Transforming municipal solid waste into a net carbon reducer

While municipal solid waste contributes relatively little to climate change, namely 3-5% of anthropogenic greenhouse gases (GHG) emissions, the waste management sector offers immediate, cost-effective and fast-acting opportunities to achieve substantial cuts in global GHG emissions. The private sector is actively participating in this trend by utilising funding and other opportunities, under notably the Clean Development Mechanism of Kyoto Protocol.

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The waste industry is positioned as a potential reducer of GHG emissions to mitigate the causes of climate change and advance towards more sustainable development (Scheinberg, A., Wilson, D., Rodic-Wiersma, L., 2010). Waste management contributes relatively little to climate change, namely 3-5% of anthropogenic GHG emissions, predominantly from the methane emissions of landfill sites and dumps. However, the waste management sector offers immediate, cost-effective and fast-acting opportunities to achieve substantial cuts in global GHG emissions. Using existing technologies that can be deployed in virtually all regions and cities, waste management can be transformed into a net carbon reducer. A number of developing countries have instituted and are implementing policies to enhance waste management practices in order to reduce their GHG impact, and the private sector is actively involved in these processes. It has notably engaged in the funding opportunities under the Clean Development Mechanism (CDM) and is examining options under the Nationally Appropriate Mitigation Action (NAMA) framework.

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[1] *This article is based on the ISWA publication, White Paper on Waste and Climate Change (ISWA, 2009).*

TECHNOLOGIES FOR SAVING GHG EMISSIONS

The contribution of GHG emissions from waste-related activities varies from country to country according to their dependence on specific waste treatment technologies. For developing economies, the greatest impact of GHG emissions in the sector stems from the methane and carbon dioxide from the predominantly organic component of their dumped waste. The organic component of municipal waste generated in developing countries is greater than in developed economies, comprising well over 50% in these countries compared with less than 30% in developed countries. Incineration and most other methods of energy recovery from waste appear inappropriate in these countries, as the moisture fraction of the waste is too great to make it autothermal (ISWA, 2011). Furthermore, local repair and maintenance operators are absent, and there are several examples of abandoned incineration plants in Asia, Africa and South America. In that context, biological treatment, composting in particular, can help recover and transform organic waste into soil conditioners and fertilisers. These processes reduce GHG emissions by sequestering biogenic carbon in the soil, improving its physical properties, adding nutrients, and reducing the need for pesticides. This appears to be a more practical solution than the more advanced technologies such as incineration. Moreover, the meth-

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FOCUS

ISWA is a global NGO representing national professional associations, companies, organisations, academics and researchers specialising in the management of waste and resources. Based in Vienna, ISWA has ten working groups, one of which is dedicated to the relationship between waste management and climate change. ISWA has been actively involved in the most recent United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties (CoP) meetings in Copenhagen, Cancun and Durban.

ane (not the carbon dioxide) produced can be captured to produce electricity.

Engineered landfill, rather than open dumping, can also contribute to GHG mitigation. Landfilling refers to disposal sites where waste is placed in lined sections, where it degrades while producing CO_2 and methane. Landfill processes can be controlled in order to stimulate a biogas reactor. The main output of a modern landfill system is electricity production from the combustion of biogas, with an average energy efficiency of 35%. Engineered landfills enable the control of fugitive emissions. Another pretreatment option for landfills is Mechanical Biological Treatment, a means of diverting and stabilising biodegradable waste before landfilling. Another alternative is producing high-calorie fuels through subsequent thermal processing, for example, in cement kilns.

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However, the greatest savings in GHG emissions are associated with the recovery and reprocessing of recyclable wastes, provided that these materials can be reclaimed and reutilised. This is due mainly to the large environmental savings that accrue from substituting secondary raw materials for those produced from primary extractive sources. Recycling reduces the amount of waste that must be disposed, and provides substitutes for the use of raw materials in product manufacturing. For many industries, using recycled materials avoids the need for extraction, transportation to the production site, and the energy used in producing new products from virgin materials.

Opportunities and pitfalls of the CDM

The CDM[2], introduced under the Kyoto protocol, has provided an opportunity for the waste sectors in developing countries to generate revenue from the sale of carbon credits, thereby making significant advances towards reducing GHG emissions. However, owing to a number of barriers in the early stages of developing the CDM, the available possibilities have remained in many ways unexploited. As a result, the adoption of more resource-efficient and GHG-reducing waste management practices in developing and transitioning economies were slower than desired by ISWA and other international organisations.

Waste-related projects account for approximately 18% of all CDM projects. The former include solid waste projects (landfill gas recovery, composting and incineration) as well as methane-avoidance technologies (composting, anaerobic and aerobic treatment) for waste water, agricultural and forestry waste. Since the inception of the CDM, over 200 municipal solid waste (MSW) projects have been registered worldwide. Nearly 90% of registered solid waste projects involve landfill gas flaring and recovery. One of the most ambitious schemes is the landfill gas-to-energy scheme in Bogota, Colombia. The landfill site accepts 6,000 tons per day of waste, and is now engineered to trap landfill gas and utilise the methane to produce electricity for up to 70 neighbouring brick kilns, replacing the fossil fuels currently used. But many of the landfill-related CDM projects are less ambitious, offering controlled flaring rather than the utilisation of energy potential.

