Methane to Markets Coal Subcommittee and Project Network
Draft Policy White Paper

Flaring Coal Mine Methane: When Does It Contribute to Sustainable Development?

I. Background

Methane is a powerful greenhouse gas, 23 times[1] more potent than carbon dioxide (CO_2). In 2000, methane accounted for 15 percent of all human-induced greenhouse gas emissions globally, and coal mining contributed 8 percent of the total methane emissions that year[2], so coal mine methane contributes more than one percent to global emissions.

Although historically methane was considered simply a safety hazard and an impediment to coal production, in recent decades awareness of the environmental impact of methane and of the availability of technologies to beneficially use coal mine methane (CMM) has grown, including use for town gas, electric power production, industrial boilers, and other applications. Furthermore, the potential efficacy of one technology for oxidizing the very low concentrations of methane contained in ventilation air exhausts from gassy underground coal mines (typically below 1 percent) has been demonstrated, and other ventilation air methane (VAM) use technologies are in the research and development pipeline. Drained methane in concentrations within or near the explosive range (5 – 15 %) exists in many regions and poses challenges to safe use and therefore is often vented to the atmosphere.

II. Project Economics: CMM-Use versus Flaring

The economics of some CMM use projects are marginal or not profitable and thus require supplemental revenue, such as that deriving from the sale of carbon emission reductions, to improve expected project cash flow and attract investors. Simply flaring methane may be economically attractive with the sale of emission reduction credits. Capital and operating costs of CMM flaring projects are low enough that even without generating revenues from any tangible project output (e.g., sales of electricity or of pipeline-quality gas) capital investment can be recouped in a reasonable timeframe and an attractive internal rate of return (IRR) can be captured solely based on the sale of carbon emission reductions. VAM "flaring" (i.e., oxidation only, without energy capture and use) requires a greater capital investment than does CMM flaring, but over a longer project life also may offer a positive cash flow. CMM/VAM-to-energy projects will involve even higher capital expense (i.e., because they include energy conversion equipment) than will flaring/oxidation alone, but they also offer the added revenues that result from sale of the energy product.

Thus, when considering CMM/VAM emission mitigation projects, two approaches can be taken. One captures the energy content of CMM/VAM and derives revenues from the combined sale of energy and from carbon emission reductions. The other simply oxidizes the methane and obtains revenues solely from the carbon sale. In planning CMM emission mitigation projects, therefore, a key question is: When is it appropriate to select flaring as the technological option of choice as opposed to employing technologies that can capture the energy content of methane?

III. Flexibility Mechanisms and Sustainable Development

In considering the technology choice question it is clear that if maximizing profit is the only motivation then market forces alone should decide whether energy production or flaring is the optimal choice. In such cases the lower capital investment associated with flaring/oxidation projects could prove attractive from cash flow and payback time perspectives. However, global carbon markets are greatly influenced by the requirements of the project-based mechanisms of the Kyoto Protocol: Joint Implementation and the Clean Development Mechanism. A key element of the philosophy underlying the Kyoto Protocol is that climate change mitigation should be carried out in a manner that is consistent with and supportive of sustainable development. For example, Article 12.2 of the Protocol states that "The purpose of the

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[1] *Climate Change 2001* – the third assessment report of the Intergovernmental Panel on Climate Change.

[2] US Environmental Protection Agency compilations.

clean development mechanism shall be to assist Parties not included in Annex I in achieving sustainable development …" Including consideration of sustainable development in the technology selection process, however, means that careful evaluation of the non-financial implications of flaring versus energy use is appropriate.

How can CMM emission mitigation projects contribute to sustainable development? Broadly speaking, they do so in either of two ways. First, power generation or thermal applications clearly offer means of conserving energy resources (e.g., other fossil fuel) that may be used to generate power or heat by instead employing methane that otherwise would be wasted to the atmosphere. It also reduces greenhouse gas emissions, thereby mitigating global climate change and thus contributing to sound environmental stewardship. Second, although flaring does not conserve any energy resource, it still contributes to sustainable development by supporting sound environmental stewardship through mitigation of greenhouse gas emissions. Clearly the first approach offers greater benefit regarding sustainability than does flaring, although flaring does provide for at least some degree of sustainability by providing a global environmental benefit. Thus, when we compare one with the other the two approaches clearly reflect a hierarchy in terms of the degree of benefit that they offer. However, either approach is beneficial to some degree when employed in the appropriate settings.

