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FROM EDITOR'S DESK

ENVIS-NSWAI has been involved in various aspects of Urban Solid Waste Management in India ever since its inception. One of the important activities is to disseminate the information in the form of newsletter.

*This 10th issue of the newsletter contains abstracts of original articles on Green House Gases (GHGs) relating to Waste Management presented by experts all over the world in the scientific *Waste Management & Research Journal Vol. 26 Issue.1 of February, 2008, published by International Solid Waste Association (ISWA)*

The United Kingdom's Department for Environment, Food and Rural affairs (Defra) estimates that 1 tone of biodegradable waste can generate approximately 200-400 m^3 of landfill gas. In the developing world the GHG contribution from Solid Waste is from the open dumps. Organic matter in the anaerobic environment produce Methane (CH_4) gas. The Clean Development Mechanism (CDM) of the Kyoto protocol foresees a mechanism for industrialized nations to meet their GHG emission-saving targets by generating Certified Emission Reductions (CER) in the developing countries, thereby implementing projects going beyond business. In addition to promoting more sustainable practices in developing nations, these projects will help in improving sanitation and land fill practices in future. The success of these efforts will involve the commitment and expertise of Solid Waste managers and researchers around the world.

**Available to ISWA members. Visit www.iswa.org*

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i) Role of waste management with regard to climate protection: a case study

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According to Kyoto Protocol and the burden sharing agreement of the European Union, Austria is required to cut the Green House Gas (GHG) emission during the years 2008 to 2012 in order to achieve an average reduction of 13%, based on the level of emissions for the year 1990. The present contribution gives an overview of the history of GHG emission regulation in Austria and identifies the progress made towards the realization of the national climate strategy to attain the GHG emission targets. The contribution uses Austria as an example of the way in which proper waste management can help to reduce GHG emissions. The GHG inventories show that everything must be done to minimize the carbon input due to waste deposition at landfill sites. The incineration of the waste is particularly helpful in reducing GHG emissions. The waste-to-energy by incineration plants and recovery of energy yield an ecologically proper treatment of waste using state-of-the-art techniques of very high standard. The potential of GHG reduction of conventional waste treatment technologies has been estimated by the authors. A growing number of waste incinerators and intensified co-incineration of waste in Austrian industry will both help to reduce national GHG emission substantially. By increasing the number and capacity of plants for thermal treatment of waste the contribution of the proper waste management to the national target for the reduction of GHG emissions will be in the range of 8 to 14%. The GHG inventories also indicate that the potential CO_2 reduction of about 5, 00,000 t/year is achievable by co-incineration of the waste in Austrian industry.

ii) Mitigation of global greenhouse gas emissions from waste: conclusion and strategies from the Intergovernmental Panel on Climate Change (IPCC) fourth assessment report. Working group III (Mitigation)

Jean Bogner (USA), Riitta Pipatti (Finland), Seiji Hashimoto (Japan), Cristobal Diaz (Cuba), Katarina Mareckova (Slovakia), Luis Diaz (USA), Peter Kjeldsen (Denmark), Suvi Monni (Finland), Andre Faaij (The Netherlands), Qingxian Gao (China), Tianzhu Zhang (China), Mohammed Abdelrafie Ahmed (Sudan), R.T.M. Sutamihardja (Indonesia), Robert Gregory (UK)

Intergovernmental Panel on Climate Change (IPCC): Working Group III (Mitigation)

