

RESEARCH BULLETIN

Greenhouse Gases in the Waste Management Industry

ABSTRACT: Greenhouse gases (GHG) generated by the waste management industry were examined both nationally and internationally to determine their relationship to global warming.

Recent and future changes to the Earth's climate are currently believed by many to be closely associated with changes in the composition of the atmosphere. Anthropogenic activities that generate greenhouse gases (GHG) are believed to have brought about or accelerated this change. Although uncertainty exists about how Earth's climate responds to these gases, global temperatures appear to be rising.

Action is now occurring at the governmental, organizational, and global levels to avoid, reduce, and better understand the risks associated with climate change. Although a very wide range of gases may potentially contribute to climate change, the GHG covered by the United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), and sulphur hexafluoride (SF₆).

The significance of each of these gases is a function of the extent of their emission by human activities and the global warming potential (GWP) of the GHG. Of particular importance for the municipal solid waste (MSW) industry are CH₄ and CO₂, which, since the beginning of the industrial revolution, have risen in their atmospheric concentrations (i.e., an increase of 30 percent for CO₂ and more than double for CH₄). Therefore, the Kyoto Protocol may apply to the following waste management activities: land disposal of solid waste, wastewater handling, waste collection and transportation, and waste incineration.

This research program established a statement of best practices for the waste management industry with regard to GHG emission reductions. The principal objectives of the research comprised a review of the following:

- Regulatory framework for GHG emissions and reductions, and the consequences of such for the waste management industry. This aspect established the need for planning for the implementation of the Kyoto Protocol in a number of countries and provided a summary of current and future regulations that will impact the waste management industry and identified their consequences. The conclusions of the regulatory framework study were as follows:
 - Within the European Union (EU), legislation is driving a decrease in the amount of waste sent for final disposal as well as providing incentives for the promotion of energy from waste under a framework of policies that promote renewable energy sources.
 - The implications for EU countries of the Landfill Directive, under which organic matter is diverted from final disposal, limits the amount of waste available for energy recovery, although the Directive promotes the use of bio-energy.
 - While specific domestic laws promoting energy recovery from waste do not exist in non-Annex I countries, a large scope for the application of energy-recovery technology exists based on considerations of the use of the project-based mechanisms.

- Within the U.S., prescriptive regulations driving investments in waste management related GHG mitigation are unlikely to be forthcoming from the current administration or its agencies. However, through EPA's investment in the voluntary Landfill Methane Outreach Program, the waste management industry should expect to see continued emphasis on projects using landfill CH₄ as a power source.
- Technical aspects that contribute to GHG emissions within the waste management industry. Modelling studies examined the effect that waste management strategies (recycling, waste-to-energy, composting, and landfilling) have on GHG emissions in two world regions (North America/Western Europe and Asia). The results of the analysis showed that the amount of combustion, recycling, composting, and landfill methane management all strongly influence the quantity of GHG emissions from municipal solid waste (MSW) management. The modeling showed:
 - For the North America region, the strategy yielding the greatest GHG reductions involved a high degree of waste-to-energy conversion (87%). The strategy, which led to the least cost per ton of GHG reduction, incorporated 20 percent recycling, energy recovery of landfill gas using an internal combustion engine, and the use of a biocover to improve waste oxidation. This strategy gave a GHG reduction of 95 percent.
 - For the Asia region, optimal GHG reductions could be achieved by increasing waste-to-energy use by between 60 and 90 percent. Only in the case of Taiwan was this also the minimum cost reduction option. For both Hong Kong and Singapore, the minimum cost scenarios both involved increasing recycling to 40 percent, although for Singapore this led to an increase in GHG emissions as compared to the existing situation. In Hong Kong, the minimum costs strategy lead to a 87 percent reduction on the existing situation
- Economic viewpoint that involved the review of the current international carbon credit market and how the market is evolving in several countries. This aspect also considered the financial opportunities, in a qualitative manner, and the opportunities for deriving additional value from landfill gas utilization projects in Central Europe by exploring country-specific policy developments in waste management, green energy markets, and GHG emissions management. Overall the results of this research showed that:
 - The fundamental decisions faced by a company with regard to climate change and GHG emissions reduction are, whether to reduce emissions or not, based on an evaluation of the economic feasibility. There are currently numerous incentives for companies to adopt voluntary programs. This requires identification of activities where GHG reductions may be feasible and the development of a systematic optimization process in which the quantified objective of emissions reduction would match the maximum level of financial profitability. In the case of the waste management industry, the greatest opportunities were associated with emissions reduction of CH₄ from landfilling activities.
 - Many waste management companies are in ideal positions to take advantage of the flexibility mechanisms of the Kyoto Protocol, while additional work is required to obtain information on the emissions baseline so that external marginal costs may be calculated with improved accuracy. For companies, which are both multi-sector and trans-national, one of the most efficient mechanisms may be internal emission trading.

Copies of this research report are available on CD by contacting Sarah Stancliff at 703/299-5139 extension 10 for a cost of \$15.00

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