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Organic Waste in Asia: 3Rs Tackle Climate Change



Organic fractions are the largest component of municipal solid waste in Asia's developing nations, accounting for on average 63% of total waste.

Janya Sang-Arunn explains how a number of initiatives in cities across the region have implemented the 3Rs to tackle the problem, and turn the waste into a valuable product.

The quantity of organic waste has increased with the urbanisation of developing Asia. For instance, the urban population of China in 2000 was approximately 36% of the total population and increased to 43% in 2005. Accordingly, the China Urban Construction Statistical Yearbook recorded that the quantity of municipal solid waste collected in 2000 was approximately 118 million tonnes and increased to 156 million tonnes in 2005. The waste in China consists of around 50% food waste and 15% paper, so assuming that waste composition remained constant, organic waste in China was estimated to have increased by 31% over this five-year period.

Methane emissions from municipal solid waste treatment in Asia have increased substantially. The Vietnamese Government, for example, reported to the United Nations Framework Convention on Climate Change that greenhouse gas (GHG) emissions from solid waste treatment increased fourfold between 1994 and 2000, and the sector's contribution to the total national GHG emissions increased from 0.9% in 1994 to 3.7% in 2000. Current GHG emissions from solid waste treatment could be much higher, not only because of an increase in waste generation but also due to an increase in the rate of waste collection and in the expanding use of landfill disposal.

The experiences of using landfill gas recovery systems in the region however, are not very encouraging. For instance, a Clean Development Mechanism (CDM) project on landfill gas recovery for electricity generation in Wuxi, China, was estimated to provide an 18% methane emission reduction from 2005-2008, but the methane emission reduction achieved was only 12% of the baseline emissions, and the electricity generation only reached 60% of the target output.

The region faces difficulties in managing waste in an environmentally sound manner due largely to budget and personnel constraints. Current priorities of many municipalities are to increase the coverage of waste collection services, to construct new disposal sites and to improve existing disposal sites towards engineered landfills. Most landfills, including those constructed recently, do not have gas collection systems. The percentage of organic waste recovery in most countries is low and from a climate perspective, these trends are worrying.

The 3Rs and climate change

The 3Rs (reduce, reuse, recycle) is an approach to sustainable waste management based on a philosophy of cascading where the full resource value of materials is utilised. The 3Rs can substantially decrease the amount of waste to be disposed of and thereby reduce greenhouse gas emissions both from the waste sector and from other sectors.

Generally speaking, while organic waste generation can be reduced, it cannot be completely eliminated. Reuse of organic wastes (e.g. the use of food waste as animal feed) directly contributes to avoided GHG emissions from the reduced need for production. Recycling of organic waste (e.g. composting and anaerobic digestion) can reduce net GHG emissions, but its efficiency depends on the technology and operating conditions.

Legislation and national policies

Developing Asia has no comparable regulation to Europe's landfill directive (99/31/EC) that requires diversion or pre-treatment of biodegradable waste. Landfill of organic waste is still regarded as an appropriate treatment method, due partly to the potential revenue from the CDM and lack of waste separation.



A picker in a composting plant. Also, small scale AD is a promising technology for the region

Nevertheless, the legislation and policies in Asia are gradually shifting towards resource efficiency and the 3Rs. In the Philippines, the RA9003 Act (2000) emphasises recycling and composting of municipal solid waste. Likewise, in Malaysia, the Solid Waste and Public Cleansing Management Corporation Bill (2007) promotes the 3Rs for solid waste management, while Thailand has drafted the Law for Promotion of Waste Reduction and Utilisation, which aims to achieve sustainable development through a recycling society.

China, India, Indonesia, Thailand and the Philippines have stated explicitly in their national action plans for climate change that they intend to promote the 3Rs. Recently, several countries have developed national strategies on the 3Rs (Bangladesh, Cambodia, Indonesia, Malaysia, the Philippines, Thailand, and Vietnam) and some of these countries have ambitious plans to expand composting and anaerobic digestion (AD).

