

Seria: GORNICTWO

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RATIONAL USE OF BOWELS –A WAY TO THE DECISION OF ECOLOGICAL, SOCIAL AND ECONOMIC PROBLEMS OF COAL-MINING BRANCH

Summary. Necessity of complex and rational use of bowels both with economic, and with ecological the points of view is considered. The expediency of use of methane, underground waters is shown, to geothermal energy, rare elements. Lack of experts of the given structure of Ukraine is marked. It is offered to carry out preparation of engineers on specialization «Complex and rational use of bowels» in Donetsk national technical university.

RACJONALNE WYKORZYSTANIE ZŁÓ – DROGA DO ROZWI ZANIA PROBLEMÓW EKOLOGICZNYCH I SOCJALNO-EKONOMICZNYCH W GÓRNICTWIE.

Streszczenie. Rozpatrzona jest konieczno kompleksowego i racjonalnego wykorzystania złó jak z ekonomicznego tak i ekologicznego punktu widzenia. Pokazana docelowo wykorzystania metanu, energii geotermalnej oraz rzadkich elementow chemicznych. W sprawie przygotowania fachowców z kierunku „Kompleksowe wykorzystanie złó ” zwrócono uwage po pierwsze na brak fachowców danego kierunku oraz na konieczno rozpocz cia szkolenia takich fachowców na Politechnice Donieckiej.

Introduction

High power consumption of the majority of industries requires development and introduction of new effective technical and economic mechanisms. Coal, despite of its big cost price, is considered as a strategic resource which use considerably reduces power dependence of economy of Ukraine on

other states. In fuel and energy balance the USA and Germany the share of coal exceeds 50 %, and by 2010 in global manufacture of the electric power it will be at a level of 40 %. Volumes of a coal mining to China already there is more than billion tons, Australia has increased extraction twice, the USA and Canada – in one and a half time. And in Ukraine a coal mining since 1990 has decreased more than twice and now makes less 80 million tons one year. Despite of significant state financial support, the coal industry of Ukraine continues to be in a deep economic crisis. Volumes of a coal mining in Ukraine as a whole and in Donetsk area, in particular, do not satisfy to requirements of economy. The role of coal will considerably increase during a conclusion from operation of old nuclear blocks and introduction new, that should take place the nearest 5-7 years. For this time it is necessary to carry out full re-structuring of the coal enterprises. Actions spent for the present time on re-structuring branch are shown basically to closing especially unprofitable mines and cuts, and transformation of patterns of ownership is carried out slowly and while has captured only the best coal-mining enterprises and the companies. Perfection of management by branch was conducted not consistently and not in a complex, the basic attention was given change of organizational structures of management, instead of methods of the system and complex approach.

Problems of development of coal-mining branch of Ukraine

Geological and mine technical conditions of working off of coal deposits of Donbass are one of the most difficult in the world. The big depth of development of layers of low power at rather small durability of rocks, danger of emission layers of coal and layers of sandstones, significant plenty of gas of the files, the raised level of temperature, out-of-date technologies of extraction, a deterioration of a fixed capital of mines and other reasons have caused high labour input and the cost price of a coal mining. Today it is much higher than its market cost, that negatively influences competitiveness of a wide spectrum of the nomenclature of production which make with use of Donetsk coal and its derivatives. The ukrainian coal quickly loses competitiveness in comparison with russian, polish and even australian, that is important in view of the introduction of Ukraine into the world organization of trade.

During 2006 under the direction of Donetsk regional state administration complex work as a result of which the basic relationships of cause and effect of an emergency which was generated in coal branch have been revealed has been executed. Results of the researches have shown, that coal deposits accustom to bowels of Donetsk area not in a complex. Not enough attention is given

extraction and use of mine methane, works on use of waste products of coal manufacture and mine waters, processing of waste heaps and another are weakened.

Economic and environmental problems have generated social disorders among which the most difficult is outflow from branch of the qualified efficient staff. Low prestigiousness of the miner's work, unreasoned re-structuring of the enterprises have generated a number of social problems in mining regions: lack of workplaces, unemployment, degradation of settlements and degeneration of an infrastructure of small miner's cities and so on.

Together with economic and social the circuit of environmental problems of branch and mountain regions (tab. 1) is saved up. Influences on an atmosphere consists in significant emissions with ventilating streams of hydrocarbonic gases and dioxides of carbon that promotes a hotbed effect. Process infiltration methane from old manufactures on a surface is long-term during tens years. At burning waste heaps the significant volume of toxic and harmful gases is created. Besides at underground and superficial technological processes the significant weight of aerosols, including cancerogenic and radioactive is allocated.

Simultaneously with each ton of the extracted coal on a surface pump out about three cubic metre mineralizing mine waters. At processing clearing works spoil water horizons which contain stocks of water of drinking standard. Besides on these territories bogs are frequently formed.

