CDM INVESTMENT NEWSLETTER

Nr. 1/2008 A joint initiative of BEA International and the Climate Business Network

Methane (1)-Rev1

Table of contents

Editorial

METHANE, AS READERS KNOW, HAS A GLOBAL WARMING POTENTIAL (GWP) OF 21 and is therefore a much more potent greenhouse gas than carbon dioxide (GWP=1); therefore, it makes more business sense (for the businessmen among our readers) to invest in and generate carbon credits from this gas as the potential returns per equivalent unit of investment are that much greater.

Methane results from a number of areas of anthropogenic activities (e.g. agriculture, industrial processes, sanitation, municipal waste management and fossil fuel extraction & related processes) as well as from natural systems (e.g. decomposing matter under anaerobic conditions and human / animal gases). It is a gas that can, through various processes be avoided, captured or utilized (e.g. for energy generation, in industrial processes, and for compost), or can be 'de-carbonized' through flaring (reducing from a GWP of 21 to 1).

Three major global concerns will influence the volume of methane produced or can benefit from increased capture and utilization of this gas: population growth; rapid urbanization; and the associated problem of energy access. For instance, it has been projected that, between 2000 and 2020, methane emissions from rice production, livestock waste, and livestock ruminants (all from food production required to feed a growing population), are projected to increase by 22%, 24%, and 30%, respectively[1]. If captured and utilized, some of these wastes could help address the increasing need for more energy especially in the rural areas where the wastes are generated. The CDM and additional financial flows that is generates could help increase the capture and utilization of methane for energy generation.

THERE ARE ALREADY A NUMBER OF APPROVED, METHANE-RELATED, CDM METHODOLOGIES AND ASSOCIATED PROJECTS (especially coal mine or coal bed methane, landfills and agricultural waste utilization) that have been registered and CERs have already been issued from such projects. Methodologies can be found for small- (AMS) and large-scale projects (AM) and there are already three combined methodologies (ACM for wastewater, landfill & methane from coal mining) indicating that several similar projects in these categories have been put forward. In addition to the list of approved methodologies below there are a few that have since been superseded by combined ones (ACM) and a couple that have, as yet, had no project submitted using that approach.

- ACM1: Landfill gas project activities (148 projects);
- ACM8: Coal bed methane and coal mine methane capture and use for power (electrical or motive) and heat/or destruction by flaring (54 projects);
- ACM14: Avoided methane emissions from wastewater treatment (3 projects);
- AM9: Recovery and utilization of gas from oil wells that would otherwise be flared or vented (17 projects);
- AM23: Leak reduction from natural gas pipeline compressor or gate stations (1 project);
- AM37: Flare reduction and gas utilization at oil and gas processing facilities (6 projects);

- AM39: Methane emissions reduction from organic waste water and bioorganic solid waste using co-composting (21 projects);
- AM41: Mitigation of Methane Emissions in the Wood Carbonization Activity for Charcoal Production (1 project);
- AM43: Leak reduction from a natural gas distribution grid by replacing old cast iron pipes with polyethylene pipes (0 projects);
- AMS III/D: Methane recovery in animal manure managements systems (21 projects);
- AMS III/E: Avoidance of methane production from biomass decay through controlled combustion (59 projects);
- AMS III/F: Avoidance of methane production from biomass decay through composting (53 projects);
- AMS III/G: Landfill methane recovery (18 projects);
- AMS III/H: Methane recovery in wastewater treatment (87 projects);
- AMS III/I: Avoidance of methane production in wastewater treatment through replacement of anaerobic lagoons by aerobic systems (6 projects);
- AMS III/K: Avoidance of methane release from charcoal production by shifting from pit method to mechanized charcoaling process (2 projects);
- AMS III/O: Hydrogen production using methane extracted from biogas (1 project);
- AMS III/R: Methane recovery in agricultural activities at household/small farm level (1 project).

As can be seen from the list, there are a number of large-scale methodologies that capture methane from fossil fuel-related operations for energy generation; there are, in addition, a number of methodologies (not in this list) that, synergistically, encourage fuel switching from carbon intensive feedstock to natural gas as a lower carbon feedstock. Interestingly, these twin possibilities are encouraging hitherto Kyoto-hesitant countries (especially the oil and gas producing ones) to embrace the CDM as a means of diversifying their economies (most being heavily dependent upon oil revenues) and their energy infrastructure. Considering that there are several non-Annex I countries with significant volumes of natural gas that is flared, some of which have major energy supply problems, there are significant opportunities in methane capture and utilization (e.g. fuel switching) projects. Of note are the United Arab Emirates, Qatar (Gulf), Nigeria, Equatorial Guinea and the Congo (Africa).