Green House Gas (GHG) emissions from the post-consumer waste and waste water are small contributor (about 3%) to total global anthropogenic GHG emission. Emissions for 2004-2005 totalled 1.4 Gt CO_2-eq/year relative to total emissions from all the sectors of 49 Gt CO_2 eq/year [including carbon dioxide, methane, nitrous oxide F-gases normalized according to their 100-year Global Warming Potentials (GWP)]. The methane from the landfills and the waste water collectively accounted for about 90% of waste sector emission or about 18% of global anthropogenic methane emission (which were about 14% of global total in 2004). Waste water N_2O and CO_2 from the incineration of waste containing fossil carbon (plastics; synthetic textiles) are minor sources. Due to wide range of mature technologies that can mitigate GHG emission from the waste and provide public health, environmental protection and sustainable development co-benefits, existing waste management practices can provide effective mitigation of GHG emission from this sector. Current mitigation technologies include landfill gas recovery, improved landfill practices and engineered waste water management. In addition significant GHG generation is avoided through controlled composting state-of-the-art incineration and expanded sanitation coverage. Reduced waste generation and the exploitation of energy from waste (landfill gas, incineration, anaerobic digester biogas) produce an indirect reduction of GHG emissions through the conservation of raw material, improved energy and resource efficiency and fossil fuel avoidance. Flexible strategies and financial incentives can expand waste management options to achieve GHG mitigation goals; local technology decisions are influenced by a variety of factors such as waste quantity and characteristics, cost and financing issues, infrastructure requirement including land area, collection and transport regularity and constraints. Existing studies on mitigation potential and cost for the waste sector tend to focus on landfill methane as baseline. The commercial recovery of landfill methane as source of renewable energy has been practiced at full scale since 1975 and currently exceeds 105 Mt CO_2 eq/year. Although landfill methane emissions from the developed countries have been largely stabilized; emissions from the developing countries are increasing as more controlled (anaerobic) land filling practices are implemented; these emission could be reduced by accelerating the introduction of engineered gas recovery increasing the rates of waste minimization and recycling, and implementing alternative waste management strategies provided they are affordable, effective and sustainable. Aided by Kyoto mechanism such as Clean Development Mechanism (CDM) and Joint Implementation (JI), the total global economic mitigation potential for reducing waste sector emission in 2030 is estimated to be >1000 Mt CO_2 eq (or 70 % of estimated emissions) at cost below 100 US$ /t CO_2-eq/year. An estimated 20-30% of the projected emissions for 2030 can be reduced at negative cost and 30-50% at cost < 20US$/t CO_2-eq/year. As the landfill produced methane for several decades, incineration and composting are complimentary mitigation measures to landfill recovery in short-to medium-term-at the present time, there are >130 Mt waste/year incinerated at more than 600 plants. Current uncertainties with respect to emissions and mitigation potential could be reduced by more consistent national definitions, coordinated international data collection, standardized data analysis, field validation of models and consistent applications of life-cycle assessment tools inclusive of fossil fuel offsets.

iii) Biotic systems to mitigate landfill methane emissions

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Landfill gases produced during biological degradation of buried organic wastes include methane, which when released to the atmosphere can contribute to the global climate change. Increasing the use of gas collection system has reduced the risk of escaping methane emission entering the atmosphere but gas capture is not 100% efficient, and further, there are still many instances when gas collection system are not used. Biotic methane mitigation system exploits the propensity of some naturally occurring bacteria to oxidise methane. By providing optimum condition for microbial habitation and efficiently routing landfill gases to where they are cultivated a number of bio-based systems such as interim or long term bio-covers passively or actively vented biofilters, biowindows and daily used biotarps have been developed that can alone or with other gas collection mitigate land fill methane emission. The paper reviews the science that guides bio based designs; summarizes experiences with diverse natural or engineered substrates used in such systems describes some of the studies and field trial being used to evaluate them and discuss how they can be used for better landfill operation, capping and aftercare.

