

COAL MINE METHANE PROJECT

CONDUCTED BY JCOAL

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ABSTRACT

Japan has a system for the effective recovery and control of coal mine methane (CMM) gas generated in the course of coal production. The recovered mine gas has been effectively utilized as a clean energy for generating electricity and for producing town gas and methanol in Japan.

It is the aim of JCOAL to contribute to the prevention of global warming, the improvement of coal mine safety, and the utilization of clean energy, through the effective recovery and utilization of coal mine methane gas, which has 21 times the global warming effect of carbon dioxide. To this end, JCOAL is engaged in information gathering, investigations, technology development, feasibility study and demonstration project for effective recovery and utilization of coal mine methane gas emitted in both operating mine and abandoned mine. JCOAL also implement investigation and research activities related to global warming such as joint implementation (JI) projects, CDM projects and emission trading on the Kyoto mechanism.

JCOAL aims for active utilization of the flexible measures set out in the Kyoto Protocol adopted at COP 3, and it undertakes surveys for projects on a commission basis for Japanese Government in countries such as China, Russia, Ukraine, and Poland.

1.0 BASIC STUDY FOR PROMOTING JOINT IMPLEMENTATION

The objective of the study is to carry out pre-feasibility studies for projects aiming at the effective recovery and utilization of the coal mine methane that are currently discharged into the atmosphere in large quantities in the process of mining operation in collieries in countries such as China, Russia, Ukraine and Poland, and to link these studies with future projects under the Joint Implementation (JI) and Clean Development Mechanisms (CDM).

The study has been commissioned by the New Energy and Industrial Technology Development Organization of Japan (NEDO), and is being carried on a scale of some 30 to 40 projects at a budget of around 30 to 50 million yen each.

1.1 Power Generation, Town Gas and Methanol Project in China (1998)

1.1.1 Companies in counterpart nation and project site

Yangquan Colliery Company Limited, Shanxi Province

Panjiang Coal Mining and Electricity Company Limited, Guizhou Province

1.1.2 Project description

The project is to improve the gas recovery system in six of Yangquan's collieries and use 130 million m³/year of the recovered gas for generating 100 MW of electricity by mixed combustion with clean coal, 5.6 MW of electricity by compound gas turbine generation, and 5.6 MW of electricity by gas engine co-generation and for the supply of town gas. In five of a Panjiang's collieries, the gas recovery systems are to be improved and 130 million m³/year of the recovered gas is to be used for generating 50 MW of electricity by mixed combustion with tailings of preparation plant, 7 MW of electricity by gas turbine generation and for producing methanol and town gas.

1.1.3 Initial investment amount

Yangquan: 31 billion yen

Panjiang : 11.5 billion yen

1.1.4 Greenhouse gas emission reduction effect

5,385 thousand t-CO₂/year

Cost/benefit effect: 126.7 t-CO₂-y /M yen

1.2 Power Generation Project in Russia (1999)

1.2.1 Company in counterpart country and project site

Kuzbass Ugolj - Cheljchinskaya Colliery: Kemerovo City

1.2.2 Project description

The project is to improve the gas recovery system at the Cheljchinskaya Colliery and supply 14 million cubic meter of the recovered gas per year to three 1.7 MW gas engine units for power generation.

1.2.3 Initial investment amount

Power generating equipment: 1.8 billion yen, improved gas recovery equipment: 0.6 billion yen, total: 2.4 billion yen

1.2.4 Alternative energy effect and greenhouse gas emission reduction effect

Alternative energy effect converted to petroleum: 9,067 toe/year

Cost/benefit effect: 5.0 toe-y/M yen

Greenhouse gas emission reduction effect: 200,843 t-CO₂/year

Cost/benefit effect: 111.6 t-CO₂ -y /M yen

1.3 Power Generation Project in Ukraine (2000)

1.3.1 Company in counterpart country and project site

Komsomolets Donbass Colliery, Donetsk Coal Field

1.3.2 Project description

The Donbass Colliery is the most advanced and efficient underground coal mine in the whole of the Donetsk Coal Field. It produces some 1.2 - 1.4 million tons of coal a year. In order to reduce the gas emissions to the working face in this mine, the colliery practices borehole drilling for gas drainage. A part of the recovered gas is used as a boiler fuel for heating in the winter season. However, most of the gas is directly discharged into the atmosphere.

To recover the mine gas in this colliery more effectively, medium-distance (300 m) gas drain borehole drilling equipment and a gas control system are to be introduced. For the effective utilization of the recovered gas, the plan is to introduce gas engine generator/heat supply equipment (seven 1.7 MW units) capable of combusting low-concentration gases.

1.3.3 Initial investment amount

3 billion yen

1.3.4 Alternative energy effect and greenhouse gas emission reduction effect

Alternative energy effect converted to petroleum: 31,400 toe/year

Cost/benefit effect: 10.5 toe-y/M yen

Greenhouse gas emission reduction effect: 482,000 t-CO₂/year

Cost/benefit effect: 161 t-CO₂-y/M yen

1.4 Power Generation Project in Poland (2000)

1.4.1 Company in counterpart country and project site

Budryk Coal Field

1.4.2 Project description

Poland is one of the world's major coal producing countries, and its mining operations produce a vast amount of coal mine methane that is released into the atmosphere. The Polish Industrial Restructuring Corporation as the counterpart has requested the Japan-side to conduct a study on a prospective project for using the coal mine methane for power generation and for heat recovery while at the same time benefiting from the greenhouse gas reduction effect such a project would have. The study covers the Budryk Colliery which discharged 20.61 Mm³/year of methane gas. Converted to CO₂, this is equivalent to an emission level of 240,000 tons of CO₂ per year. The project envisages the installation of (four 1,920 kW output) gas engine generators using Japanese technology on the premises of this coal mine. Its target is to achieve energy conservation and reduce greenhouse gas emissions.

