What urban waste has to do with global warming

In these columns, we have been presenting the public health implications of different aspects of solid waste management activities in Indian cities. Today we spell out how such improvement will also reap extra dividends by mitigating global warming.

Greenhouse gases (GHGs) create a natural blanket around the Earth's atmosphere by preventing some of the sun's heat energy from radiating back into space, thus keeping the Earth warm. Over the last century-and-a-half, human activities have added considerably to GHGs in the atmosphere, and that continues to result in global warming. Activities involved in the management of solid waste generate (GHGs) such as carbon dioxide, methane, and small amounts of nitrous oxide. The global warming potential of methane is 25 times as much and nitrous oxide 298 times as much as that of carbon dioxide, over the long run (100 years).

GHG emissions from solid waste disposal as reported to the UNFCCC in 2015/16 by India increased at the rate of 3.1per cent per annum between 2000 and 2010, and by China at 4.6per cent per annum between 2005 and 2012. However, there is reason to believe that for both India and China, the estimates of emissions from the waste sector are underestimated for not considering emissions from the transportation of waste.

Much of the problem arises because we mix biodegradable waste with other waste at the point where waste is generated. This increases the volume that has to be transported as the waste is hauled all the way to the landfill sites. The increased fuel usage in transportation results in more emissions.

The volume of waste sent to the landfill sites can be reduced if biodegradable waste is processed locally through aerobic decomposition with the help of microbes or earthworms (vermicomposting) to produce compost or organicfertiliser. Compost helps store carbon back in the soil. Its usage reduces the need for chemical fertilisers which emit large quantities of nitrous oxide — both during production and in application— and thereby helps mitigate emissions. Compost also improves moisture retention in the soil.

We are losing out on mitigation through composting because at most only two per cent of the municipal solid waste in India is composted. The Supreme Court order of 2006 directed fertiliser companies to co-market city compost with chemical fertilisers. However, the government incentive of market development assistance for city compost at Rs 1,500 per tonne to fertiliser companies is no match for the capital subsidy and transport subsidy provided to chemical fertilisers, which renders compost uncompetitive vis-a-vis chemical fertilisers.

An alternative to composting for biodegradable waste is biomethanation or anaerobic decomposition. Biomethanation generates biogas which is a substitute for fossil fuel and produces slurry which is an excellent organic fertiliser, both helping to mitigate global warming. Local processing also means that biomethanation saves on transportation. Very few Indian cities are trying biomethanation because segregation at source and feeding biodegradable waste to the plants in time remain a major challenge.

Recycling of waste also helps reduce GHG emissions because the energy required to manufacture a product using virgin materials is higher than when using recycled materials. While India has had a tradition of recycling paper, glass, metals, etc with the engagement of the informal sector, lack of segregation comes in the way of realising the full potential of recycling.This is particularly true for paper that soils easily when waste is mixed. As a result, only 27 per cent of paper in India is recycled, compared with 60 per cent in Japan and 73 per cent in Germany

(CPPRI, 2013). Recycling requires up to 50 per cent less energy compared to production of paper based on wood pulp, and it also saves trees from being cut.

The non-biodegradable and non-recyclable waste other than hazardous waste (batteries, CFLs, etc), can be converted into Refuse Derived Fuel for use in high-temperature furnaces, for example, in cement kilns and power plants. Technologies are also available for controlled incineration and/or gasification for energy recovery from this waste. These are commonly referred to as "waste-to-energy" plants.

In an earlier column ('Don't just light the fire', IE, May 31, 2017), we had pointed out that incinerating unsegregated municipal solid waste to generate electricity in Indian cities is unsustainable. The low calorific value of the unsegregated waste and the need for auxiliary fuel input makes these plants financially unviable, besides generating more greenhouse gases. On the other hand, incineration of mixed waste in the absence of auxiliary fuel can release dioxins and furans which are severe air pollutants. This has to be countered by installing appropriate filters in these plants.

The Solid Waste Management Rules (2016) have laid down clear guidelines on permissible emission norms. There is a need for real-time monitoring and open access to emissions data to ensure enforcement of the norms. Both the Central Pollution Control Board and the National Green Tribunal have been working towards these goals. But if the regulatory framework is not considerably strengthened, such plants will only end up converting solid waste into air pollution and leaving a larger carbon footprint.

If incineration is not desirable or acceptable, the solution is not simply to dump untreated mixed waste at landfill sites. Landfills in India are neither scientifically engineered nor scientifically closed. They serve as open dumpsites. The discarded plastics in the mixed waste are a major contributor to dumpsite fires. Disposal of mixed waste including biodegradable matter (sometimes as high as 60per cent) in these dumpsites provides a perfect anaerobic environment for generation of methane and leachate. One tonne of biodegradable waste releases 0.84 tonne of carbon dioxide equivalent emissions if left to decompose anaerobically.

The untreated disposal of mixed municipal solid waste at landfill sites is around 80per cent for Mumbai and Chennai, 50-60per cent for Delhi and Bengaluru, and 35per cent for Pune. This implies that Mumbai emitted 921 k-tonne of carbon dioxide equivalent of GHG gases from landfill sites in 2016, equal to annual emissions from 1,96,000 typical cars. For Delhi, the estimate is 137,000 cars. Bioremediation offers a relatively quick and inexpensive mitigation instrument for reducing the GHG emissions from landfill sites through aerobic decomposition of organic fraction of the waste ('A city laid waste', IE, June 28, 2017).

There are lessons to be learnt from other countries. GHG emissions from solid waste have been declining in Germany and Japan. A ban on landfilling of non-pre-treated waste in Germany has led to 47 per cent of the waste being recycled, and 36 per cent incinerated. In Japan, 75 per cent of the waste is incinerated, while 21 per cent is recycled. The regulations in both countries ensure that incinerators have state-of-the-art emission control technologies, and the directly landfilled municipal solid waste is as low as oneper cent.

India needs to get its act together to improve its municipal solid waste management with the triple objective of resource recovery, improving public health conditions and mitigating the risks associated with human-induced global warming.

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