Urban organic waste management

In parallel with policy development at the national level, many local governments are putting the 3Rs into practice. Unfortunately, for food waste recovery is very low, partly due to a lack of separation at source.

Separation of rapidly biodegradable materials from mixed urban waste is not easy. Therefore recovery rates of this waste are relatively low and often the organic fraction decreases the quality of other recyclables. In many parts of developing Asia leftover food is a social symbol of wealth and generosity. The amounts of waste generated are therefore very large and there is a huge potential for waste reduction.

Examples of reuse can be found in the informal sector. For instance, farmers in many countries (e.g. Laos and Cambodia) collect food waste from restaurants and markets, which they reuse as animal feed – farmers who collect food waste from food markets in Nonthaburi, Thailand help reducing GHG emissions from the local landfill by approximately 5%. The climate protection from this type of activity would be further increased if it were more strongly supported by the local governments.

Recycling of organic waste is mainly handled by local governments, though in some cities, such as Phnom Penh and Dhaka, it is initiated and handled by NGOs. Composting is widely promoted by governments, though most of the composting activities are community-based small scale projects. An example is Phitsanulok Municipality, Thailand, where communities and households were encouraged to produce compost for sale. These activities were reported as successful for a certain period, but they declined because a lack of follow-up activities by the municipality, a change of community leadership, low willingness of households to spend the time needed for composting, low immediate income compared with other recyclables, and lower income from selling compost compared to other activities.

Anaerobic digestion of food waste is quite new to most cities in developing Asia; most of the anaerobic digestion projects in the region are implemented for wastewater treatment. While many governments are interested in applying anaerobic digestion technology to municipal solid waste, and while some pilot projects are being implemented, many local governments remain skeptical. They feel that the costs and technology requirements do not reflect the local conditions and capacities.

Small-scale AD seems to be promising for developing Asia, particularly where energy security is low. Many communities in India have succeeded in implementing small scale AD for food waste treatment. Gas recovered from the system can replace approximately 30% to 50% of the liquid petroleum gas (LPG) households use for cooking.

As most cities in the region do not have food waste separation at source and suitable collection systems, the quality of the feedstock for large scale composting and AD relies on the front-end separation process. For instance, a large-scale composting facility in Bangkok employed a front-end separation process for screening of mixed municipal solid waste prior to composting.

Every treatment technology has its specific advantages and disadvantages, and local conditions play an important role. It is not possible to say that one single technology is superior in a generic sense. In general, an integrated system combining different technical solutions is recommended for an effective implementation of the 3Rs. A good example is found in Phitsanulok Municipality, where residents practice recyclables separation for sale, and some do household composting. The remaining waste is treated with an MBT system.

Challenges and recommendations for 3Rs

One of the main challenges to strengthened 3Rs implementation in Asia's developing nations is changing the mindset of local authorities from the typical top-down management approach towards increased public participation. Some local governments believe that public participation is too time-consuming and that the 3Rs approach is not applicable due to the local circumstances and behaviour of the residents. Therefore, they prefer a centralised end-of-pipe treatment system, which they believe to be the best solution given resource constraints and large quantities of waste to be managed.



Small scale AD in India and can replace 30% to 50% of the LPG used for household cooking

To stimulate a change in the attitude of local authorities, there is a need for outside support, especially for capacity development and training, and in some cases for financing. A second challenge is public education and raising awareness among residents. Public participation is a prerequisite, particularly for waste reduction which often requires changes in attitude and behaviour of residents and other relevant stakeholders. Changes are needed in order to secure the quantity and quality of feedstock to the recycling facility. A failure factor frequently found for large-scale projects in this region is the deficiency of feedstock of the required quality.

A third challenge is legislation and enforcement. The efforts of local authorities and the participation of residents are driving factors for initial achievements, whereas legislation and enforcement provide foundations for long-term success. The risk to investments in organic waste projects can be minimised where there is sound basic legislation and related targets that are properly implemented.

Hopefully, when the understanding of the synergies between improved organic waste management and GHG mitigation becomes more widespread, this will accelerate the implementation of the 3Rs. Experiences from many cities across the region suggest that this will not be easy, but that it is possible.

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