TECHNICAL REVIEW

Review of a Proposed GEF Project[1]

Ukraine Coalbed Methane Project (GEF)

January 22, 1998

1. Overall Impressions and Recommendations

This proposal for a coalbed methane (CBM) recovery project in the Ukraine addresses an important area for possible GEF funding. The Ukraine is one of the largest coal and coalmine gas (CH_4) producing areas in the world, however limited coalbed methane is recovered and utilized (most coalmine gas is vented). The proposed project has the "potential" to demonstrate the technical recovery of CBM at two mines, significantly reduce CBM emissions at the project sites, and have an important demonstration effect for the entire Ukraine coal mining industry. The project will also establish a "gas sales" company that, if successful, might be expanded to a larger scale. Successful implementation of this project can make an important contribution to both short and possibly longer term CBM emissions in the Ukraine. Although there is a long history of CBM recovery in Ukraine, this project is apparently the first CBM project of this kind in the Ukraine.

The project has at least medium risk of not fully meeting its objectives due to the unstable nature of the struggling Ukraine coal mining sector. The linkage with the broader World Bank coal reform activities (Coal Mining Improvement Project) in Ukraine, enhances the potential for closer monitoring (and guidance) on the part of the World Bank.

A number of the assumptions behind the avoided cost calculations for carbon are unknown, unclear or appear speculative. Quick recalculations, based on this consultant's assumptions (and those of Dr. Xiaodong Wang, an energy and environmental specialist), produced abatement costs well below $10/tC. If the project can meet its operational targets, the abatement costs of carbon recovery are projected to be below 7/tC. This consultant recommends that the project be funded by GEF. However, it is recommended

[1] The consultant was given one day to review selected documents, including: (i) the Project Concept Document, dated January 12, 1998; (ii) Annex 2, Incremental Cost Analysis – Ukraine Coalbed Methane Recovery Project (received January 21, 1998); (iii) draft spreadsheet for incremental analysis (received January 20, 1998), revised but only partially readable spreadsheet (received January 22, 1998).

that a "more detailed" planning document be prepared, along with benchmarks for the project, and a more thorough spreadsheet analysis.

2. Scientific and Technical Soundness

The technical CBM resources in Ukraine are known to be large, and many mines are gassy (have high levels of coalmine gas emissions that pose both a health and safety risk to miners, and contribute to GHG). The CBM resources in the Ukraine are sufficient to sustain large scale CBM development. In general, the mining operations of Ukraine coal mines fall far below acceptable coal mining industry standards. Therefore, problems in mining operations (Mining Component) could adversely impact on the success of the coalmine gas recovery part of the project. The "Gas Production and Sales Component" of the project depends heavily on establishment of a corporate entity with motivated and trained staff. The project should have close involvement of consultants that have participated in successful CBM and associated electricity generation projects in other countries.[2]

3. Global (and Regional) Environmental Benefits/Risks

Global emissions of CBM were estimated at between 36 and 58.4 billion m^3 in 1990.[3] China, United States, Russia and Ukraine account for more than 70 percent of world CBM emissions. Selective, well managed, high profile CBM recovery and utilization projects in China, Russia and Ukraine are needed to stimulate the development of a large industry for CBM recovery. The large potential size of such a CBM industry could have major global and regional environmental and safety benefits in reducing CBM emissions. Three important risks need to be noted: First, coalmine gas recovery requires close cooperation of mine staff whose main interest in CBM recovery has been to reduce the risk of mine explosions. Second, the quality and quantity of coalmine gas recovery often varies to such an extent that electricity generation is not a viable option. Third, realistic prices for methane and electricity need to be assured.

4. Fit with the Goals of GEF

The GEF program has focused considerable attention on the important emerging options in renewable energy, where support is clearly needed. However, the benefits of these activities are offset by growing environmental emissions from fossil-fuel use, particularly coal. An area of inadequate investment is on coalbed methane recovery and utilization. World CBM emissions are a substantial contributor to greenhouse gases, and Ukraine is among the larger CBM emitting countries. The GEF program has an opportunity to slow the rate of increase of CBM emissions by funding selected projects in leading coal producing countries, China, India, Russia and Ukraine. Successful demonstrations of CBM recovery and utilization projects can facilitate the eventual establishment of a commercial CBM industry in the countries.

