Unconventional (borehole) Technologies for Gas Fuel Producing from Coal Fields

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Abstract

The scheme discribtion of borehole thechnologies for coal fields utilization is cited in the report. The merits and shortages of the technologies are discussed. The several conclusions are expressed.

Key words*: borehole technology, coal seam, coalbed methane, recovery, comparision.*

Geotechnology is the method of raw fossil recovery through the surface boreholes. The raw fossil may be presented both liquid and gas or hard materials. The geotechnological methods have used since beginning of XX century.

Conventional methods of coal mining permit to receive 7-9% useful energy from coal in situ potential energy (calorific value of it). This energy effectiveness have calculated on the base of mining and transportation and processing of the coal [1]. Besides, capacity of labour during underground mining activity is not very high and is evaluated as 0.02-0.5 man-sheet per one ton of coal. The coal mining is accompanied high shake of extracted rock (in Russian coal fields as many as 25-27%). As much as 8-12 tones of clean air are given for one ton of the produced coal. The coefficient of fatal accidents in the coal mines ranges as 1.2-1.5 per 1 million tons of the coal recovery.

Underground (mines) and surface (open pits) mining make negative influence on the environment. Hydrogeology and air basin and Earth condition are exposed to intensive loading. Thrown out gasses and mineral particles assist total a growth of our planet warmth. The negative tendency may be decreased or excluded with unconventional technologies use.

Today borehole hydraulic monitor technology and coal-gas-electricity technology are most grounded [2,3].

The hydromonitor technology presents a system of boreholes from the surface to a coal seam. One part of the boreholes services for coal recovery (production boreholes) and another part for rock filling of a gob of the coal seam. The main mining unit consists of the flexible hydromonitor which is got down from the surface to the coal seam and is connected with borehole pipe line. The pipe line services for water pumping through the hydromonitor under high pressure.

However, hydromonitor exploitation may be scientific and technological difficulties. So, there is big problem to destroy of the coal mass in situ. Other problem is supporting of the coal seam roof during coal extraction. Next problem consists in effective technology of broken coal transport through the gob to the productive borehole bottom.

For effective activity the chemical and microbiological methods must be used for disintegration of the coal mass. The hydromonitor must have flexible pipe line which may be changed under the variable angle relatively the vertical axis of the borehole. The gob of the coal seam may be filled in with the filling material. The roof of the gob may be supported with pillars too.

The product of the hydromonitor technology is coal mass in pieces with water that is a pulp. Transportation of the coal pieces along a borehole up to the surface the borehole is equipped with air or mechanical lifts. The unconventional technology must be connected with the surface coal gasification unit. Therefore near a head of the borehole special surface gas generators are placed on the surface. The pulp moves to the gas generation and generator combustible gas is produced. This way the gas fuel is generated in a coal field.

The borehole coal-gas-electricity technology presents the combination of the several blocks of boreholes. There are the block of gas producing boreholes and the block of air-given boreholes and the block of coalbed methane recovery boreholes. The essence of this unconventional technology consists in to transform hard fuel (coal) in the gas fuel form through underground coal gasification (UCG) process. Besides coalbed methane recovery process have place through the methane recovery boreholes. The combustible generator gas and coalbed methane are connected in one pipe line and moved to electricity generator unit. The electricity unit of combine cycle may be as the unit

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An insufficient heat of the generator gas (calorific value) from UCG (as a rule before 4.5 MJ/m^3) is compensated with cleaning and enriching processes. The processes consists of excluding the CO_2-component from combustible generator mixture and adding coalbed methane in its. As a result the heat of the mixture is achieved to 7-9 MJ/m^3 and more.

One of the important problem of the unconventional technology is technical possibility to have flow rate of coalbed methane through a single methane recovery borehole on the economical required level. Our analysis has shown that economically based flow rate of the single methane recovery borehole for unconventional technology is more 10000 m^3/day. But the flow rates for commercial recovery of coalbed methane is considered to be not less 25000m^3/day.

As a rule the experience of exploitation of coal gassy mines has shown flow rates of the single extraction borehole are equal njt more as 5000-7000 m3/day. These flow rates not may be recognized as sufficient for commercial use. For commercial use of coalbed methane the methods of intensification of the flow rate must be used. Those methods are hydrofracturing and physical-chemical and cavitation methods. These methods permit to increase flow rate of single borehole in 4-8 times. The intensive technologies of coalbed methane extraction from the coal seams have created in Russia (Moscow State Mining University) and USA (Gas production companies).

A technical and economical comparison of unconventional technologies use have shown that a labour productivity of its in 2.4 times higher relatively convention technologies and specific capital expenditures in 2 times less. Cost price is in 1.55 times less and quality of technical personal is in 2 times less. The effectiveness of useful use of energy of coal is more in 3-4 times.

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