Emptiness that remain in bowels after flooding mines, in due course lose resistance and collapse, that is accompanied by intensive deformations and creation of failures on a surface. The mountain weight, underground waters and gases which leave on a surface, have the raised temperature and a radio-activity that results in negative change of a condition of the certain physical fields near to mines.

In view of established facts, «The concept of development of the coal industry of Ukraine» which provides achievement of economic equation of branch in macroeconomic structure of the state due to maintenance of financial self-sufficiency of the enterprises by scale re-structuring and application of modern mechanisms of market transformations has been developed. It is offered at distribution of public funds for support of branch to pay the basic attention extremely on the most perspective, so-called basic, mines for achievement on them expanded manufacture, escalating of volumes of extraction and improvement of economic parameters of work. Other mines need to be financed by a residual principle, proceeding from the allocated volumes of the state support. To this group the enterprises which demand base reconstruction with a stop of industrial activity, belong to preservation and liquidation. Assignment of state support to group of basic mines on capital construction and modernisation should be carried out on a competitive basis.

Table 1

The basic kinds of negative influence of the mines on an environment

Component of an environment	A kind of negative influence	Sources of occurrence
atmosphere	gas impurity	<ul style="list-style-type: none"> • issue in manufactures from a file and infiltration on a surface • the centers of burning of breeds and coal
	aerosols	<ul style="list-style-type: none"> • destruction of a file by mountain tools and water • termodestruction coal and breeds, which burn
hydrosphere	chemical compounds	<ul style="list-style-type: none"> • dissolution of rocks • flow of oils
	the weighed substances	mixing with products destruction of breeds
	change of a hydrological mode	formation depressive soaking up hole
surface	deformations of a relief and constructions	displacement fulfilled breeds
	destruction of the fertile grounds	warehousing breeds in waste heaps and industrial territories
	formation of bogs	displacement surfaces and water horizons
bowels	the unsteady emptiness	dredging mountain weight
physical fields	are raised temperature and radiation	delivery on a surface of the radioactive gases heated up by geothermal heat, waters and mountain weight

Besides basic positions of the concept of development of the coal industry also are:

- change of a price policy with coal production of power assignment;

- wide use of modern methods of financing of programs technical equipment of mines;
- attraction of investments on the state coal-mining enterprises;
- use the complex approach at use of bowels.

The complex approach to use of bowels

It is necessary to note, that the further development of domestic economy is impossible without decrease in the cost price of our basic energy carrier – coal. Among scientifically proved ways of achievement of it the most effective and rather fast is the complex approach to development of coal deposits at which decrease in the cost price of production reach due to reception of the additional income of realization of in passing extracted products. Such sources of the income is methane, underground waters, geothermal energy, rare minerals and other (tab. 2).

Besides the complex approach to development of coal deposits allows to increase a level of safety of works and to reduce anthropogenous loading of mountain manufacture by an environment that gets special value within the framework of action of the Kioto report.

Analyzing the given information, it is possible to draw a conclusion, that reception of the additional profit is possible as due to additional processing the basic product – coal, and adjusting manufacture and sale of gaseous, liquid and firm substances, and also utilizing heat.

Mines and are capable to deliver concentrating factories to consumers not only ordinary coal and a concentrate, and to alter them in more valuable products, for example, in semi-coke, receiving in parallel phenolic compounds, pitches, coke gas, etc. Realization of such assortment of production allows to improve economic parameters of the enterprise essentially. In the long term attractive there is a processing of finely crushed coal in fuel briquettes with the small contents of sulfur and increased warmly ability. In connection with a rise in prices on fuel for engines of internal combustion there are competitive technologists hydrogenesis of coal for reception of gasoline and solar oils.

The important source of the additional profit for mines is methane. It agrees forecasts till 2020 global issue of coal methane in equivalent CO₂ will achieve 560 million tons (in 2000 – 440 million tons). The part of the ukrainian mines in it will make about 7 %. This volume of methane can be compared to a consumption level of natural gas in the country.

Table 2

The basic directions of rational use of bowels

Raw material	A way of processing	An end-product
Coal	Additional physical and chemical processing sub-standard coal	<ul style="list-style-type: none"> • liquid fuel • semi-coke • chemical products • fuel briquettes
Metane and other combustible gases	<p>The previous and accompanying decontamination of a hills.</p> <p>Uses of ventilating metane.</p> <p>Decontamination of the produced space.</p>	<ul style="list-style-type: none"> • a gas concentrate • motor fuel • the electric power • heat • impurity to fuel • chemical substances
Underground waters	<p>Removal of clean water.</p> <p>Clarification, clearing and disinfecting of underground waters.</p>	<ul style="list-style-type: none"> • technical water • watering • drinking • medical
Rock	<p>Enrichment.</p> <p>Uses as binding hardening mixes.</p>	<ul style="list-style-type: none"> • rare minerals • building and ballast materials
Geothermal energy	Heat exchange	<ul style="list-style-type: none"> • heat • a cold
Coal of sub-standard layers	Underground gasification	<ul style="list-style-type: none"> • generating gases • heat • chemical compounds

Now in Ukraine some percent of metane are utilized. Such state of affairs is necessary for considering as a squander of national natural riches, alongside with drawing of ecological damage to biosphere. In this connection use of ways and means of reduction in negative ecological consequences of allocation of metane is represented actual at coal output, it catching and uses as fuel or chemical raw material. Distinguish the following kinds of decontamination of coal deposits:

- preliminary – which carry out on perspective sites before designing and construction of mines.