THE ARTICLES SUBMITTED FOR THIS ISSUE of the Newsletter, however, deal with municipal solid waste and landfill gas (LFG) capture and utilization. It is hoped that a future issue can be put together covering some of the other methane-related topics. While it is clear from the above list that a significant number of LFG projects have been submitted, the articles all opt to examine issues that have caused problems with this project category. The first article (page 4) provides an overview and statistics of the problems and subsequent efforts to change the approach being taken by project developers. The next author (page 7) considers that LFG projects have been underperforming for a few reasons and that they are therefore not really the 'low hanging fruit' as initially perceived. The final author (page 9) takes a look at 'critical issues' that a project developer needs to consider when developing LFG projects. The articles give a lot of advice to would-be developers of LFG CDM projects and there are certainly a lot of opportunities left to tap into this market segment.

[1] *USEPA, 2006. Global Anthropogenic Emissions of Non-CO2 Greenhouse Gases 1990-2020, June 2006.*

Landfill Gas Recovery System Performance, by Charles Peterson, W. Nick Bowden and Abhishek Bhaskar, Carbon Finance Unit, World Bank

IN AN EFFORT TO MITIGATE GREENHOUSE GAS EMISSIONS under the Clean Development Mechanism (CDM), solid waste disposal sites have been looked upon as being relatively easier to develop than projects in other sectors. Furthermore, disposal sites are a common feature in urban areas that are now home to 50% of the world's population. Urban areas are widespread in developing countries. On a regional basis, urban areas account for a high 78% of the population of Latin America to a low of 29% in South Asia. Urbanization is growing at a rapid rate in all developing country regions. There are, as an example, about 400 cities / urban areas in developing countries with a population of a million or more. Each of these cities sends its waste to at least one local disposal site.

In a disposal site, aerobic organisms begin the process of decomposing organic biomass, such as food waste, but as the oxygen available in the waste mass is consumed, the decomposition process switches to anaerobic conditions. A by-product of anaerobic decomposition is methane, a greenhouse gas with 21 times the Global Warming Potential of carbon dioxide.

Waste placed in a disposal site tends to decompose in an anaerobic manner, as it is covered by additional waste. Use of daily cover (soil), mobile equipment (landfill compactors, bulldozers) to compact incoming waste and fill sequence that leads to shallow waste depth as well as high leachate levels and engineered design features of a site such as bottom liners and other environmental protection systems can affect the amount of oxygen that might be available to in-place waste. These factors also play a role in the quantity of air pulled into the waste mass in an active landfill gas (LFG) capture system, where the gas is withdrawn under a vacuum.

While a common feature of urban life, disposal sites are not all created equal ranging from open dumps to engineered landfills and the quantity of methane generated will increase accordingly. In addition to these factors, other variable operational factors and fires, which consume the organic biomass that leads to methane as it anaerobically decomposes, will diminish the potential of a site to generate LFG. These differences can significantly alter the quantity of methane generated by and/or available from a disposal site and thus the percentage of methane in the LFG that can be captured.

LFG is typically composed of methane (50%) and other gases, primarily carbon dioxide, and is the third largest global source of non-carbon dioxide anthropogenic greenhouse gas emissions. LFG contributes about 13% of global anthropogenic methane. The carbon dioxide fraction of LFG, which is derived from organic biomass, is classified as carbon neutral. The carbon dioxide by-product from the combustion of the methane in LFG, either flared or used for energy, is likewise considered to be carbon neutral.

Despite the wide spread of solid waste management via landfills/disposal sites in urban areas and LFG's significant contribution to greenhouse gas emissions, LFG projects have failed to deliver the emission reductions forecast in the Project Design Documents (PDDs) prepared for many of the projects registered under the CDM.

A question therefore arises whether this situation is a result of over-expectation (forecasting of greater potential emission reductions than can be delivered) or under-performance (inadequate engineering of the LFG capture and use systems).