iv) Greenhouse gas emissions from composting and mechanical biological treatment

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In order to carry out life cycle assessment as basis for far reaching decision about environmentally sustainable waste treatment, it is important that the input data be reliable and sound. A comparison of the potential Green House Gas (GHG) emission associated with each solid waste treatment option is essential. The paper addresses GHG emission from controlled composting processes. Some important methodological prerequisites for proper measurement and data interpretation are described and a common scale and dimension of emission data are proposed so that the data from the different studies can be compared. A range of emission factors associated with home composting, open windrow composting, encapsulated composting system with waste air treatment and mechanical biological waste treatment (MBT) are presented from our own investigation as well as from our literature. The composition of the source material along with process management issues such as aeration, mechanical agitation, moisture control and temperature regime are the most important factor controlling methane, nitrous oxide and ammoniac emission. If the ammoniac is not stripped during the initial rotting phase or by acid scrubber systems biofilteration of waste air provides only limited GHG mitigation since additional nitrous oxide may be synthesized during oxidation of ammonia and only a small amount of methane degradation occurs in the biofilters. It is estimated that composting contributes very little to national GHG inventories generating only 0.01-0.06% of global emissions. This analysis does not include the emissions from preceding or post treatment activities (such as collection, transportation, energy consumption during processing and land spreading) so that for a full emissions account, emission from these activities would need to be added to an analysis. ■

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v) The potential role of compost in reducing green house gases

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The contribution of the agricultural sector to emissions of climate change gases is becoming better understood. At the same time, the potential of the role of the sector as means through which to tackle climate change, widely neglected in past, is becoming more widely acknowledged. The absorption potential of agricultural soil could contribute significantly to constraining growth in green house gas emission while also contributing to improvement in soil quality in some areas. In addition to measures listed above, other benefit of compost application may have some relevance. Some of these measure includes replacement of chemical fertilizers (implying avoidance of Green House Gases related to their production), reduced used of pesticides (avoiding emissions associated with their production), improved tilth and workability (less consumption of fuels). Typically life cycled analysis (LCAs) exhibit limitation related to assessing the effect of 'time-limited' carbon sequestration in soils. This has ended to obscure the potentially important effect of composting in which biogenic carbon is held in soil for a period of time before the carbon is released. The paper seeks to understand these effects and offer comment on contribution of biological treatment to tackling climate change issues. Key issues include the replacement of fertilizers reduction of nitrous oxide emission, and peat replacement. ■

vi) Energy efficiency in waste to energy and its relevance with regard to climate control

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The article focuses on systematically highlighting ways to optimize waste-to-energy plants in terms of their energy efficiency as an indicator of the positive effect with regard to climate control. Potential for increasing energy efficiency are identified and grouped into categories. The mentioned are illustrated by real world example. As an example, district cooling as means for increasing energy efficiency in a district heating network of Vienna is described. Furthermore a scenarios analysis shows the relevance of energy efficiency in waste management scenarios based on thermal treatment of waste with regard to climate control. The description is based on model that comprises all relevant process from the collection and transportation up to thermal treatment of waste. The model has been applied for household like commercial waste. The alternatives compared are combined heat and power incinerator, which is being introduced in many places as an industrial utility boiler or in metropolitan areas where there is demand for district heating and a classical municipal solid waste incinerator producing solely electrical power. For comparative purposes a direct land filling scenario has been included in the scenario analysis. It shown that the energy efficiency of thermal treatment facilities is crucial to the quantity of green house gases emitted.

vii) Methods for determining the biomass content of waste

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As carbon dioxide emission trading in Europe has been established it is for essential importance to distinguish between biogenic and fossil emissions. Emissions resulting from biofuels and biogenous fraction are categorized as climate-neutral. Determination of plants using only fossil or bio-fuels is simple but categorization becomes more difficult for plant using mix of fossil and biofuel such as solid recovered fuels. In the meantime, different methods for solving this problem have been developed. Using different approaches and technologies, all of these methods have the same goal: determining the biogas content (biogenic fraction), for example, in solid recovered fuels or in the off gas of the mono or co-incineration plant in order to calculate the biogenic carbon dioxide emissions. In the article the most common methods for determining the biogenic fraction of fuels, namely the selective dissolution method, the Balance method and the C-method are explained in detail.

