Abatement of VAM emissions and generating hot water from the energy released in VAM oxidation

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Nationality: Swedish

Organisation - 2: ZhengZhou Mining Group
Nationality: People's Republic of China

General

Overall scope and content of the activity:

Coal mining technology and energy efficiency. Reducing methane emissions and take care of the heat for distict heating

Date of identification/start of co-operation: 2008

Project identification

Project location (country, city): People's Republic of China, Henan Province

Project summary, including technology description: Project Design Document of Zhengzhou Coal Industry (Group) Co., Ltd. Coalmine Methane Utilization Project. PDD can be found at: http://cdm.unfccc.int/Projects/DB/DNV-CUK1201793890.37/view

One possible project is the VAM (Ventilation Air Methane) from the GaoCheng coal mine of the ZhengZhou Mining Group in the Henan Province in the People's Republic of China is being emitted to the atmosphere in concentrations varying typically between 0.3 and 0.7 %.

Utilization or abatement of the VAM emission had not been previously demonstrated in China due to the nature of the emission with very large air flow with extremely dilute methane concentration.

For more information see the PI appendix Swe Megtec in China.

The objective of the project is to oxidize the methane and generate hot water from the released energy.

Business co-operation

Short description of nature of co-operation, including how the co-operation was initiated:

Continual contacts. The project could easily be duplicated and there are many interesting countries that have mines were methane could be reduced. Polen, Australia, Inida are very interesting countries.

Organisations involved – other than those mentioned above:

Eco-Carbon, info@eco-carbone.com - http://www.eco-carbone.com

Follow up

Anticipated follow-up activities (of the project identification and/or business cooperation):

SETatWork will follow up the activities to find out if this cooperation will lead to a finial business and how many carbon credits will be achieved through the project.

SETatWork Project Identification and Business Cooperation

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Setting	
Country	People's Republic of China
Location	Henan Province
Project start date	ASAP, discussions are ongoing
Project end date	2028
Technology keywords	Coal mining technology, energy efficiency
Host sector	Coal mining sector

Technical summary of the project

Objective of the project:

One possible project is the VAM (Ventilation Air Methane) from the GaoCheng coal mine of the ZhengZhou Mining Group in the Henan Province in the People's Republic of China is being emitted to the atmosphere in concentrations varying typically between 0.3 and 0.7 %.

Utilization or abatement of the VAM emission had not been previously demonstrated in China due to the nature of the emission with very large air flow with extremely dilute methane concentration.

The objective of the project is to oxidize the methane and generate hot water from the released energy.

The project will be a part of the CDM project 1603: Zhengzhou Coal Industry (Group) Co., Ltd. Coalmine Methane Utilization Project. GaoCheng coal mine is one out of several coal mines where Vocsidizers will be installed.

Objective of the project:

The ZhengZhou Mining Group chooses to apply a single Vocsidizer from MEGTEC Systems. Technology provider MEGTEC Systems had earlier demonstrated the VAM processing technology at British Coal in England, at CONSOL Energy in the USA and at BHP Billiton in Australia.

The Vocsidizer is by equipment type a single-bed flameless RTO (Regenerative Thermal Oxidation). The heat developed during oxidation is by heat exchange inside a ceramic bed efficiently used to preheat the incoming ventilation air to the natural oxidation temperature of methane, so that the next incoming VAM molecules are oxidized – releasing their oxidation energy, which is efficiently heat exchanged to preheat the next incoming VAM molecules to oxidation etc. Only the energy of 0.2 % methane concentration is required in order to maintain the system in self sustaining oxidation mode. The energy of VAM concentrations exceeding this level can be recovered as thermal energy in the form of e.g. hot water or steam. Experience shows that the VAM concentration in the ventilation air being fed to the Vocsidizer installation in periods has been lower than 0.2 %, whereby the system has been automatically stopped.

The Vocsidizer has no combustion chamber. The oxidation is taking place inside the ceramic bed. The system does therefore not have any open flame. Besides being a flameless oxidation system, this means that it does not have any generation of thermal NOx and is therefore defined as a no NOx system.