SHORTFALL OF REPORTED EMISSION REDUCTIONS RELATIVE TO PROJECTIONS IN PDDS. Concern about reported shortfalls in delivery of emission reductions by LFG projects in the World Bank's (Bank) portfolio of CDM projects as well as those of other project developers in late 2006 led the Bank to investigate this situation. One action undertaken by was to commission a review that compared forecast and reported methane emissions from 14 registered CDM and Joint Implementation projects, thirteen of which '…were found to fall well short of PDD estimates.' (SCS, 2007).

The Bank has sought to address the situation on an on-going basis as well as raise awareness among developers and landfill owners about shortfalls in emission reductions from CDM LFG projects *inter alia* through: a one-day workshop with representatives of six LFG projects and several LFG experts in 2007 to discuss whether this shortfall in emission reductions was a result of excessive estimates at the PDD stage or inadequately engineered and/or operated LFG capture and combustion systems (World Bank, 2007); Bank-sponsored side events at Carbon Expo in 2007 and 2008; presentations by Bank staff, landfill / LFG system operators (Veolia Environmental Services) and Designated Operational Entities (DOEs) such TUV-SUD, SGS, and DNV (Peterson, 2007).

CDM LFG PROJECTS. As of mid-January 2009, there were 1,335 registered CDM projects, including 89 on LFG, or 6.7% of the total registered (table 1). The number of new registrations has been fairly consistent for the past three years (2006 to 2008) ranging from 24 to 29 per year. However, the forecast total annual emission reductions, as specified in the PDDs, peaked in 2006 at almost 7.99 million tons of carbon dioxide equivalents (tCO_2e).

By 2008, the forecast annual average emission reductions for new projects had declined to just over 2.89 million tCO2e, a decrease of about 5.10 million tCO_2e (63.8%) from the peak year (2006). More importantly the average annual average emission reduction forecast of all registered LFG projects decreased to less than 120,500 tCO_2e in 2008, the lowest annual average since CDM LFG projects were first registered.

Table 1: Registered CDM LFG Projects, Forecast Total and Average Emission Reductions, and Registered LFG CDM Projects with Performance Reports on an Annual Basis, 2004-2008

Registration Year	Registered LFG Projects	Forecast: Total Annual Average Emission Reductions for Registered LFG Projects * (tCO_2e)	Forecast: Average Annual Average Emission Reductions per Registered LFG Project (tCO_2e)	Registered LFG Projects with Performance Reports
2004	1	670,133	670,133	1
2005	10	2,198,346	219,835	7
2006	25	7,987,748	319,510	20
2007	29	7.172,475	247,327	15
2008	24	2,890,697	120,442	6
Total	89	20,919,309	235,048	49

* *Source: Projects PDDs.*

Performance reports (Verification / Certification Reports and/or Monitoring Reports), available (mid-January 2009) for 49 of the 89 registered CDM LFG projects for the period 2004 through 2008 (tables 1 and 2) indicate that there was a positive trend from 2005 to 2007 as the level of reported performance relative to forecast emissions reduction increased from 11.5% (2005) to 58.4% (2007) (table 2). This trend was reversed in 2008 as the performance of LFG projects registered in that year declined to 37.9%. Although the specific reasons for this decline have not been investigated, they may, in part, be due to start-up delays. Such delays have been observed in CDM LFG projects registered between 2004 and 2007.

Regardless of the reason for the reduction of LFG system performance for projects registered in 2008, the data shows that even with an improvement in the rate of emission reductions through 2007, the performance levels are still well below emission reduction rates forecast in the PDDs.

Table 2: Registered LFG Projects with Emission Reductions Performance Reports and a Comparison of Reported to Forecast Emission Reductions by Year of Project Registration, 2005-2008

Registration Year	Register LFG Projects with Monitoring Reports	Forecast Emission Reductions * (tCO_2e)	Reported Emission Reduction ** (tCO_2e)	Comparison of Reported to Forecast Emission Reductions (%)
2005	8	11,119,553	1,275,181	11.5%
2006	20	20,646,628	8,436,336	40.9%
2007	15	4,642,092	2,711,192	58.4%
2008	6	817,768	310,170	37.9%
TOTAL	49	37,226,041	12,732,879	34.2%