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[2] Some of most experienced consultants in commercial CBM projects have worked in the San Juan Basin of the United States.

[3] Sources of estimates: US Environmental Protection Agency, 1993; Schraufnagel, 1993 and DRCCU, 1994.

The project fits under the GEF "Short Term Project" category, although it also has important long term implications to the level of CBM emissions. The following criteria for a GEF "Short Term Project" are met by this project: (i) it is projected to mitigate carbon emissions at a cost considerably below $10/tC); (ii) it has a medium probability of technical success; (iii) Ukraine has demonstrated that CBM recovery is a priority area through its establishment of a National Methane Recovery Program.

5. Replicability and Sustainability

Replicability and sustainability of CBM projects in the Ukraine may be difficult because much of the present industry is not economic and can only survive with heavy government subsidies. It is essential that the CBM project should be placed only in viable mines with relatively long commercial lives. If investments were made in CBM recovery in uneconomic mines, two risks are added to the project. First, it might be argued that subeconomic mines were being kept operating beyond their economic lives, therefore producing coal and CBM (and carbon) that would not have been produced without the CBM project. Second, subeconomic mines are likely to have less stable mining operations, and less stable CBM recovery systems, therefore high risk of failure to meet the project objectives.

Given the large geological potential for CBM recovery in the Ukraine, and the large number of gassy mines, a successful demonstration project, could become an important catalyst for the spread of CBM recovery systems in Ukraine.

6. Linkages with Other Regional Programs

There are CBM projects underway in a number of developing countries, most notably China (through APEC) and India (through GEF), plus numerous commercial CBM exploration projects in China. The United States leads the world in commercial recovery of CBM.

Funds should be made available to ensure that key people involved in this project can participate in international CBM meetings to exchange views on how to better promote the development of successful CBM projects. The World Bank plan to have this project as a component of the larger Coal Mine Improvement Project is a strong factor that should enhance the chances that this project will succeed. The large scale of the World Bank's coal mine assistance package, enhances the prospects that Ukraine officials will be more responsive to World Bank advice and guidance with respect to the CBM project.

7. Stakeholder Involvement

Among the most important factors in the success of this project will be the "degree of commitment" of the mine management and workers (Mining Component), and the Gas Production and Sales company staff. In conjunction with the need to ensure that those involved in the project are fully committed to its success, will be the need to demonstrate that some of the benefits of the project accrue to the people involved. Part of the solution will be to ensure that the benefits from the project are reported regularly, and in a timely way, to those involved with the project. Those directly involved with the project at the mine and sales level, are likely to be more interested in the potential "economic and safety benefits" than reducing carbon emissions.

8. Capacity Building

Successful CBM projects in developing economies are rare, particularly where electricity generation is a component of the project. An important problem is that sustained recovery and use of methane in the quantities and qualities most useable, requires considerable skill, and an appropriate regulatory and energy pricing structures. The consultant was not supplied with details of the planned education and training programs associated with this project. It is essential that these programs receive high priority, and that experienced CBM experts are actively involved in planning and implementation of the program. Capacity building needs to extend beyond the direct mine facilities, and include policy makers responsible for formulating and implementing policies and legislation necessary to the eventual development of a commercial CBM industry.

9. Project Spreadsheet Analyses

The draft spreadsheets that were examined contained a number of unknown assumptions, and possibly errors. However, after adjusting for possible errors in the calculations the results show that abatement costs substantially below the $10/tC GEF limit. The following are comments and findings relating to the spreadsheet analysis (for calculated numbers in the following section refer to attached spreadsheet 1 which was prepared by my associate Dr. Xiaodong Wang). Because of the lack of any detail on the assumptions in the spreadsheets examined, it is possible that some errors were made in our analysis, however, any are unlikely to change the conclusions:

9.1 There appear to be differences of opinion in whether to discount the CH_4 in the determination of avoided costs. The total CH_4 recovered without discounting is 2.0 MtC. In Table 2, under Alternative, Gas Production and Sale Component: the calculation of avoided GHG emission from recovered CH_4 does not appear consistent with 81.3 m3/tC, therefore the result of avoided GHG emissions should be 1.26 ktC instead of 0.63 ktC.