At the initial start up of the system, heating elements brings the horizontal centre portion of the system up to 1000 degrees C. When this is achieved, the heaters are turned off, and the process fan is started, bringing ventilation air through the Vocsidizer, heating the air to oxidation of the VAM, releasing its oxidation energy – which will then be providing the heating energy driving the oxidation process. The electrical start up is typically done once per year only, in relation to yearly maintenance.

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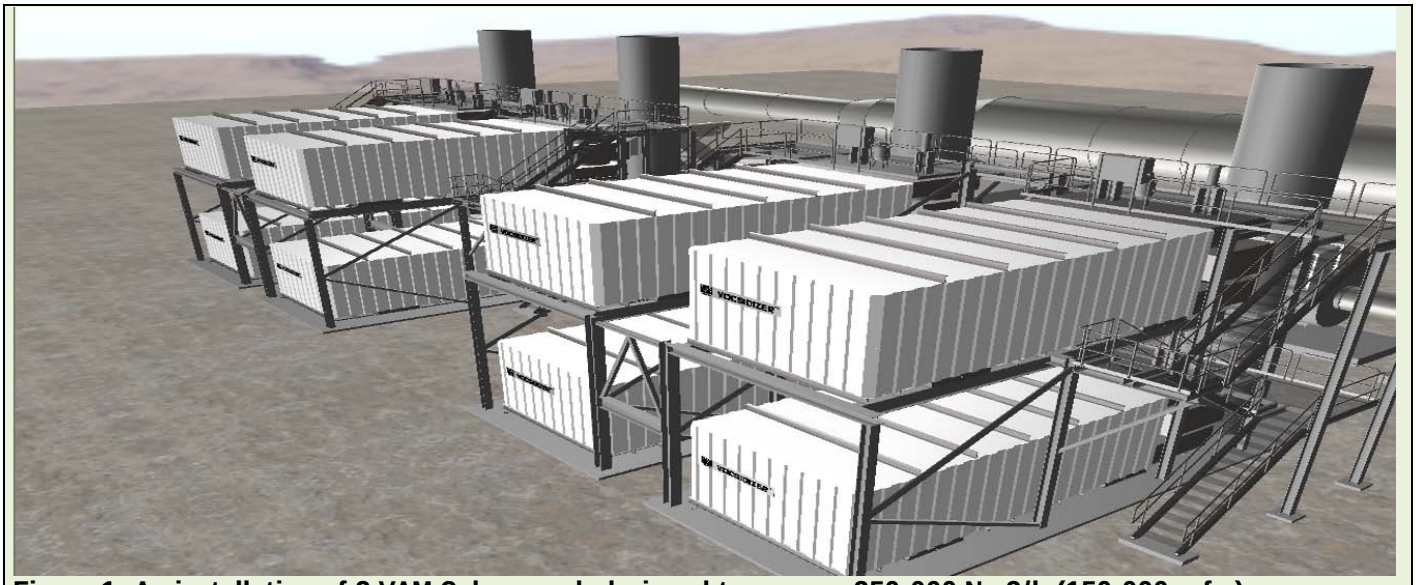

Figure 1: An installation of 2 VAM Cubes, each designed to process 250,000 Nm3/h (150,000 scfm).

The VAM processing installation at the GaoCheng mine of the ZhengZhou Mining Group consists of a single Vocsidizer, intended for system demonstration. The VAM Vocsidizer technology is modular in nature, intended for installations processing very large VAM volumes. The constellation is typically in VAM Cubes, each consisting of 4 Vocsidizers served by 2 fans in an arrangement on two levels by a steel frame with a foot print of approx 20 meters by 25 meters. A VAM Cube is designed to process 250,000 Nm3/h (150,000 scfm) of ventilation air.