** Source: Project PDDs for relevant years for which Verification / Certification Reports and/or Monitoring Reports, as available from the CDM website. As an example, if the project was registered in 2005 and reported emission reduction data were available for 2005 through 2007, then only the forecast emission reduction data from 2005-2007 were included in the analysis. If the project was projected to begin operations in a given year (say 2006) but reporting data were available only for 2007, the forecast emission reductions for 2006-2007 were included in the analysis.*

*** Source: Project Verification / Certification Reports and/or Monitoring Reports, as available from the CDM website. Data for a portion of a year was adjusted for an entire year to assess performance of the LFG systems.*

One factor that points to over-expectation as a leading cause for the shortfall in the delivery of emission reductions in LFG projects is the high rates used in the modeling work done for the PDDs reviewed. As stated in the SCS report, the LFG potential (Lo) in developing countries should most likely be in the range of 60 to 85 cubic meters per megagram[1] (m^3/Mg). The Lo data used in the majority of registered LFG PDDs exceeds the range suggested by SCS. A positive trend is that the Lo used in PDDs has, on average, declined in every year since 2005 (table 3) decreasing by 70 m^3/Mg to 97 m^3/Mg. This level is still higher than the rate stated in the SCS report.

The relatively high decay constant (k value) is also an important contributor to the estimated emission reduction rates in the PDDs, especially for earlier projects that used a single k value. Projects developed since 2006 use the multi-material k values provided in the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories.

Another significant factor has been the high LFG capture rate used by many of the projects, although this has declined from 85% (2004) to an average of 60% (2007), with a slight increase to 62% in 2008. Although high capture rates (80+%) might be applicable to well-engineered and operated landfills, such rates are unsuitable for most disposal sites in developing countries where the 2007 and 2008 averages are more suitable. The Bank typically uses a conservative capture rate of 50% on new LFG projects.

Table 3: Average LFG Potential (Lo), Decay Constant, and LFG Capture Rate by Registration Year, 2004-2008

Registration Year	Registered LFG Projects with Performance Reports	Average: LFG Potential (Lo) Values (m^3/Mg	Average: Decay Constant (k)	Average: LFG Capture Rates
2004	1	164	0.10	85.%
2005	7	167	0.11	69 %
2006	20	129	0.10	73 %
2007	15	100	0.07	60 %
2008	6	97	0.13	62 %

CONCLUSIONS. Even though registered CDM LFG projects have had a track record of under-delivery, with a few exceptions, there has been an improvement in their annual average performance relative to the forecasts provided in the PDDs with the exception of 2008, which may be a result of start-up delays.

The previously overly-optimistic forecasts of LFG system operations were due to erroneous application of the factors (Lo, k value, gas capture rate) used to model performance estimates. The general trend is now towards applying more conservative data estimates that bring LFG system performance more in line with PDD forecasts. This reflects an increasing awareness of the excessive optimism of earlier LFG developments that may be attributable to the efforts of the Bank and others to inform developers and disposal site owners of this situation.

The Bank will continue its effort to increase awareness of LFG systems performance during a session on waste management that will be held during the 2009 Carbon Expo (Barcelona, Spain; May 27-29).

1 Megagram (Mg) is the proper International System of Units designation, but more commonly is referred to as a metric ton.

References
SCS Engineers. Comparison of Forecast and Reported Methane Recovery Rates at Selected Landfills in Developing Countries. World Bank, Carbon Finance Unit. Washington, DC. November 2007.
Landfill Gas Capture: Project Design vs. Actual Performance and the Future for CDM Projects. World Bank. Washington, DC. April 2007. http://go.worldbank.org/3EY0H9PNC0
*Peterson, Charles. Performance of Landfill Gas (LFG) Projects in Developing Countries. Carbon Expo Cologne Germany May 3, 2007.***http://wbcarbonfinance.org/Router.cfm?Page=DocLib&CatalogID=33620**

CDM Landfill Gas Projects – A piece of cake? Retrospective on four years of LFG Project Implementation in the Carbon Market, by Ina Ballik[1]

THE PUBLIC PERCEPTION OF LANDFILL GAS (LFG) PROJECTS in the Clean Development Mechanism (CDM) as financially attractive and easy to develop has branded them the "low-hanging fruit of the carbon markets"[2]. However, looking back on four years of implementing LFG projects (since Nova Gerar achieved registration in late 2004) these projects have proved to be more cumbersome than expected. A recent UNEP RISØ Centre analysis shows that the performance of LFG projects is only 39%, which places them in the lower range as one of the least performing project types in the CDM pipeline[3]. This suggests that the perception of LFG projects being "low-hanging fruit" should be revised. Some of the main reasons for under-delivery and consequent negative impacts will be identified in this article.

