Krasnogorskaya Mine Methane Utilisation

Synopsis

Entire report available from Uglemetan (tailakov@uglemetan.ru)

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1 UNECE PROGRAMME

The UNECE has received funding from the US Environmental Protection Agency (US EPA) to provide technical assistance to coal mines in Russia and other countries to develop early stage bankable documentation for coal mine methane (CMM) projects and to introduce such projects and their sponsors to potential investors. The UNECE is unable to support full feasibility or project financing or any design and engineering services; however, the UNECE can act as a bridge to others who can provide these services.

The underlying purpose of the project is to improve mine safety, reduce greenhouse gas emissions from the mining industry, and encourage the rational use of energy resources in support of the goals and objectives of the Methane to Markets Partnership. Through this project, the UNECE seeks to achieve these goals by catalyzing project development through support of the early activities that are necessary, but often overlooked, in conceptualizing, planning and implementing a CMM project.

The project began in 2004 and concludes in September 2008.

2 THE MINE AND THE PROJECT

2.1 INTRODUCTION

Krasnogorskaya mine is located in the southern part of the Kuzbass coal region near the town of Prokopevsk in Kemerovo Oblast. The mine is owned by SDS Coal, part of SDS Group headquartered in Moscow. The mine produces cocking coal for local markets. The proven reserves of coal are 18 million tons, which is 35 years at current planed production of 600,000 tons per year. The current production is 300,000 tons/year. However the mine plans to increase the production to 1 million tons per year by 2012.

The depth of mine coal seams is 450 meters bellow surface with steeply angled dip.

Specific emissions of methane from the mine are estimated at 14.0 to 22.0 m3/ton of coal. The mine currently drains methane through in-mine boreholes. Methane from the boreholes is collected by a gathering system at a single point and all of it is vented. The mine operator estimates the methane drained to 3.5 to 4.0 million m3/year. In addition the ventilation system releases an estimated 8.5 million m3/year with an average concentration of 0.4%. The mine does not utilise any methane either from the ventilation or the drainage systems.

The current concentration of methane in the gas drainage system is bellow 30% for one third of the operation time.

The mine has expressed interest in utilising the methane from the drainage system in on-side boilers for heat and generation of electricity. In addition, the mine has also expressed interest in flaring any excess methane resulting from not use in the summer months.

To utilise the methane for heat or electricity generation it is necessary to upgrade the drainage system to deliver concentrations above 30% consistently. The mine stated its intent to upgrade the system and schedule the coal production in order to achieve such concentration.

The utilisation of ventilation methane from the mine with the currently available technologies would be non economical.

At current production, the mine has a heat demand of 18 Gcal from October through May, met by 4 coal boilers with a total capacity of 24 Gcal and uses electrical heathers of 250 kW for hot water in the summer. To power the boilers the mine buys 15,000 to 17,000 tons of coal per year at current price of 543 R/ton. An increased production of the mine is not expected to materially increase the demand for heat.

The base load electrical demand of the mine is 17 MW throughout the year. The expected increase of coal production is expected to result in 30-40% electricity demand by 2012.

There are plans to drill test wells – 3 in the pillar area and 1 in the virgin coal seam. The methane potentially produced by these wells – as reported by the developer - from 10,000 to 20,000 m3/day from each well is not being taken into account in this analysis. For comparison, the current volume of the methane from the mine to be used is assumed to be 10,000 m3/day.

2.2 TECHNOLOGIES FOR HEAT AND ELECTRICITY PRODUCTION

Heat Production

One of the options to utilise the mine methane is to use 100% of the available methane as Boiler fuel replacing part of the coal purchases for boiler fuel from October through May. A flaring of the methane will be required from May to October.

Currently there are 4 coal boilers of total capacity of 24 Gcal/h from which the mine uses 18 Gcal/h and one of the boilers is in reserve. A small pilot boiler of 0.6 Gcal/h is being installed in the framework of an UNDP sponsored project. Our understanding is that the existing 4 outdated boilers, commissioned between 1959 and 1961, will be replaced with new, more efficient boilers.

The amount of heat which can be produced using the coal mine methane is estimated at 3.5 Gcal/h. With the planned increase of coal production in 2012 it is estimated that the drained methane would be able to produce 7.1 Gcal/h.

The following assumptions were applied in this scenario:

1. Volume of drained methane: 3.5 million m3/year in 2008, increasing on linear basis to 7.0 m3/year in 2012.
2. Incremental cost of converting two of the replaced boilers to dual fuel – coal/methane.
3. Distance between the boiler station and the pumping house is 500 m.
4. Purchase and installation of piping and vacuum pumps.
5. 100% of the available methane is used in the boilers from October to May and fared from May to October.
6. Purchase of enclosed flare.

7. The cost of avoided coal is assumed at 460 Roubles/ton + VAT (NDS) 18% (June 2008)
8. It is assumed that the emissions of the avoided coal will be credited to the project at a ratio of 1 ton of coal avoided results in 1 ton of CO_2 avoided.

Electricity Generation

1. The proposed configuration envisages purchase and installation of, initially 1 and in future up to 3, electricity generating installations of installed capacity of 1.3 MWe each.
2. 100% of the electricity generated will be used to contribute to the base load requirement of the mine and offset equivalent amounts of electricity purchased from the grid.
3. The cost of avoided electricity is assumed at 2.0 Roubles/kWh (June 2008)
4. It is assumed that the electricity generated will replace electricity from the grid, which in Kemerovo region is generated by coal power plants.

Recommendation for improvement:

The use of waste heat from electricity production may be a more profitable and energy efficient way of use of the methane resource, but may be technically more complicated. It is recommended that this option is considered in a further study.

3 INVESTMENT PLAN AND FINANCE

3.1 BASE CASE ASSUMPTIONS

The current model has been prepared with a limited information of the financial status, situation and forecasts for the mine and its owner – SDS Ugol. To illustrate the financial performance of the different options, it is assumed that they are financed entirely by own equity and any financial impact of taxes, tax rebates, value added tax, inflation, currency depreciation and similar, are not being considered in this preliminary financial analysis. Without a knowledge of the actual cost of capital employed, or the hurdle rate used by the company, a discount rate of 10% has been used as a base case.

3.1.1 TIMING OF THE PROJECT

It is assumed that the project will start in 2009, the equipment will be purchased and installed by the end of 2009 and be operational in 2010. An economic life of 15 years is assumed.

3.1.2 RESULTS OF COST/REVENUE AND SENSITIVITY ANALYSIS

The results of the analysis show that both project options can be profitable and achieve positive rates of return. The base case for power generation yields a net present value (NPV) of 32 million roubles (RUR) and an internal rate of return (IRR) of 20%. For use in boilers and flaring, the base case delivers an NPV of 16 million RUR and an IRR of 16%. No use of external finance is being considered at this stage. For the base case, a carbon price of €16 per tonne of CO_2 was used through 2012 and €8 per tonne of CO_2 from 2013-2025.

To test alternative cases, several sensitivity analyses were run considering differing power prices, cost, discount rates and carbon prices. The results show great sensitivity to changes in these key factors, especially carbon prices.