Only a limited number of large-scale projects have been registered that involve advanced MSW treatment technologies such as large-scale composting, gasification, anaerobic digestion, refuse-derived fuel processing, and thermal treatment without incineration (Box 1). CDM projects in the waste management sector have been unevenly distributed and have generally not yet benefited the least developed countries. However, there is significant and unrealised potential for additional CDM projects, in terms of ▸▸▸

BOX 1: A SUCCESSFUL COMPOST CDM PROJECT IN BANGLADESH

One of the earliest and best examples of a non-landfill CDM project is in Dhaka, the capital city of Bangladesh. Dhaka is the 11th largest megacity in the world, and generated 13,300 tonnes of waste per day in 2005. This figure has subsequently doubled. Anything not salvaged by the informal sector is deposited in open dumps. Therefore, most of the waste is organic.

In 2003, World Wide Recycling BV, a private company based in the Netherlands, was approached by Waste Concern, an NGO based in Bangladesh, to start a large-scale composting project. This project obtained UNFCCC approval for its CDM submission in September 2005. The project includes the design, construction and operation of a composting plant for the processing of organic waste from Dhaka City. The plant, which took 18 months to set up, costs €12 million and was opened in November 2008. It employs 800 staff drawn from the poorest areas in Dhaka. Seven hundred tonnes per day of selected organic waste from markets in Dhaka are processed to produce compost in the new joint-venture compost plant.

The compost allows a reduction in the use of chemical fertiliser by 25-50% and increases crop yields by up to 30%. In March 2009, the compost as a fertiliser was approved by the national fertiliser committee. The entire project is effectively funded through the 89,000 tonnes of CO_2 of carbon credits owned jointly by the project partners. (Sudhakar, Y., 2012)

[2] *The CDM enables countries, or entities within countries that have agreed to GHG emission reductions under the Protocol, to invest in emission-reduction projects in developing countries and to use the associated emission-reduction credits towards achieving their own targets, as a supplement to their domestic GHG reduction actions.*

▶▶▶ technological solutions and host-country coverage.
Although significant progress has been made on the CDM since its inception, improvements in the approval process could lead to a much greater number and better geographical distribution of implemented emission-reduction projects. One of the demands of ISWA is to improve the operation of the CDM, assuming that this mechanism is still in place beyond 2015. The system needs to be streamlined though, and the bureaucracy reduced. To extend the range of projects currently being supported by CDM credits, especially recycling projects, GHG emission measurement methods also need to be improved. Current methodologies form a valuable basis for the assessment of GHG emissions from waste activities; however, improvements are required to adequately cover the full life cycle of materials and energy. CDM methodologies should cover a broader range of GHG emission reduction or avoidance benefits in activities such as recycling and composting. The accurate measurement and quantification of GHG emissions is vital in order to set and monitor realistic reduction targets at all levels. Given the number of players from collection to reprocessing, another issue is the property rights to the Certified Emission Reduction (CER) credits, which are more complicated than for other sectors.

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From the CDM to NAMAs

Initially set out in the Bali Action Plan in 2007, NAMA offers new mechanisms to support waste-management-enhancing initiatives in developing countries (Box 2). The substantial, short-term potential for GHG reduction inherent in the waste management sector makes it an essential, front-running element for the development of NAMA and the support of the Green Climate Fund (GCF)[3]. Of the 47 NAMA submissions generated by September 2011, approximately one third included waste-related actions.
NAMAs tend to focus more on the development of policies or strategies than on specific projects, such as those in the CDM. The purpose of NAMA is to provide support to sectors that provide long-term or indirect emission reductions, initiatives that address underlying barriers to mitigation measures, and actions that cannot easily be valued in tonnes of CO_2 equivalent. This is a very valuable approach to waste management as it complements the CDM.
The NAMA system has yet to be formally agreed upon by UNFCCC. At present, therefore, the precise manners in which national governments and the private sector can realise benefits from this mechanism have yet to be set down. However, it is widely anticipated that national governments in developing countries that have sound proposals for the enhancement of their waste management practices set out within a NAMA, either as a standalone proposal or incorporated within a suite of GHG emission-reduction targets, will benefit from the provision of funding through the GCF.
The relationship between waste management and climate change has been recognised by the World Bank (Hoornweg, D., Bhada-Tata, P., 2012). This report acknowledged that waste management was a challenge comparable to climate change. This should help secure greater funding for international agencies and allow access to improved financial mechanisms for waste management improvement in developing countries after the Kyoto Protocol comes to an end in December 2012. •

[3] Launched in 2011, the Green Climate Fund (GCF) was founded within the framework of the UNFCCC as a mechanism to transfer funds from the developed countries to the developing world to assist developing countries with adaptation and mitigation practices for combating climate change. It is governed by a board of 24 members.

BOX 2: SUPPORT FOR DEVELOPING COUNTRIES THROUGH NAMA

The term NAMA was first used in the Bali Action Plan in 2007, and was later formalised in the Copenhagen Agreement and Cancun Agreements. It refers to a set of policies and actions undertaken, on a voluntary basis, by developing countries to reduce GHG emissions and to mitigate climate change. The term 'nationally appropriate' implies that NAMAs are country-driven. Where no clear definition exists at the international level, a distinction has been made between unilateral NAMAs, which rely on domestic resources, and supported NAMAs, which require international financial support. NAMAs give developing countries the opportunity to access international finance, technology and capacity-building support for their policies and programmes promoting GHG reductions.
NAMAs include different types of action: data-gathering, research and development; strategy development at a national/regional and sector level; implementation and enforcement of regulations; capacity and institution building; provision of financial incentives; awareness raising campaigns; and technology penetration programs, technology demonstration projects, and other projects.

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