WHAT ARE THE REASONS FOR PROJECT UNDERPERFORMANCE?

Principle reasons for under-delivery of CERs from LFG projects in the CDM include: the inappropriate use of modelling techniques; mismatching technology for the developing country's project requirements; unfair business practices by some competitors in the CDM markets; and frequent changes in the CDM's rule framework (i.e. changes to methodologies and tools, Executive Board guidelines, validation and verification scopes and requirements, lack of precedence, etc.).

a) *Inappropriate application of gas models to estimate LFG generation*

The use of laboratory-confirmed gas models for the estimation of emission reduction potential from CDM LFG projects rarely accords with project reality in developing countries. Still, CDM projects in the LFG sector have based their ex-ante estimates of emission reductions on first order kinetic gas generation models. The use of these models, however, is inappropriate for two main reasons.

Firstly, kinetic gas generation models were built to conclude gas yields of landfills in developed countries that are operated under optimal conditions. The models are therefore not applicable in developing countries since sub-optimal conditions (e.g. methane migration due to missing sealing systems at the bottom of the landfills and slopes, missing leachate capturing systems, missing waste compaction, non-availability of historical waste data in terms of quantity and composition, unregulated pre-segregation of waste streams, missing design for expansions or accessibility of cells, insufficient capping or inappropriate capping material, etc.) cannot be factored in adequately.

Secondly, kinetic gas generation models apply mathematical modelling techniques to predict the long-term (> 25 years) outgassing behaviour of landfill sites, and using them for short-term predictions (e.g. until 2012 to estimate the commercial value for CDM LFG projects), yields a high error rate. The inappropriate use of these models may have led to overestimating LFG generation in many CDM projects.

b) Divergent waste disposal and management practices

LFG capture and destruction systems were designed to ensure high performance in landfills being operated according to best practices. However, since countries apply different waste management practices, certain technology designs from developed countries may be unsuitable for landfill operation practices in developing countries. When introducing LFG capturing and destruction systems, investors and technology providers encounter inappropriate management practices, such as disposal of waste in inadequate locations (like riverbeds, abandoned pits, canyons or upon irregular natural surfaces without appropriate compaction and sealing works), missing compaction of the tipped waste, waste spreading out over large and shallow areas without daily covering, and a lack of infrastructure inside waste disposal sites. Modifications or simplifications to gas capturing systems will hence often be necessary to meet project reality. In some cases, modifications cannot be made efficiently in the short timeline of CDM implementation and projects have to go ahead without them. Consequently, high quality gas capturing systems will be unable to perform optimally. In other cases, system designs need to be changed entirely, thereby triggering delays in the implementation cycle of the project activity. These delays lead to late project registrations, verifications and issuances and thus to less emission reductions than expected.

c) Overestimation in contracting phase

Regrettably, the emerging markets of the CDM attracted not only reputable technology providers and carbon aggregators following best business practices. Some market players may have overestimated the gas quality and quantity of a landfill site in order to obtain a contract and may have resorted to unfair tactics in project appraisal in order to secure project development rights. Projections with inflated emission reduction potential may have been made, thus overvaluing the attractiveness of the project and presenting a financially more attractive deal to the potential client in order to secure a gas rights contract. It is only later, during project development and implementation, that one discovers that initial projections do not yield according to expectations.

d) Continuous changes in the CDM

Project developers, as well as Designated Operational Entities (DOEs), struggle with the continuously changing CDM applicability. Methodologies have been added, withdrawn, consolidated and changed, and complementary tools and guidelines added and modified at a staggering speed (for instance ACM0001 released 3 new versions within 6 months!), which led to significant disorientation and uncertainty in the LFG sector. Due to these numerous changes, project developers are required to constantly revise assumptions and project designs; consequently the project suffers setbacks. At the same time, DOEs are becoming increasingly stringent in their assessments, given that they are liable for material misstatements. All in all, the uncertain framework of rules continues to cause postponement of timelines in project development and impairs project success through overly-strict interpretation of CDM rules.