IV. When to Flare?

Because flaring-only contributes substantially less to sustainability than does energy capture, flaring should never be the only option considered when planning methane emission abatement. That is, project developers should not "rush to flare" but should instead consider the costs and benefits of all technologically viable mitigation options and clearly demonstrate that flaring on balance constitutes the solution of choice in terms of maximizing sustainability while achieving acceptable project economics. CMM/VAM mitigation options (not only a proposed solution), insofar as options exist, always should be included when preparing project design documents (PDDs) for emission reduction credit approval.

Thus, to assure that sustainability is adequately factored into the project planning, selection, and approval process, those projects seeking to capture carbon emission reduction revenues should always consider the technical and economic viability of technologies that exploit methane's energy content in some manner. In the flaring context, this means that in considering project options, the feasibility (both technical and economic) of both flaring and power generation both should be evaluated. But not all energy projects are created equal. Not all will prove economically attractive even with the added revenues that carbon emission reduction sales can provide, and some options clearly will be infeasible. For example, if there is no local market for thermal energy, thermal applications would be ruled out. In other cases, where both flaring and non-flaring options offer potentially viable cash flows, clear rationale for selecting one over the other should be provided.

In all cases it should be incumbent on project developers proposing to flare and seeking to benefit from carbon emission reduction revenues to demonstrate that a good faith effort to assess energy utilization options has been made and that none have been found adequate from an economic standpoint. Developers should be required to assure that they have used due diligence in evaluating alternative energy utilization options. If energy production is technically feasible but project economics can be demonstrated to be unacceptable for energy utilization, flaring methane with no energy capture can be considered an acceptable alternative.

When other options are unavailable, flaring would at least provide the environmental benefit of reducing greenhouse gas emissions. Thus, although the energy content of the flared methane is not exploited, its global warming potential will be substantially reduced by combusting it and converting it to carbon dioxide and water. With a global warming potential 23 times that of carbon dioxide, methane flaring provides significant GHG emission reduction. Because a sustainable environment is supportive of sustainable development, flaring can be seen as contributing indirectly to sustainable development, and thus, in the absence of viable (technically or economically) energy utilization options, it offers at least a last resort means of achieving an environmental good.

Additional benefit may come from projects that primarily use the gas for energy generation but that also incorporate a flaring component where flaring may offer an opportunity to further reduce greenhouse gas emissions either before gas use equipment is deployed or in concert with power generation in cases where gas availability exceeds reasonable capacity for methane use equipment.

V. Summary

In light of the above, a logical, stepwise process for determining if flaring is an acceptable technological choice when carbon emission reduction revenues are sought is:

1. Identify all technically feasible CMM or VAM use options (i.e., flaring, thermal applications, and CMM/VAM-to-power)
2. Eliminate any options for which local markets do not exist or could not be created, and provide data supporting that determination
3. Assess capital investment versus project output (e.g., $$$/MW) as well as cash flow
4. Define and defend key economic signals (minimum acceptable IRR/ROI, maximum capital investment per unit output ($$$/MW), etc.)
5. Select power generation when technically viable AND if it passes defensible economic hurdles.
6. Select flaring if power generation is not technically feasible OR if it cannot pass economic hurdles.

VI. Conclusion

It should be noted that the process described above is not intended to drive an "all or nothing at all" mindset. To the contrary, it is recognized that in some cases a mine site will be able to sustain a combined methane use and flaring project. When project developers are contemplating this option, they would employ the stepwise process to first determine what portion of methane emissions meets the investment thresholds for methane use, and then may justify flaring the remainder. Such residual methane is likely to be that quantity of methane exceeding reasonable methane use capacities due to fluctuations in methane quantities or qualities. Such combined projects are in fact highly desirous as they may allow mitigation of all methane emissions rather than beneficially using a portion of methane and simply venting the remainder.

Furthermore, employing this process means that neither (1) selecting flaring without considering the viability and benefits of energy capture and use nor (2) blanket prohibitions against flaring in any circumstance are appropriate. Instead, it inherently reflects an understanding and appreciation of the potential benefits that methane flaring can provide when applied in an appropriate setting, and it is intended to provide an analytical paradigm for determining and defending when and where those settings exist.

Review Notes:

Please provide any comments on this draft by September 8, 2006 to the co-authors, Karl Schultz and Lee Schultz at LSchultz@bcs-hq.com and Karl Schultz at karl@climate-mitigation.com.

We thank you for your interest and consideration in this important environmental issue.