessment for the mineral deposit allows to estimate natural resources of territories, on this basis to establish the evidence-based market value of minerals to exercise more exact project and control of territorial development, defining the existing natural opportunities of the region.

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