NEGATIVE IMPACTS DUE TO UNDER-DELIVERY OF LFG PROJECTS

The persistent underperformance of LFG projects under the CDM has resulted in the abandonment of promising opportunities and hence an unused potential to reduce emissions that, in turn, impairs its potential to contribute to sustainable development.

a) Unused opportunities to reduce emissions

Some projects have not been able to keep up with the speed of the permanently changing CDM environment and hence have been abandoned since, for example, they ran out of funds for making necessary modifications to the project design. Since the resumption of once-abandoned CDM projects turns out to be particularly cumbersome, and therefore do not represent a realistic course of action to any reasonable project developer, emission reduction projects lie idle and continue emitting greenhouse gases. In these cases, the potential to recover and destroy LFG is not being exploited and the CDM still does not provide the incentives to realize full emission reduction potential.

b) Minimal increment of renewable energy sources

The fact that the aggregation of electricity recovery facilities in landfill sites are scarce, since gas yields have fallen under the expected estimations, is even more concerning. Moreover, most host countries are still lacking the necessary programmes and the legal framework for electricity generation from renewable resources. Electricity generation from renewables is rarely subsidized in the host countries. Most project developers cannot afford the costs to install this expensive equipment, which is compounded by the absence of a legal framework in this sector. This means that yet further potential to diversify the renewable energy sector and reduce emissions by displacement of more carbon-intensive fuels are unused.

c) Decrease in sustainable development

The CDM does not contribute to improving waste management practices in developing countries as much as it could. The majority of the waste deposit sites still employ poor waste management practices and many prospective CDM projects on such sites have failed. Hence, project developers tend to refrain from undertaking emission reduction projects in these sites as they require higher investments to ensure favourable gas yields; rather, in order to optimize their cost-benefit ratio, they are now more inclined to look for well-managed landfill sites, comparable to those in the developed world. Therefore, the goal of fostering sustainable development is not being achieved in this sector, since there are no comparable or generally applicable indicators of sustainable development against which to measure LFG projects, and the CDM has so far not provided proactive solutions in respect thereof. Host countries' waste sector remains almost unchanged in sites where improvement is most needed.

FINAL CONCLUSIONS

With continuing underperformance, the public perception of CDM LFG projects as low hanging fruit will soon change if it has not done so already. The continuing speed with which CDM applicability requirements are changed offers little predictability; therefore scepticism among investors and project developers against CDM itself will consequently increase and, in the worst case, the LFG sector will eventually stop growing even while potential landfill sites remain undeveloped.

It should be in the policy-makers' own interest to overcome such scepticism against CDM LFG projects in order to regain stability and credibility for this sector and to maximise the opportunity for developing countries to contribute to global GHG mitigation.

[1] *DISCLAIMER: This paper was prepared by Ina Ballik (EcoSecurities, Implementation Department). The observations and conclusions expressed in this paper are the author's private views and do not necessarily represent the view of EcoSecurities.*
[2] *"Landfill Gas Recovery: The low hanging fruit for carbon credits trading in the Developing Countries", Lee et al., Sep 2005*
[3] *UNEP RISØ Centre, Jørgen Fenhann, May 2008*

CDMability of MSW based Waste-to-Energy Projects in India, by *Hari Gadde, Clean Energy Advisor, Sinclair Knight Merz*

MANY WASTE MANAGEMENT PROJECTS in the developing world are eligible for carbon credits through better waste management practices. Municipal Solid Waste (MSW) management is one such project area with vast potential, but one of the least considered methods (in respect to its potential vs. implementation) of generating energy as well as earning carbon credits. Rapid industrialization and urbanization in India has put tremendous pressure on local governments to manage their waste disposal; this has been further aggravated by their poor financial health and lack of trained personnel as well as a lack of knowledge on efficient solid waste management techniques.