Total CH_4 recovered with discounting is 1.13 MtC. This is the approach used in the World Bank report: China Efficiency and Environmental Impact of Coal Use (Report No. 8915-CHA, 1991) Annex 1, p1. In this report the "average incremental cost" is defined as A/B, where

A = Present value of total capital and cash operating costs
(discount rate = 10 percent)

B = Total annual production over project life, discounted by
10 percent.

Using the World Bank approach, and assuming the net incremental cost in Table 2 is correct, the unit abatement cost is:

3.6 $/tC (without discounting avoided GHG emissions)
6.5 $/tC (with discounting avoided GHG emissions)

9.2 The following are "quick estimates" and our assumptions of avoided CH_4 emissions:

Mining component:

The avoided GHG emissions include two parts: (i) a direct benefit of avoided methane emissions; and (ii) an indirect benefit from using methane instead of a more carbon-intensive mix of fuel. However, Ukrainian power generation relies on a mix of fuels including coal, gas, nuclear, and hydro. If a total of 62.1 Mm^3 gas (without discounting) is used to replace coal, then 24.6 ktC[4] will be avoided. If this amount of gas is used to substitute for nuclear and hydro, then 3.8 ktC will be added. Since the information on the fuel mix for Ukraine's electricity generation was not available, the second part of the avoided GHG emissions was not be estimated.

Economic benefits of the projects:

(a) Mining Component:

Gas recovered in the mining component will be used to meet the mine's internal power needs, that is, it would replace electricity from the grid. Therefore, a plausible interpretation is that the opportunity cost of the Mining Component is the avoided annual electricity bill from the grid, rather than the gas revenue and avoided import gas. If it is assumed that electricity tariff in Ukraine is 6 c/kWh (the electricity tariff information was not available) and diesel generator has an efficiency of 30%, then the net cost of the Mining Component of the project is estimated to be $5.0M instead of $5.5M.

(b) Commercial Component:

Gas recovered in the Gas Production and Sale Component would apparently primarily replace imported gas. Thus, the opportunity cost of the Commercial component appears to be the gas revenue to the Gas Production and Sale company, rather than the avoided import gas cost. Under such an assumption, the net cost of the Commercial component of the project is estimated at $3.8 M instead of $3.3 M.

With the revised net incremental cost and discounted avoided GHG emissions, the result shows that the unit abatement cost is $6.3/tC instead of $5.1/tC.

[4] 62.1 Mm3 gas x 37.68 GJ/1000m3 = 2340 TJ. 2340 TJ gas will emit 35.8 KtC equivalent with 15.3 tC/TJ, while 2340 TJ coal will emit 60.4 ktC equivalent with 25.8 tC/TJ.

With projects:													
Mining Component													
	1	2	3	4	5	6	7	8	9	10	NPV		
capital	8.2	0	0	0	0	0	0	0	0	0	$7.45	M$	
O&M	0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	$4.19	M$	
gas	0	3 7	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	38.77	Mm3	62.1
carbon	0	44.9	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	476.34	ktC	763.3
avoided electricity	0	0 70	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	$6.64		
net cost											$5.00		
note: avoided electricity bill: 6c/kWh x gas (Mm3) x 37.68 GJ/1000m3 x 30% efficiency / 3.6 MJ/kWh													
Commercial Component													
	1	2	3	4	5	6	7	8	9	10	NPV		
capital	4.3	0	0	0	0	0	0	0	0	0	$3.91	M$	
O&M	0	0 8	0.8	0.8	0 8	0.8	0.8	0.8	0.8	0.8	$4.19	M$	
gas	0	0	0	4.4	6 6	9.9	14.8	22.2	22.2	22.2	53 40	Mm3	102.3
carbon	0	0	0 0	54.1	81.2	121 8	182 0	273.1	273.1	273.1	657.79	ktC	1258.303
gas revenue	0	0	0	0.352	0.528	0.792	1.184	1.776	1.776	1.776	$ 4.28		
net cost											$3.82		
Incremental													
Mining component													
									incremental cost		$3 30		
									GHG avoided		476 34		
									abatement cost		6 9		
Commercial component													
									incremental cost		$3.82		
									GHG avoided		657.79		
									abatement cost		5.8		
Total													
									incremental cost		$7.12		
									GHG avoided		1134.13		
									abatement cost		6.3		