Waste and Climate

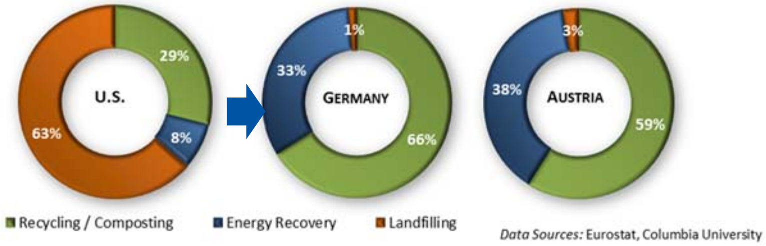
Reducing Your Footprint

Covanta
WHITE PAPER

> ***"Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentration of greenhouse gases has increased."***
> IPCC, 2013: Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis

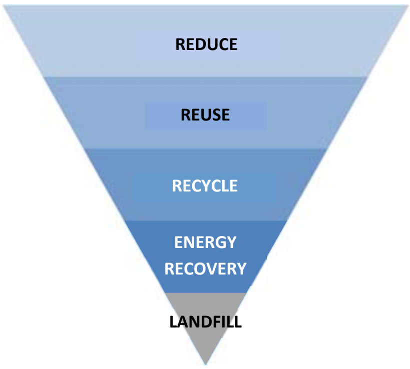
When it comes to addressing climate change, we normally think of carbon pollution from power plants, cars, and heating our homes and businesses. However, how we manage materials and waste has a big impact on the climate as well. In fact, if everyone globally were able to manage their waste as sustainably as countries like Germany and Austria, the greenhouse gas (GHG) savings would be the equivalent to:[1]

- Closing 1000 large coal-fired power plants,
- Building two million 1MW wind machines, or
- Doubling the nuclear power plant capacity in the U.S.



How Can We Manage Waste More Sustainably?

In general, by following the waste management hierarchy: waste reduction and reuse, recycling, energy recovery, and then finally, only landfilling what's left over.[2,3] By recognizing waste as a resource, we can reduce the demand for new raw materials, lesson our dependence on fossil fuel-fired electricity, and keep materials out of landfills.



What is Energy-from-Waste's Role?

Energy from Waste (EfW) is an important part of an overall integrated waste management approach, recognized in the European Union and U.S. EPA waste management hierarchies as preferable to landfilling for those materials remaining after waste reduction, reuse, and recycling efforts have been exhausted. Even after accounting for stack emissions of CO_2, Energy from Waste (EfW) can help reduce GHG emissions by keeping the waste that remains after recycling efforts have been exhausted out of landfills, generating electricity, and recovering metals for recycling. Given its benefits, EfW has been recognized internationally as a source of GHG mitigation by the following organizations:

- European Union[4,5]
- Intergovernmental Panel on Climate Change (IPCC)[6]
- World Economic Forum (WEF)[7]
- U.S. Environmental Protection Agency[8,9]
- National Renewable Energy Lab[10]
- Columbia University[11] & Univ. of Buffalo scientists[12]
- Obama administration Clean Power Plan[13]
- Clean Development Mechanism of the Kyoto Protocol[14]
- Voluntary carbon markets[15]
- Center for American Progress[16]
- California's Solid Waste Regulator (CalRecycle)[17]
- California Air Resources Board (CARB)[18,19]
- U.S. EPA Scientists[20]
- Berkeley Law Center for Law, Energy & the Environment[21]

Why is it Important to Divert Waste from Landfills?

Landfills are a leading source of anthropogenic methane, globally and in the United States.[22,23] When biodegradable waste is placed in landfills, it breaks down anaerobically, generating methane. While many landfills have systems in place to capture and combust this methane, either in flares or engines for energy recovery, it's not a perfect system: landfills only capture a fraction of the gas. LFG escapes through cracks and imperfections in the surface cap, around wells and penetrations, through leachate collection systems, and through the cap itself. Over the life of waste in a landfill, the lifetime collection efficiency is estimated to be only **35 – 70%**, leaving a significant amount of methane uncollected.[24-28]

Furthermore, landfills don't measure their emissions, they model them: One study found the typical landfill emissions model used underestimated emissions.[29] Direct measurement of landfill methane plumes has corroborated this conclusion. Across a series of recent studies employing direct measurement of methane plumes via aircraft downwind of landfills (example, Figure 1), actual measured emissions from landfills have averaged **twice the amount reported** in GHG inventories (Table 1).

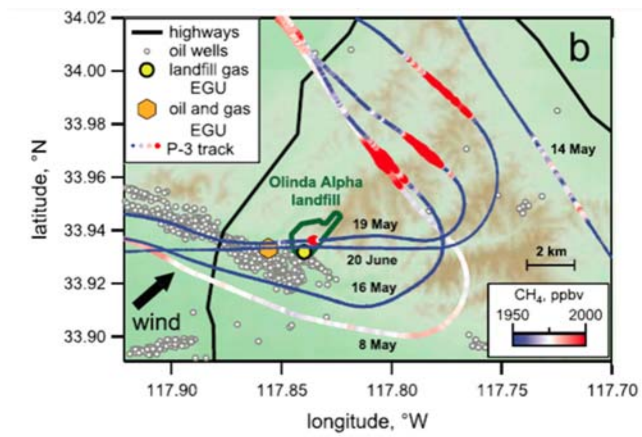
Table 1. Comparison of Measured Emissions to GHG Inventories

Study Area	Landfill Inventory (Gg CH_4/y)	Landfill Measurement (Gg CH_4/y)	Difference Factor
L.A. Basin*[30]	17.84	24.1 – 43.9	1.9x
California**[31]	312	840	2.7x
Indianapolis*[32]	13.93	22.5	1.6x
Indiana*[33]	3.73	4 – 6.6	1.4x
Baltimore/DC[34]	19.68	47.3	2.4x
San Francisco Bay[35]	61.5	88.5 – 143.8	1.9x
LF Average			***2.0x***

*values are for a single landfill within respective scope

**values calculated from combined total for landfills/wastewater treatment

Figure 1. Landfill methane plume observations[30]



Why the Focus on Methane?

Overall, the climate impact of methane is much larger than previously reported and atmospheric concentrations continue to rise. According to the IPCC's 5th Assessment Report, methane is 34 times stronger than CO_2 over 100 years when all effects are included and 84 times more potent over 20 years.[36]

Methane is the second largest contributor to global climate change.[37] A short-lived climate pollutant (SLCP) increasingly under international scrutiny, methane has a larger climate impact and its atmospheric concentrations continue to rise.[38] Methane also may be lingering longer in the atmosphere today than before, as a result of a possible decline in the atmosphere's oxidative capacity, adding to its impact.[39] Fast action to reduce SLCPs, including methane, can significantly reduce the rate of sea level rise and "has the potential to slow down the global warming expected by 2050 by as much as 0.5 Celsius degrees."[40] In the near-term, reducing emissions of SLCPs like methane is more effective than reducing CO_2.[41] A failure to address SLCPs, like methane, significantly increases the risk of crossing the 2°C temperature increase threshold widely discussed as the harbinger of severe climate change impacts.[42]

In response to the growing concern about methane and other SLCPs, the 20-year GWP has been adopted by California in its *Short-Lived Climate Pollutant Reduction Strategy*[43] and by NY State in its recent Climate Bill.[44] When viewed from the perspective of a 20-year GWP, the climate benefits of WTE are even more compelling.

> *"The use of GWPs with a time horizon of 20 years better captures the importance of the SLCPs and gives a better perspective on the speed at which SLCP emission controls will impact the atmosphere relative to CO_2 emission controls."[43]*

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