Projects that generate methane, a potent greenhouse gas with a global warming potential of 21, are considered to have the greatest potential to obtain carbon credits in developing countries like India. Notably, there are quite a few projects in India already claiming revenue through the Clean Development Mechanism (CDM) of the Kyoto Protocol. Recent success stories of project developers in India obtaining carbon revenue for their MSW-based waste to energy projects are expected to motivate many local governments, and other project developers who are exploring new avenues for additional revenue, in addition to solving waste disposal problems. This is also likely to encourage new entrants into the field. On the flip side, however, many NGOs, think tanks, and other stakeholder groups are raising environmental concerns due to the absence of stricter environmental regulations and the suitability of existing technologies to treat different waste characteristics. Considering the importance of a project's contribution to the sustainable development of the host country as part of the eligibility to claim carbon credits, the CDMability of MSW projects is now under scrutiny. Issues related to the stack emissions, waste handling and disposal practices, usage of unsustainable alternative fuels (for co-firing), obtaining the No-Objection Certificate (NOC) from local Government authorities, resistance from local stakeholders and data metering & monitoring practices are a few of the major factors that could impede the CDMability of these projects.

As of 27 July 2008, a total of 1,128 projects world-wide were registered as CDM projects and a total of 169 million credits have been issued. Out of the total number of registered CDM projects, 286 are from the waste handling/disposal sector. Out of this, 178 projects are related to biogas (mainly from animal waste and waste water treatment), 94 are methane recovery & utilisation with the remaining being methane avoidance projects. To date, two Indian MSW-based waste-to-energy projects are registered under the CDM.

These include:

Project No.	*Project Title*	*Methodology*	*Annual average emission reductions, $tCO2_e$*
0959	*SESL 6 MW Municipal Solid Waste based Power Project at Vijayawada & Guntur, Andhra Pradesh*	*AMS I.D & AMS III.E*	*64,599*
1254	*The TIMARPUR-OKHLA Waste Management Company Pvt Ltd's (TOWMCL) integrated waste to energy project in Delhi*	*AM0025*	*262,791*

Source: cdm.unfccc.int

Similar projects in Solapur (Maharashtra), Ghazipur (Delhi) and Bangalore (Karnataka) are at the validation stage awaiting approval to submit for registration.

CRITICAL ISSUES: Not all submitted CDM projects in the waste sector were registered or CERs issued without undergoing further 'review' by the Executive Board. Most of the waste- to-energy projects in India received adverse comments from global stakeholders on various issues during the comments period required under validation. Though all the waste-to-energy projects are, in essence, eligible to claim carbon credits, all must address issues related to the sustainability of the project, show correct application of the CDM methodologies and, in addition, must institute suitable metering and monitoring practices.

Based on review comments by the EB, DOE, and global stakeholders on Indian MSW based waste-to-energy projects, the following issues have been observed as critical for the successful registration and verification of emission reductions for these kinds of projects in India. Though these issues were identified based on experience drawn from Indian projects, they might well be useful for similar projects in other developing countries as well.

a) *Sustainability* issues are very critical to the success of any waste-to-energy project. Any such project is expected to increase the social, environmental, economic, and technological well-being of the host country and address the treatment technology adopted, location of the project, waste handling and disposal practices, pollution control measures, and type of supporting fuels used. Many global stakeholders expressed their concerns about toxic substances that are released during the combustion process. In addition, there are also concerns by the DOEs on the usage of unsustainable fuels such as mango wood or neem wood, which are sometimes used as supplementary fuels during the rainy season when high moisture levels in the waste make it difficult to efficiently burn in the combustion chamber.

b) *Metering and Monitoring* Improper data on waste composition and the amount of non-biomass materials (like plastic and rubber) in the waste stream poses a serious threat to the emission reduction claims by the project developer. Often, the DOEs cite this as a major reason for delaying the emission reductions verification. Project developers typically fail to provide this data due to improper and/or inadequate data monitoring practices. To a certain extent, it is understandable that varying waste characteristics make it difficult for a project developer to monitor the composition of the waste on a regular basis due to higher costs of monitoring. However, adhering to the monitoring frequency of parameters specified by the CDM methodology applied would streamline the verification process. The sampling frequency and the resultant waste composition data should reflect the composition of the waste coming from the region. In addition, project developers generally ignore monitoring of emissions from vehicles transporting waste, which account for a major part of the project emissions profile. Project developers should also monitor the amount of waste received, combusted, and disposed (including inert materials) on a regular basis to enable the verifier to cross check with the energy generation figures (using a mass and energy balance method).