1.4.3 Initial investment amount

1.77 billion yen

1.4.4 Energy conservation effect and greenhouse gas emission reduction effect

Energy conservation effect: 18,500 toe/year

Cost/benefit effect: 10.5 toe-y/M yen

Greenhouse gas emission reduction effect: 282,000 t-CO₂/year

Cost/benefit effect: 160 t-CO₂-y/M yen

1.5 Acetic Acid Production Project in China (2001)

1.5.1 Company in counterpart nation and project site

Tongchuan Mining Bureau, Shanxi Province

1.5.2 Project description

The gas recovery system in the Tongchuan Coal Mining Bureau is recovered

and approximately 27 million m³/y of methane-lean mine gas from the coal seams in the course of mining for use as a fuel, to produce 90,000 tons/year of acetic acid.

1.5.3 Initial investment amount

15 billion yen

1.5.4 Alternative energy effect and greenhouse gas emission reduction effect

Alternative energy effect : 19,500 toe/year : Cost/benefit effect: 39 toe-y/M yen

Greenhouse gas emission reduction effect: 360,000 t-CO₂/year : Cost/benefit effect: 752 t-CO₂-y/M yen

1.6 Power Generation Project in China (2002)

1.6.1 Companies in counterpart nation and project site

Pingdingshan Coal Corporation, Henan Province

1.6.2 Project description

The project is to improve the gas recovery system in No.10 mine of Pingdingshan Coal Corporation and use 6 million m³/year of the recovered gas for generating 3 MW of electricity.

1.6.3 Initial investment amount

516 million yen

1.6.4 Greenhouse gas emission reduction effect

90,808 t-CO₂/year

Cost/benefit effect: 45.5 US\$/t-CO₂-y

2.0 GREEN AID PLAN MODEL PROJECT IN CHINA (1998 to 2004)

This Project is implemented as an APEC Multilateral Cooperation Model Project for the purpose of verifying the technical and economic feasibility of the efficient recovery and effective utilization of coal mine methane in Chinese coal mines.

The Tiefa Coal Industry (Group) Limited Liability Company, Liaoning Province, will improve the gas recovery system and upgraded the gas recovery ratio under the project. As a result, the gas recovered from its seven collieries is collected through a network pipeline and supplied as town gas to the colliery

housing estates and the neighboring city.

The results that can be expected from the Project are an improvement in mine safety and management, a reduction in greenhouse gas emissions and the effective utilization of a currently unused clean energy.

The gas recovery and utilization system consists mainly of gas draining boring equipment, sealing equipment, suction equipment for gas withdrawal from the seal, gas storage equipment, gas concentration controlling equipment, gas pressure-feeding equipment, and a central monitoring and control system. The costs for the introduction of these items of equipment and the transfer of the technology are shared between Japan and China. The technology transfer is taking place by having engineers from the Tiefa Coal Industry (Group) Limited Liability Company come to Japan for training and Japanese engineers go to China to give technical instructions and guidance.

The installation and operation of a demonstration system for the recovery and utilization of coal mine methane (CMM) has been completed. It includes the improvement of the CMM recovery system in 7 mines, a gas storage facility, and pipeline network to allow CMM use. The project has been completed in Mar. 2003.

3.0 PILOT PROJECT IN JAPAN

This project is a 3 years project conducted from 2000 to 2002 at Akabira coal mine in Japan, financed by Ministry of Economy, Trade and Industry, Japan. And after 2003 it has been conducted by JCOAL own budget.

In this Project, CMM is recovered from the underground of closed coal mine through pipelines inserted through the sealing of the vertical shafts and inclined shafts. The recovered CMM is utilized for the fuels of 5 units of micro turbine power generators manufactured in USA. The exhaust gas of micro turbines is injected into the underground by pipeline in the vertical shafts to replace with the CMM. The target of the project is zero emission power generation utilizing CMM.

The Akabira coal mine was one of the gassiest coal mines in Japan, operated from 1939 to 1994 for 56 years. The total coal production was 48 million tons and the maximum annual production was 1.9 million tons. The gas content of coal was 3 to 9 m³/ton but the gas emission was 73 m³/ton of coal production.

The excess gas was come from roof and floor rocks of coal seams. The depth of the deepest mining face was –850 m.

The pit mouth of each shafts and the entrance of main entries were sealed but the mined out area in underground considered to be connected each other as making a very large gas holder. CMM is emitted from each shaft by positive pressure, gathered by pipeline and injected into the micro turbine by compressor. The exhaust gas is injected into the shaft by the blower.

The concentration of CMM is over 80 % and the volume is 3m³/min from each pit mouth. (The concentration of CO₂ in the exhaust gas is less than 30%.)

5 sets of 30 kW micro turbine made by Capstone company of USA are installed for gas utilization. These turbines are controlled by a personal computer and the operation is monitored by portable telephone in Tokyo.

4.0 CAPACITY BUILDING STUDY IN CHINA (2002-2003)

The purpose of the study is to collect information for CDM projects and emission trading on the Kyoto mechanism in China and conduct some case studies for CDM projects in Huaibei Coal Corporation in Anhui Province.

In Huaibei Coal Corporation, 493 m³/min of CMM is emitted and 30 million m³/year is recovered. (2001)

The case study is conducted for utilization of 20 million m³/year of CMM.