Don't Waste Our Climate

CIWM President, **Professor David C Wilson MBE**, makes the case for resource and waste management as an entry point to achieve significant climate mitigation

A key challenge in implementing the Paris Climate Agreement is to prioritise opportunities for significant short- and medium-term reductions in greenhouse gas (GHG) emissions across the economy. I am frustrated that we as resource and waste management professionals are not doing more to promote the potential for our sector as one such "entry point". A major reason is the often-reported headline result that solid waste management contributed around three percent of total GHG emissions in 2010. I will argue here that this is a gross under-estimate of the potential reductions that could be achieved through better resource and waste management.

Climate science comes under intense scrutiny and the Intergovernmental Panel on Climate Change (IPCC) as its UN custodians rightly take a very careful approach in their official publications. They define their base year; segment the economy into sectors taking great care to avoid any overlaps that could lead to double counting; and only include emission sources for which the data meets a quality threshold.

The IPCC's definition of the waste sector includes "solid waste disposal on land" (with the major emission being methane from landfills); "wastewater handling" (methane from anaerobic digestion); "waste incineration" without energy recovery; and "other" (which is effectively limited to composting). Other components of waste management, including transport, recycling, agricultural use of compost and waste incineration with energy recovery, are reported under other IPCC sectors.

Using this definition, the IPCC's latest (and fifth) assessment report estimates the contribution of the waste sector to global GHG emissions in 2010 at three-to-five percent. Of this total, 97 percent is due to methane emissions, split roughly equally between methane from landfills and from wastewater. Methane is dominant, at least partly because it is around 30 times more powerful than CO_2 as a GHG.

Starting In 2010

LET US begin by considering the base date of 2010. More than half of global waste generation at that time was from high-income countries, which had already substantially reduced methane emissions from landfills. For example, changes in Germany's waste sector between 1990 and 2006 reduced the country's total GHG emissions by five percent, and this was in addition to the significant mitigation of methane emissions already achieved between the 1970s – when environmental controls were first introduced – and 1990. Beyond 2010, waste generation is rising fast in the medium- and low-income countries. So it appears that 2010 likely represented a minimum point in the contribution of the waste sector to total GHG emissions.

There is then, the very narrow definition of the waste sector, which means that their estimates necessarily omits those emissions displaced through waste prevention, reuse, recycling and biogenic energy recovery, as these savings would be credited by the IPCC to other sectors of the economy. For example, using recycled materials in industrial production to displace virgin materials significantly reduces GHG emissions, both by reducing direct energy consumption in the production process – eg, in glass production by 35 percent, paper and steel more than 50 percent, plastics more than 70 percent and aluminium more than 90 percent – and by the indirect upstream avoidance of mining, processing and transport of primary raw materials.

To gain an insight into such economy-wide savings in GHG emissions, it is necessary to move from IPCC's narrow "carbon accounting" to a methodology such as life cycle assessment (LCA). One study for the German government, applying LCA to four example countries – Germany, Turkey, Tunisia and Mexico – estimated that a 10-15 percent reduction in global GHG emissions could be achieved through improved solid waste management, including landfill mitigation and diversion, energy from waste and recycling.[1]

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Including waste prevention could further increase this estimate, although quantifying that is challenging to say the least. To take just the example of food waste, the UN Food and Agricultural Organisation (FAO) has estimated that 1.3bn tonnes of edible food waste is generated every year, representing one-third of all food produced for human consumption and enough to feed all the hungry people in the world twice over. Prevention of this food waste would reduce total global GHG emissions by nine percent – more than the total emissions of any country other than the US and China. And it's not just GHG emissions: work by my colleague Stephen Smith at Imperial College suggests that prevention of edible food waste could also reduce global water use by 15 percent.

Overall, the inaugural Global Waste Management Outlook, published in 2015 by UNEP and ISWA, and for which I

was editor-in-chief, concluded that the potential impact of improved resource and waste management on reducing GHG emissions across a broad range of economic sectors could be 15-20 percent.

However, even that estimate still ignores the third restriction imposed by the IPCC's careful approach, that only emission sources for which the data meets a quality threshold is included. The main issue here for our sector is black carbon emissions from the open burning of wastes. The relative quantities may be small compared to methane from landfill, but black carbon is around 2,000 more powerful than CO_2 as a GHG, and has an even shorter half-life than methane. Both are classified as short-lived climate pollutants, which are particularly interesting for climate mitigation in the short term as the impacts will be felt much more quickly than for CO_2.

Modelling studies of the generation and impact of black carbon from open burning have attracted much publicity: the estimated contribution amounts to five percent of total GHG emissions[2], causing 270,000 premature deaths a year.[3] These estimates are based on broad assumptions and are particularly uncertain. Real data are understandably hard to come by as to how much solid wastes are disposed of by open burning, either by households or at uncontrolled dumpsites. Also, emission factors – ie, how much black carbon is produced by burning a kilogram of waste – have been based on just a couple of field measurements.

My PhD student at Imperial College London, Natalia Reyna, has been working to address these data gaps for the last few years, with one objective of helping to meet the IPCC's quality criterion so as to allow black carbon emissions to be included in its next assessment report due in 2022. Our early results suggest that the CO_2 equivalent of black carbon emissions from uncontrolled burning in backyards in Mexico was 15 times larger compared to methane released from the decomposition of equivalent amounts of combustible biodegradable waste disposed at a final disposal site.[4] This suggests that urgent action is needed to reduce domestic open burning of waste and that this would have a significant impact, both on improving local air quality and respiratory health, and on reducing climate change.

Putting all of this information together, one could make a case that better resource and waste management has the potential for reducing GHG emissions across the world economy by 15, 20 or 25 percent, or even more. Such numbers by their nature are "guesstimates", and as such are anathema to climate scientists. However, whatever number we choose to use, the message is still the same. Our sector provides a useful entry point to make very significant contributions to climate mitigation targets. And some of those reductions could be seen as "low hanging fruits", and/or to offer significant reductions over a short timeframe.

Methane mitigation from landfill and also increased recycling has already served this purpose in developed countries in the early target periods under the Kyoto Convention from 1990-2010. Going forward, we can continue to target these and add also food waste prevention and the elimination of open burning of waste, both of which could also deliver significant carbon reductions in the near term.

The contribution of the resource and waste sector to climate mitigation is both an existing success story, and a reason to raise the political priority of further investment in the sector, in both developing and developed countries. As professionals, it is our job to make the case heard. ■

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References

1. Dehoust G. et al. (2010). Climate Protection Potential in the Waste Management Sector - Examples: Municipal Waste and Waste Wood. Berlin: UBA and BDE (German Government). [Online] http://www.umweltbundesamt.de/publikationen/climate-protection-potential-in-waste-management).
2. Wiedinmyer C., Yokelson R. and Gullett B. (2014), 'Global Emissions of Trace Gases, Particulate Matter, and Hazardous Air Pollutants from Open Burning of Domestic Waste', Environ. Sci. Technol. 2014 48 (16) 9523–9530. Online: doi.org/10.1021/es502250z
3. Kodros J.K. et al (2016), 'Global burden of mortalities due to chronic exposure to ambient PM2.5 from open combustion of domestic waste', Environ. Res. Lett. 11 124022. Online open access: doi.org/10.1088/1748-9326/11/12/124022
4. Reyna-Bensusan N., Wilson D.C. and Smith S.R. (2018). Uncontrolled burning of solid waste by households in Mexico is a significant contributor to climate change in the country. Environmental Research 163 (2018) 280–288. Online: doi.org/10.1016/j.envres.2018.01.042