It allows to extend up to 15...25 % of gas which is allocated at working off of a mine field;

- previous – during construction of mine (10...20 %);
- accompanying – at operation of mine (5...25 %). Besides during this period ventilation delete 20...50 % of methane which contains in a carboniferous file;
- following – from the closed mines (15...45 %).

As follows from the resulted data, the basic part of gas extend from deposits by their development and after closing mines. Therefore development of underground and superficial decontamination, air-conditioning and processing of methane in electric and thermal energy, the concentrated fuel and chemical compounds is effective enough direction of improvement of the ukrainian coal branch.

Operating streams of underground mineral and technological waters by their division on few and highly polluted, using means of underground clarification and clearing, it is possible to reduce essentially loading on water-outflow installations, to reduce their wear process. Besides with the help of additional processing mine waters are possible for finishing with watering and technological standard which realization will allow to receive significant profit.

Concerning a question of preservation of qualitative properties ground and resistance of the constructions placed on them, it is necessary to explain the following. These ecological-economic problems are possible for solving by complex use of measures of geoautomatic and irrigational character. For example, planning of a direction and rates of conducting clearing works for reduction of deformations of constructions. Due to carrying out of irrigational actions the fast drain of superficial waters for limits of ground removal of mine is provided, and also reduction of infiltration of water from a surface in mountain manufactures is possible. It reduces loading on water-outflow mechanisms, reduces volume of a mineralization of water, reduces the area of the boggy grounds.

Many mines of Donbass have achieved mountain works of depths 800 ... 1000 and more where the temperature exceeds a mark 30...40⁰. This boundary is sufficient for use of geothermal energy, for example in systems cogeneration. Qualitative break in a question of extraction of underground heat and its use is developed in Donetsk national technical university the technology of creation underground heat exchanges, that allows to increase essentially volume and especially duration (up to hundreds years) receptions of heat of bowels.

It is possible to ascertain, that at an engineering level many questions in a problem of reception of the additional income the mining enterprises are solved full enough. Problem there are questions of legislative and financial character, including tax privileges, long-term credits and so on. Except

for another, now wide application of the approach to complex development of coal deposits restrains shortage in branch and Donetsk region of experts on questions of complex development of bowels.

Preparation of engineers in sphere of complex use of bowels

In connection with it in Donetsk national technical university preparation of experts of the given structure is started. Since 2008-2009 academic year the set to one educational group of students in a direction «Mining» with specialization «Complex and rational use of bowels» is carried out. The purpose is preparation of experts capable to work on the basic mine manufactures (cleaning, preparatory sites, ventilation and the safety precautions), in technical both industrial departments, and having the profound knowledge and experience concerning designing and effective operation decontaminating, cogenerating, gasifying, water purifiers, processing of industrial wastes, extraction of rare minerals, etc. Number of students of a set of 2008 is planned makes 20-25 persons (one educational group). Training will be carried out for means of the budget.

The basic list of subject matters and volume of loading are developed within the framework of the working standard of a speciality «Development of deposits of minerals». The curriculum provides studying the following basic technologies of complex use of bowels:

- a coal mining from layers of working capacity;
- decontamination a file of coal breed;
- processing rock;
- clarification and demineralization of mine water;
- extraction of valuable and rare minerals and gases;
- gasification of layers of sub-standard capacity;
- getting and use of geothermal energy.

Experts of the these specialization should seize the following organizational-technical approaches and skills: monitoring of natural resources and their updating; the feasibility report on processing of natural resources; a legal substantiation of complex use of bowels; an estimation of ecological consequences; a choice of parameters of technologies; a choice of means for their realization; designing of a technological complex; development economic-financial mechanisms; realization of design decisions.

Conclusions

Thus, the complex approach to use of bowels will allow to receive -economic benefit. Extraction and use of mine methane, waste products of coal manufacture, mine waters and rare elements, and also extraction of geothermal energy enables of reception of the additional income, simultaneously reducing negative influence on surrounding natural environment.

In our opinion, there is a real opportunity of improvement of an economic situation in coal branch of Ukraine with simultaneous improvement of a quality of an environment and the decision of some social problems of mountain regions. And the Donetsk national technical university begins its realization by the first among higher educational institutions of Ukraine.

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