A significant amount of energy can be recovered from inside the Vocsidizer. This could be relevant to retrieve where for example a process industry or a district heating net work is located close to the mine evasée. The installation at the ZhengZhou mine is generating hot water for miners' showers and for heating of nearby buildings. The heat recovery is achieved by the application of an air-to-water heat exchanger installed between the Vocsidizer and its exhaust stack, recovering the energy in the heated exhaust air. The amount of energy that can be recovered by secondary heat exchange on the exhaust depends on the VAM concentration and on the water temperature to be achieved. Table 1 compares amounts of energy that can be retrieved in the form of water at 70 degrees C and 150 degrees C, respectively, at various VAM concentrations.

Result of secondary heat exchange	At 0.3 % VAM	At 0.6 % VAM	At 0.9 % VAM
Water at 70 degrees C	1 MW	8 MW	15 MW
Water at 150 degrees C	- - *Not possible* - -	2 MW	10 MW

If there is a large user of thermal energy near the mine evasée, the energy recovery should be done from inside the Vocsidizer equipment. The temperature can then be chosen at design stage. The amount of energy recovered will be higher, as indicated in Table 2.

Result of internal heat exchange	At 0.3 % VAM	At 0.6 % VAM	At 0.9 % VAM
Water/steam at chosen temperature	3 MW	11 MW	18 MW

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If there is a requirement of cooling energy near the mine evasée, hot water (70 degrees C or more) can be used as driving energy for absorption chillers in order to generate cool water (4 to 6 degrees C).

For each VAM Cube of ventilation air processing, the amounts of carbon credits that can be expected from average levels of VAM concentrations are indicated in Table 3.

	At 0.3 % VAM	At 0.6 % VAM	At 0.9 % VAM
Number of tons of CO_2e (CO_2-eqvivalentrs of carbon credits) that can be expected from processing the ventilation air at various VAM concentrations for each VAM Cube processing 250,000 Nm^3/h (150,000 scfm).	80,000	160,000	240,000

For a VAM abatement installation, the average VAM concentration should be at least 0.4 %. To improve the success of a VAM installation, requirements of thermal energy (heating or cooling) close to the mine evasée should be determined.

Environmental and social benefits	
(Estimate of) Greenhouse Gases abated (in metric tons of CO_2-equivalent)	Assumptions: 7 Vocsidizers installed in CDM project activity that together will process 22 050 000 m3 CH4/year. (Source: PDD) Annual: Up to and including 2012: 230 000 tCO_2-equivalent Up to a period of 10 years: 460 000 tCO_2-equivalent Up to a period of 15 years: 690 000 tCO_2-equivalent
Number of reduction units (EAU, CER, ERU, AAU)	The CDM project activity *Zhengzhou Coal Industry (Group) Co., Ltd. Coalmine Methane Utilization Project* (where GaoCheng coal mine is one out of several coal mines where Vocsidizers will be installed) will in total generate 1,600,000 CERs.
Socio-economic aspects What social and economic effects can be attributed to the project and which would not have occurred in a comparable situation without that project?	The project will contribute to China's sustainable development in the following ways: • Avoid emissions of various pollutants such as SO2 and nitric oxides (NOx) as a result of the replacement of coal boilers. • Introduce a new VAM oxidation technology to China with strong replicability effects. • Create employment for the operation of the above-described technologies.
Methodology used	ACM0008 (Version 03) Coal bed methane and coal mine methane capture and use for power (electrical or motive) and heat and/or destruction by flaring

Economic data	
Capital costs	1 400 000 Euros for one Vocsidizer
Financing scheme	
Financing organisation (if third party)	

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Project developer	
Name of the project developer	EcoCarbone
E-mail and/or web address	info@eco-carbone.com http://www.eco-carbone.com/
Contact person	

Host organisation	
Name of Host organisation	ZhengZhou Mining Group

Technology provider	
Name of Technology provider	MEGTEC Systems
E-mail and/or web address	http://www.megtec.com/

Additional Information

Title: Project Design Document of Zhengzhou Coal Industry (Group) Co., Ltd. Coalmine Methane Utilization Project

The PDD is available at: http://cdm.unfccc.int/Projects/DB/DNV-CUK1201793890.37/view

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