viii) Hazardous waste incineration in context with carbon dioxide

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The Kyoto Protocol of 1997 demands an emission reduction of climate-affecting gases in various industrial sectors. In this context carbon dioxide is one of the relevant gases and waste management is one of the relevant sectors. Referring to the situation in Europe, waste incineration is one of the major sources of carbon dioxide in waste management sector. The Kyoto Protocol however only covers carbon dioxide emissions originating from fossil fuels, whereas the incineration of renewable materials, e.g. wood is considered to be climate neutral since it does not make any net contribution to the carbon dioxide inventory of the atmosphere. Unlike the situation with municipal waste there is little if any information on the carbon dioxide emission caused by incineration of hazardous waste in specialized plants and the renewable fraction in these materials. The paper focuses on this gap of knowledge. Taking the full scale hazardous waste incineration plants in Biebesheim, Germany, as an example a carbon balance was set up for the whole plant taking into account all other material flows. Afterwards the determination of the proportion of the renewable materials in the hazardous waste incinerated by means of the radiocarbon method is reported. On the basis of the result, optimization potentials are discussed.

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ix) Environmental assessment of waste incineration in a life-cycle-perspective (EASEWASTE)

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A model for life cycle assessment of waste incinerators is described and applied to a case study for illustrative purposes. As life cycle thinking becomes more integrated into waste management, quantitative tools for assessing waste management technologies are needed. The presented model is a module in the life cycle assessment model EWASTE. The module accounts for all uses of materials and energy and credits the incinerator for electricity and heat recovered. The energy recovered is defined by the user as a percentage of the energy produced, calculated on the low heating value of the wet waste incinerated. Emissions are either process specific (related to the amount waste incinerated) or input specific (related to the composition of waste incinerated), while mass transfer to solid outputs are governed by transfer coefficient specified by the user. The waste input is defined by 48 material fractions and their chemical composition. The model was use to quantify the environmental performance of the incineration plant in Aarhus, Denmark before and after its upgrading in terms of improved flue gas cleaning and energy recovery. It demonstrated its usefulness in identifying the various processes and substance that contributed to the environmental loadings as well as to environmental savings. The model was instrumental in demonstrating the importance of the energy recovery system not only for electricity but also heat from the incinerator.

x) Clean Development Mechanism: an incentive for waste management projects?

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The Clean Development Mechanism (CDM) was introduced by the Kyoto protocol to provide the financial investment to establish project activities in developing countries for reducing green house gas emission while also fostering sustainable development. The article shows that waste management project activities play an important role in achieving the aims of the CDM. It describes how these activities have to prove additionally, how the emission reduction must be calculated and monitored in order to be eligible and in order to lead to Certified Emission Reductions (CERs). The article further provides an analysis about the various challenges that are involved in applying the CDM scheme to waste management project activities, which require a new specific set of technical skills and regulatory standards.

xi) Exploring the Clean Development Mechanism: Malaysian case study

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During 2006 the CDM market in Malaysia became established and by December 2007 a total of 20 Malaysian projects had registered with CDM Executive Board. The Kyoto Protocol defines the Annex 1 countries, as the countries that are obliged to reduce their Green House Gases (GHG) emission and the Clean Development Mechanism (CDM) allows Annex 1 countries to develop project which contributes to emission reduction, in non Annex 1 (developing) countries. Currently two projects have been corrected due to the request for review and there is one project for which the review is requested. Two projects have been rejected by the Executive Board. The broad knowledge of CDM in Malaysia and the number of successful projects are partly due to well functioning CDM institutional frame work in Malaysia. As an illustration, the article focuses on Malaysian-Danish projects and describe the implementation of CDM in Malaysia and refer to this specific project. The project was registered with the CDM Executive Board in May 2007 and is a methane avoidance project in which methane is captured from a landfill and used to generate electricity.

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16th Annual North American Waste-to-Energy Conference
19-05-2008
Philadelphia, Pennsylvania
Web: http://nawtec.org/

World Bio-energy 2008
27-05-2008
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Waste Management 2008
02-06-2008
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13th Annual Landfill Symposium and the Planning & Management Conference
09-06-2008
Palm Springs, California, USA
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Global Waste Management Symposium
07-09-2008
Colorado, USA
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Cologne, Germany
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