Recent drilling techniques and technologies for Coal Mine Methane (CMM) production from gobs

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Introduction

Coal Mine Methane (CMM), in special cases, Abandoned Mine Methane (AMM), trapped in hard coal mines' gobs could be valuable source of energy for both, heat and electricity production. During hard coal extraction and preparation processes, methane emission could be observed. Cheng et al., and Environmental Protection Agency pointed out several possible ways of methane exhalation: during underground coal seams degasification (as known as drainage operations); within mine ventilation air; from abandoned coal mines, from open pit mines and, finally, fugitive emission from post-mining coal processing. CMM term, generally, has two main meanings: coal mine Ventilation Air Methane (VAM) and Abandoned Mine Methane (AMM). VAM is a mixture of origin gas from coal seams (mostly methane) and ventilation air (methane must have a concentration below the lower explosive limit, commonly VAM has methane concentration lower than 1%)

AMM production modeling

As previously was pointed out, methane, emitted from coal during exploitation process, could be valuable source of energy. Numerical simulation of gas accumulation in gobs (goafs) is sophisticated problem. Sorption, migration, diffusion, as well as geomechanical issues should be considered. In 2012, Stopa & Nawrat showed results of modeling of CMM methane production from "Moszczenica" abandoned hard coal mine. Numerical model was built in Schlumberger Eclipse commercial simulator. Program was used to determine of gas production and to choose the optimal location of new wells, which should be drilled to maximize AMM production. AMM utilization should eliminate possibility of uncontrolled gas migration through strata to the atmosphere and, consequently, stop increase of global warming.

Drilling challenges

However, drilling in unconsolidated layers and crushed strata is a technical challenge. In most of cases, drilling fluid is lost in the first crushed layer (Fig.1 & 2). Authors proposed implementation technology listed below to AMM extraction by wellbores drilled from surface.

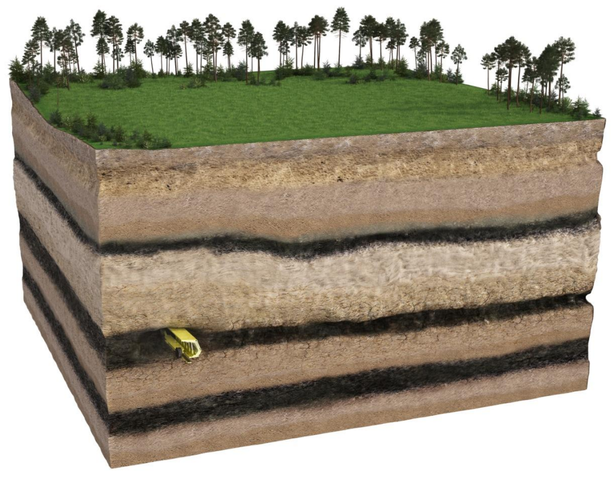

Fig.1 Gobs formed during hard coal mine exploitation

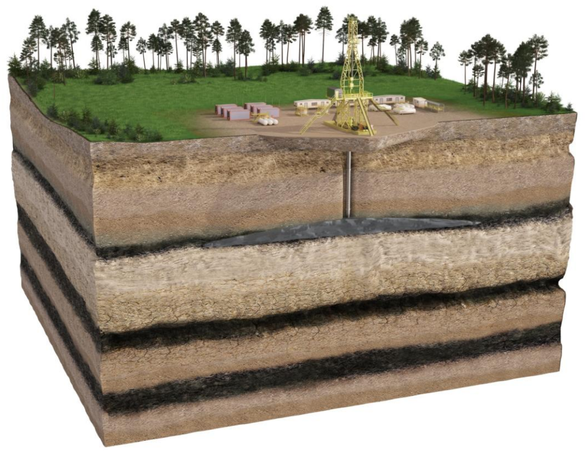

Fig.2 Drilling breakdown caused drilling fluid lost

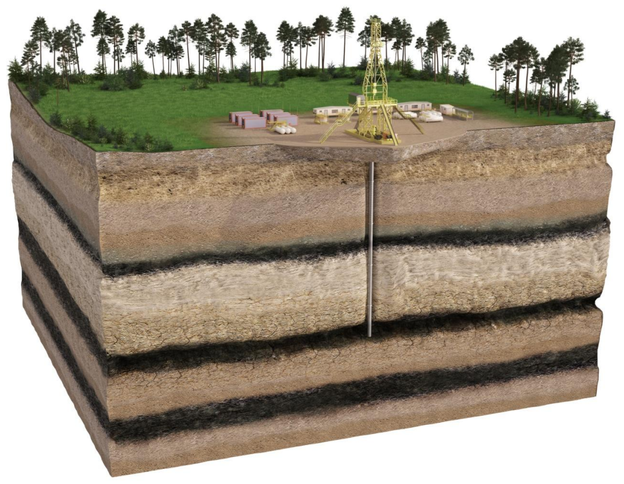

Fig.3 Successful opening of two gobs layers

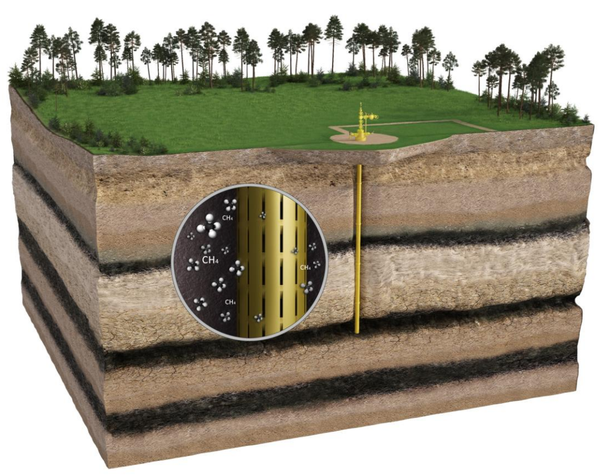

Fig.4 Multilateral Abandoned Mine Methane production

Proposed technology

1. Dual rotary drilling
2. Casing while drilling
3. DTH Hammer Bits (Down The Hole Hammers)

Implementation one of those drilling technology could open two or more gobs layers (Fig.3) and doubled gas production rate (Fig.4)

Summarize

Because of greenhouse potential of methane, as well as opportunities of explosive occurrences, capture of methane should be considered. Heat and electricity production from this gas could be clean, environmentally friendly and profitable way of methane utilization. One of method listed above will be implemented within the project: „Innovative drilling technology for gobs methane extraction and usage" funded by National Centre for Research and Development (NCRD) and The National Fund for Environmental Protection and Water Management (NFEP&WM)

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