c) *Regulatory Requirements* Obtaining the No-Objection Certificate (NOC) and having an up-to-date ‘consent for operation’ certificate from the appropriate local government authority is essential to prove that the project is meeting all the environmental regulations in the region. It is also critical to obtain the host country approval and permits for the project. The DOEs often complain that the non-availability of these documents delays the project approval. Monitoring key parameters and optimizing the plant operation with the best waste management practices will reduce the difficulty in meeting the local regulatory requirements most of the time.

d) *Methodology Selection* Project developers tend to use small-scale and inappropriate methodologies to avoid complex monitoring procedures and the comparative ease of proving additionality of the project. Improper choice or application of a methodology (e.g. using AMS III.E instead of AM0025) not only delays the project registration but also raises doubts on the project applicability.

e) *Additionality* It is a well-known fact that waste-to-energy projects would require higher initial investments and be economically unsustainable without subsidies from the government. In general, the electricity tariff for these projects will be set to provide the project developer with a positive cash flow and be based on various parameters such as the higher initial investment and the expected losses due to frequent operational problems. However, the operating costs are likely to increase beyond projected values if the wrong treatment technology is selected, there is poor plant design, and the waste is insufficiently segregated. These parameters dictate the plant operating hours and hence the revenue generation. Evaluating all of the options that could affect the project financials and providing necessary supporting documents will help the project developer to prove additionality of the project.

ESSENTIALS FOR A PROJECT DEVELOPER: To improve the CDMability of waste-to-energy projects and for successful registration and verification of emission reductions, project developers need to consider the following essential points:

- Ensure that the project meets all the sustainable development criteria of the host country. This can be achieved with proper selection and design of the treatment technology, adopting suitable pollution control measures, applying best waste handling and disposal practices, and usage of sustainable auxiliary renewable fuels (if allowed by the local regulatory authority);
- Adhere to the metering and monitoring practices specified by the local regulatory authorities and the applicable CDM methodology and maintain all records as per the standard QA/QC

procedures. Perform monitoring of the amount of waste received, combusted, and disposed along with the quantity of non-biomass materials combusted;

- Make sound judgements on various technical and operational barriers and valid assumptions in the financial analysis to prove the project's additionality;
- Ensure that the treatment plant meets local environmental regulations at all times in order to obtain up-to-date 'consent for operation' and no-objection certificates;
- Establish a CDM committee with plant operational staff forming a core team to monitor all the key parameters with the frequency prescribed by the CDM methodology.

IN CONCLUSION, OBTAINING CDM REVENUES for a waste-to-energy project is possible only by properly addressing the critical issues described above, particularly sustainability, metering and monitoring practices. Proper selection of the treatment technology and better waste management practices reduces the project's operational complexities and helps obtain carbon credits more easily. Ignoring any of the critical issues puts the CDMability of a project in jeopardy and, as a result, 'wasting' all efforts to make the project successful.

Bureau of Environmental Analysis (BEA International)

Dr. Patrick Karani
Mt. View # 121
Westlands off Waiyaki Way
P.O. Box 15953 Nairobi 00100
Kenya
Tel: +254(020)631174,(020)631433
Fax: +254(020)631421
Web: http://www.beainternational.org/
Contact info@beainternational.org

Climate Business Network (CBNet)

Dr. Peter Pembleton, Managing Editor
newsletter@climatebusiness.net
609 Lemery Place, Ayala Aabang Village,
Muntinlupa City, Metro Manila
Philippines
Tel: +63 (0)928 4363 945
Web: http://www.climatebusiness.net/
General queries info@climatebusiness.net

Contributors

Charles Peterson, (CPeterson@worldbank.org) Senior Environmental Specialist, Carbon Finance Unit, World Bank
W. Nick Bowden, (wbowden@worldbank.org) Consultant , Carbon Finance Unit, World Bank
Abhishek Bhaskar, (abhaskar@worldbank.org) Operations Analyst, Carbon Finance Unit, World Bank
Ina Ballik, (Ina.Ballik@ecosecurities.com) EcoSecurities,
Hari Gadde (HGadde@skm.co.nz, Clean Energy Advisor, Sinclair Knight Merz

Readers that are interested in presenting their experience or activities are requested to submit an outline to the editors (newsletter@climatebusiness.net); details on type of content and the publication schedule can be found on our Web site http://www.climatebusiness.net. Please note that articles should not exceed 2,000 words!